United States Department of the Interior
BUREAU OF LAND MANAGEMENT

Colorado State Office
Denver Federal Center, Building 40
Lakewood, Colorado 80225
www.blm.gov/colorado

In Reply Refer To:
CO-932 (7250)

Mr. Rob Viehl
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Mr. Viehl:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right on East Muddy Creek, located in Water Division 4.

Location and Land Status. East Muddy Creek originates at the confluence of Little Muddy Creek and Clear Fork, approximately 14.5 miles northeast of Paonia. The creek flows into Paonia Reservoir. This recommendation covers a reach that starts at the confluence with Lee Creek and extends to the confluence with West Muddy Creek. This stream reach covers a distance of approximately 6.36 miles. The BLM manages approximately 0.85 miles of this stream reach, while 5.51 miles are in private ownership.

Biological Summary. East Muddy Creek is a cold-water, low to moderate gradient stream. It flows through a mountain valley approximately 0.5 miles in width. The stream cuts through alluvial deposits in some locations and is constrained by bedrock in locations where the stream comes close to valley walls. The stream generally has medium-sized substrate, consisting of gravels, cobbles, and small boulders. The stream has a good mix of pool and riffle habitat for supporting introduced trout species as well as native fish species.

Fisheries surveys have revealed self-sustaining populations of speckled dace, mottled sculpin, bluehead sucker, rainbow trout, fathead minnow and white sucker. Speckled dace, mottled sculpin and bluehead suckers are native species, and the bluehead sucker appears on BLM's sensitive species list. Since Paonia Reservoir prevents migration of fishes between East Muddy Creek and the Gunnison River, it is likely that East Muddy Creek provides year-round habitat for bluehead sucker.

The riparian community in this part of East Muddy Creek is generally comprised of willow species, alder, spruce and narrowleaf cottonwood. In general, the riparian community is in good condition, provides some shading and cover for fish habitat, and provides stream stability during flood events.

R2Cross Analysis. BLM collected the following R2Cross data from East Fork Muddy Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
06/01/2018 #1	45.34 cfs	49.9 feet	15.16 cfs	32.41 cfs
06/01/2018 #2	43.24 cfs	42.4 feet	6.80 cfs	15.59 cfs
09/24/2019 #1	11.58 cfs	50.5 feet	13.42 cfs	17.19 cfs
09/24/2019 #2	12.17 cfs	44.5 feet	9.48 cfs	27.91 cfs
		Averages:	11.22 cfs	23.28 cfs

BLM's analysis of this data indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

> 23.00 cubic feet per second is recommended for the snowmelt runoff period from April 1 through July 31. This recommendation is driven by the wetted perimeter criteria in a majority of the cross-section data collected. Wetting 50 to 60 percent of the channel, as recommended by the R2Cross manual for streams 40 to 60 feet in width, will provide important physical habitat during a time of year when the fish population is completing key life cycle functions.
>
> 14.5 cubic feet per second is recommended for the late summer and early fall period between August 1 and October 31. This recommendation is driven by limited water availability during this period. This flow rate will generally meet the average velocity and average depth criteria in the cross sections analyzed, while providing approximately 50% wetted perimeter in the wider cross sections.
>
> 11.20 cubic feet per second is recommended during the winter period between November 1 and February 29. This recommendation is driven by limited water availability during the winter. This flow rate either meets or comes close to meeting the average depth and average velocity criteria in cross sections analyzed and should prevent icing in pools.
>
> 20.0 cubic feet per second is recommending from March 1 to March 31. This period is when lower elevation snowmelt runoff begins. Sufficient water is available to significantly exceed the winter flow recommendation and provide additional habitat before large scale snowmelt runoff occurs.

Water Availability. The BLM recommends relying upon two data sources to confirm water availability. The first information source is USGS Gage 09130500 (East Muddy Creek Near Bardine, CO). This gage was operated between 1934 and 1953, reflecting a 20-year period of record. The gage records will have to be adjusted to account for new diversions below the gage that have commenced since 1953. In addition, the gage data will need be adjusted to reflect the fact that some tributaries enter the creek downstream of the gage. The second data source is comprised of reservoir content records for Paonia Reservoir, located downstream. Daily fill volumes can be converted to incoming flow rates from East Muddy Creek. If this data source is

used, any inflow to the reservoir from West Muddy Creek would have to be subtracted out to accurately reflect water availability in the recommended instream flow reach.

The BLM is aware of only one active surface water right in the proposed reach, the John Medved Ditch 4, which is decreed for 1.5 cfs. Upstream from the proposed instream reach, BLM is aware of at least 25 active surface water rights, totaling just under 100 cfs in decreed diversion rates. BLM is also aware of multiple exchanges between Paonia Reservoir and upstream points of diversion.

Relationship to Land Management Plans. The BLM land use plan for this area calls for actions to maintain and enhance riparian and fisheries habitat. In general, any proposed new land use, such as right-of-way corridors or mineral development, must be implemented with no surface occupancy to avoid impacts to the creek. Any proposed land uses along this creek are also carefully reviewed and mitigated to prevent impacts to sensitive aquatic species which appear on BLM's sensitive species list. Establishing an instream flow water right would assist in meeting these objectives.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2020. BLM thanks both Colorado Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

JOEL HUMPHRIES Digitally signed by JOEL HUMPHRIES Date: 2024.11.27 09:06:37 -07'00' for

Alan Bittner
Deputy State Director
Resources

Cc: Kevin Hyatt, Uncompahgre FO
Dan Ben-Horin, Uncompahgre FO
Stephanie McCormick, Southwest District

Combined Summaries

Water **41741** **Muddy Creek** Date **7/17/2012**

Station **GU0040** **ABV Dugout Creek (EM-1)**

Drainage **Gunnison River** UtmX **296304** UtmY **4318625** Elevation **6478 ft**

Length **722 ft** Width **41.60 ft** Area **0.69 acre**

Surveyors **K. Thompson, S. Sherman, P. Jones, N. Thompson**

Gear **BPEF** Effort **2.00** Metric **PASS** Protocol **FULL HABITAT**

Proportional Stocking Density and Catch/Unit Effort

Species	Total Catch	Min Cut inch	Max Cut inch	Total used	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Max Length inches
BLUEHEAD SUCKER	112	5.91		112							9.49
BROOK TROUT	2	5.12		2	0.00	100.00					8.86
FLANNELMOUTH SUCKER	2	5.91		2							5.28
FATHEAD MINNOW	60			60							2.20
MOTTLED SCULPIN	102			102							4.80
NORTHERN PIKE	5	3.94		5							6.77
SPECKLED DACE	187			187							5.04
SUCKER (S.U.)	5			5							0.00
WHITE SUCKER	60	5.91		60	0.00	100.00					9.57
WHITE-BLUEHEAD SUCKER HYBRID	11			11							11.26
WHITE-FLANNELMOUTH HYBRID	1			1							0.00

Combined Summaries

Water **41741** **Muddy Creek** Date **7/17/2012**

Station **GU0040** **ABV Dugout Creek (EM-1)**

Mean, Minimum and Maximum Length and Weight

Species	Total Catch	Min cut inch	Max cut inch	Total Used	Length (inches) Mean	Length (inches) Minimum	Length (inches) Maximum	Weight (lb) Mean	Weight (lb) Minimum	Weight (lb) Maximum
BLUEHEAD SUCKER	112	5.91		112	3.85	2.44	9.49	0.04	0.00	0.33
BROOK TROUT	2	5.12		2	8.33	7.80	8.86	0.27	0.24	0.31
FLANNELMOUTH SUCKER	2	5.91		2	5.28	5.28	5.28	0.05	0.05	0.05
FATHEAD MINNOW	60			60	1.99	1.73	2.20	0.00	0.00	0.01
MOTTLED SCULPIN	102			102	3.53	2.40	4.80	0.03	0.01	0.07
NORTHERN PIKE	5	3.94		5	6.09	5.59	6.77	0.06	0.03	0.07
SPECKLED DACE	187			187	3.48	1.97	5.04	0.02	0.00	0.07
SUCKER (S.U.)	5			5		0.00	0.00		0.00	0.00
WHITE SUCKER	60	5.91		60	4.77	2.83	9.57	0.06	0.01	0.26
WHITE-BLUEHEAD SUCKER HYBRID	11			11	8.31	3.82	11.26	0.25	0.01	0.46
WHITE-FLANNELMOUTH HYBRID	1			1		0.00	0.00		0.00	0.00

Combined Summaries

Water **41741** **Muddy Creek** Date **7/17/2012**

Station **GU0040** **ABV Dugout Creek (EM-1)**

Relative Abundance and Catch/Unit Effort

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total used	Weight Lbs	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BLUEHEAD SUCKER	112	5.91		112	2.88	20.48	27.13	56.00	1.44
BROOK TROUT	2	5.12		2	0.55	0.37	5.14	1.00	0.27
FLANNELMOUTH SUCKER	2	5.91		2	0.05	0.37	0.46	1.00	0.02
FATHEAD MINNOW	60			60	0.01	10.97	0.14	30.00	0.01
MOTTLED SCULPIN	102			102	1.15	18.65	10.85	51.00	0.58
NORTHERN PIKE	5	3.94		5	0.28	0.91	2.59	2.50	0.14
SPECKLED DACE	187			187	1.67	34.19	15.71	93.50	0.84
SUCKER (S.U.)	5			5	0.00	0.91	0.00	2.50	0.00
WHITE SUCKER	60	5.91		60	1.81	10.97	17.00	30.00	0.90
WHITE-BLUEHEAD SUCKER HYBRID	11			11	2.23	2.01	21.00	5.50	1.12
WHITE-FLANNELMOUTH HYBRID	1			1	0.00	0.18	0.00	0.50	0.00

Combined Summaries

Water **41741** **Muddy Creek** Date **7/17/2012**

Station **GU0040** **ABV Dugout Creek (EM-1)**

Abundance and Biomass

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total Used	Population estimate	Biomass Lbs	Percent Number	Percent Weight	Density estimates Lb/Acre	Density estimates Fish/Acre	Density estimates Fish/Mile
BLUEHEAD SUCKER	112	5.91		112		2.88	20.48	27.13	4.18	162.48	819.29
BROOK TROUT	2	5.12		2		0.55	0.37	5.14	0.79	2.90	14.63
FLANNELMOUTH SUCKER	2	5.91		2		0.05	0.37	0.46	0.07	2.90	14.63
FATHEAD MINNOW	60			60		0.01	10.97	0.14	0.02	87.04	438.90
MOTTLED SCULPIN	102			102		1.15	18.65	10.85	1.67	147.97	746.13
NORTHERN PIKE	5	3.94		5		0.28	0.91	2.59	0.40	7.25	36.58
SPECKLED DACE	187			187		1.67	34.19	15.71	2.42	271.28	1,367.91
SUCKER (S.U.)	5			5		0.00	0.91	0.00	0.00	7.25	36.58
WHITE SUCKER	60	5.91		60		1.81	10.97	17.00	2.62	87.04	438.90
WHITE-BLUEHEAD SUCKER HYBRID	11			11		2.23	2.01	21.00	3.24	15.96	80.47
WHITE-FLANNELMOUTH HYBRID	1			1		0.00	0.18	0.00	0.00	1.45	7.32

Notes: 2x LR-24 BPEF; Primary purpose of survey is three species occupancy. Often no more than 40 specimens of individual species were weighed and measured and the remainder were counted. Therefore population estimates are not completely accurate. Leopard Frog.

COLORADO
Department of Natural Resources

Date	6/1/2018
Observer	R. Smith, J. Sondergard
Cross-section#	1
System	UTM Zone 13
X (easting)	295335
Y (northing)	4322956

R2CROSS CROSS-SECTION NOTES

Stream Name	Stream Location	Slope
East Muddy Creek	Approx 1.0 mile upstream from confluence with Spring Creek	0.0056

Feature	Distance From Initial Point (ft)	Rod Height (ft)	Water Depth (ft)	Velocity (ft/s)
Bankfull	0	3.5		
	4	4.17		
	8	4.65		
Waterline	11.9	4.95	0	0
	13	5.15	0.2	0.33
	14	5.35	0.4	1.19
	15	5.45	0.5	2.19
	16	5.75	0.8	1.68
	17	5.85	0.9	2.3
	18	5.75	0.8	1.92
	19	5.75	0.8	2.43
	20	5.85	0.9	1.89
	21	5.75	0.8	2.48
	22	5.95	1	2.53
	23	5.85	0.9	2.86
	24	5.85	0.9	2.64
	25	5.75	0.8	2.58
	26	5.85	0.9	2.56
	27	5.95	1	2.34
	28	5.95	1	2.42
	29	5.85	0.9	1.65
	30	5.95	1	1.71
	31	5.85	0.9	1.57
	32	6.05	1.1	1.63
	33	6.05	1.1	1.46
	34	5.95	1	1.81
	35	5.95	1	2
	36	5.75	0.8	1.73
	37	5.75	0.8	1.64
	38	5.7	0.75	1.65
	39	5.4	0.45	1.46
	40	5.1	0.2	0.54
Waterline	40.9	4.9	0	0
	44	4.36		
	48	3.9		
Bankfull	50.2	3.55		

COLORADO
Department of Natural Resources

Date	6/1/2018
Observer	R. Smith, J Sondergard
Cross-section#	2
System	UTM Zone 13
X (easting)	295345
Y (northing)	4323005

R2CROSS CROSS-SECTION NOTES

Stream Name	Stream Location	Slope
East Muddy Creek	Approx. 1.0 mile upstream from confluence with Spring Creek	0.0048

Feature	Distance From Initial Point (ft)	Rod Height (ft)	Water Depth (ft)	Velocity (ft/s)
	0	2.94		
Bankfull	4	3.43		
	8	3.86		
Waterline	12	4.15		
	14.5	4.4	0	0
	15	4.5	0.1	0.13
	16	5	0.6	0.81
	17	5.1	0.7	1.56
	18	5.2	0.8	1.7
	19	5.3	0.9	1.99
	20	5.3	0.9	1.09
	21	5.4	1	1.88
	22	5.4	1	2.01
	23	5.3	0.9	1.58
	24	5.4	1	2.03
	25	5.5	1.1	2.86
	26	5.4	1	2.14
	27	5.5	1.1	2.06
	28	5.5	1.1	1.9
	29	5.4	1	1.52
	30	5.5	1.1	2.38
	31	5.6	1.2	1.51
	32	5.5	1.1	1.99
	33	5.6	1.2	2.19
	34	5.6	1.2	1.6
	35	5.3	0.9	2.29
	36	5.6	1.2	1.54
	37	5.5	1.1	1.41
	38	4.8	0.4	0.98
	39	5.4	1	1.06
	40	5.4	1	0.69
	41	5.2	0.8	0.31
	42	4.6	0.2	0
Waterline	42.6	4.4	0	0
	44	3.98		
Bankfull	46.5	3.4		

COLORADO
Department of Natural Resources

Date	9/24/2019
Observer	J. Sondergard
Cross-section#	1
System	UTM Zone 13
X (easting)	295348.2
Y (northing)	4322971.9

R2CROSS CROSS-SECTION NOTES

Stream Name	Stream Location	Slope
East Muddy Creek	Approx 1.57 miles upstream from Paonia Reservoir	0.009

Feature	Distance From Initial Point (ft)	Rod Height (ft)	Water Depth (ft)	Velocity (ft/s)
	2.9	1.79		
Bankfull	5.3	2.74		
	17.25	3.96		
Waterline	20.45	4.64	0	0
	21.4	4.85	0.2	0
	22	5.1	0.45	0.63
	23	5.15	0.5	1.23
	24	5.1	0.45	0.6
	25	5	0.35	1.05
	26	5.15	0.5	1.34
	27	5.05	0.4	1.68
	28	5.15	0.5	1.4
	29	5.15	0.5	0.67
	30	5.05	0.4	1.52
	31	5.15	0.5	2.11
	32	5.05	0.4	1.78
	33	4.95	0.3	2.26
	34	5.05	0.4	1.55
	35	4.95	0.3	1.09
	36	5.05	0.4	0.48
	37	4.9	0.25	0.86
	38	4.85	0.2	0.69
	39	5.15	0.5	0.01
	40	5.15	0.5	0.31
	41	5.25	0.6	0.1
	42	5.05	0.4	0.24
	43	4.95	0.3	1.07
	44	5.05	0.4	1.4
	45	5.2	0.55	0.6
	46	5.15	0.5	0.55
	47	5.35	0.7	0.76
	48	5.5	0.85	0.9
	49	5.15	0.5	0.22
Waterline	49.5	4.65	0	0
	54.2	3.18		
Bankfull	56.25	2.63		
	56.85	2.12		

COLORADO
Department of Natural Resources

Date	9/24/2019
Observer	J. Sondergard
Cross-section#	2
Coordinate	Lat/Long
X (easting)	-107.364728
Y (northing)	39.03145

R2CROSS CROSS-SECTION NOTES

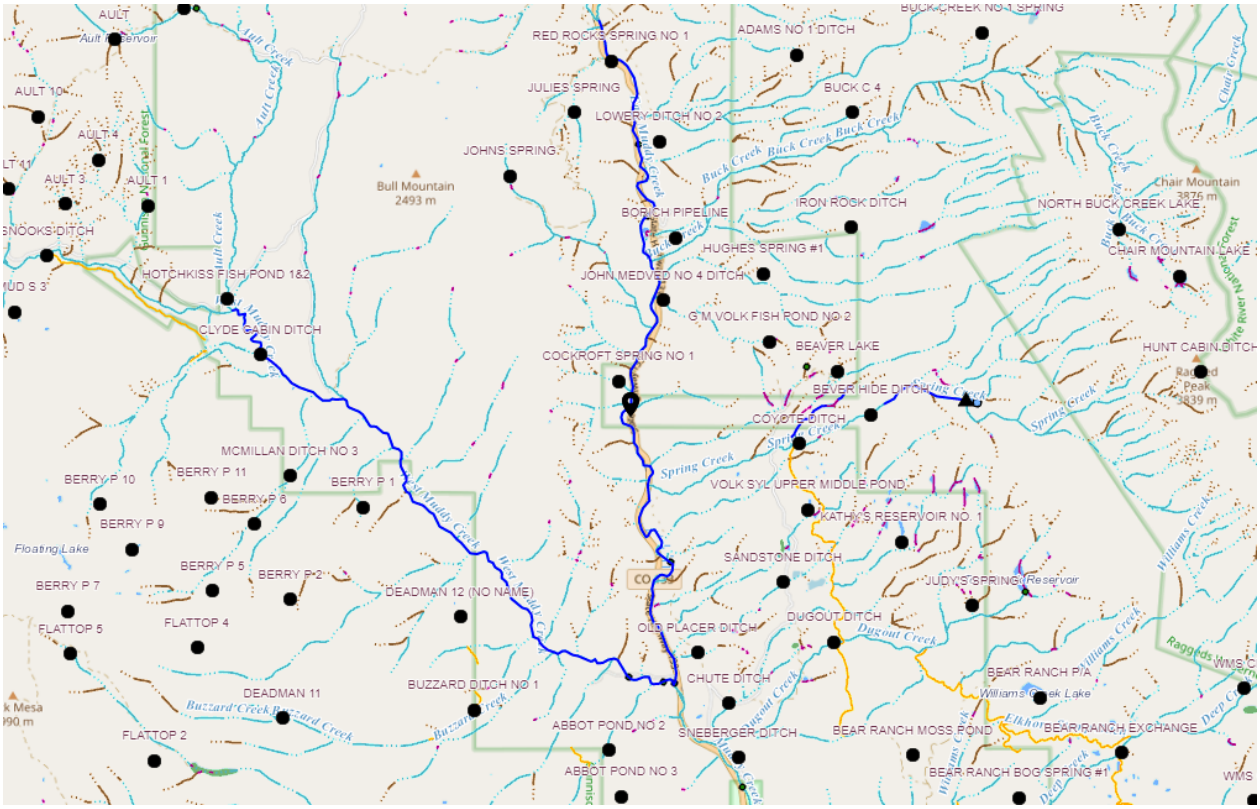
Stream Name	Stream Location	Slope
East Muddy Creek	Approx. 1.75 miles upstream from Paonia Reservoir	0.003

Feature	Distance From Initial Point (ft)	Rod Height (ft)	Water Depth (ft)	Velocity (ft/s)
	1	2.75		
Bankfull	3.65	3.55		
	8.05	4.62		
Waterline	10.1	5.14	0	0
	11	5.45	0.3	0.55
	12	5.55	0.4	0.07
	13	5.7	0.55	1.23
	14	5.75	0.6	1.5
	15	5.75	0.6	1.36
	16	5.65	0.5	1.45
	17	5.75	0.6	0.65
	18	5.95	0.8	1.43
	19	5.95	0.8	1.72
	20	5.85	0.7	1.65
	21	5.95	0.8	1.57
	22	5.95	0.8	1.24
	23	5.5	0.35	1.53
	24	5.55	0.4	1.22
	25	5.65	0.5	1.27
	26	5.6	0.45	1.31
	27	5.4	0.25	0.71
	28	5.35	0.2	0.17
	29	5.45	0.3	0.33
	30	5.15	0	0
Waterline	31.4	5.15	0	0
	33.5	4.42		
Bankfull	58.5	2.93		
	65.6	1.96		

R2Cross RESULTS

Stream Name: East Muddy Creek
Stream Locations: Approx. 1.75 miles upstream from Paonia Reservoir
Fieldwork Date: 09/24/2019
Cross-section: 2
Observers: J. Sondergard
Coordinate System: Lat/Long
X (easting): -107.364728
Y (northing): 39.03145
Date Processed: 05/29/2023
Slope: 0.003
Discharge: R2Cross data file: 12.17 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: East Muddy Creek 9-24-19 #2.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 44.45

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.4	9.48
Percent Wetted Perimeter (%)	52.2	27.91
Mean Velocity (ft/s)	1.0	7.91

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)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	3.55	44.45	1.3	2.4	57.98	45.07	100.0	1.29	0.03	3.0	173.98
	3.6	43.41	1.29	2.35	55.8	44.02	97.68	1.27	0.03	2.96	165.42
	3.65	42.36	1.27	2.3	53.65	42.97	95.34	1.25	0.03	2.93	157.16
	3.7	41.32	1.25	2.25	51.56	41.92	93.01	1.23	0.03	2.89	149.22
	3.75	40.27	1.23	2.2	49.52	40.87	90.67	1.21	0.03	2.86	141.59
	3.8	39.23	1.21	2.15	47.53	39.82	88.34	1.19	0.03	2.82	134.27
	3.85	38.18	1.19	2.1	45.6	38.76	86.0	1.18	0.03	2.79	127.26
	3.9	37.14	1.18	2.05	43.71	37.71	83.67	1.16	0.03	2.76	120.55
	3.95	36.1	1.16	2.0	41.88	36.66	81.34	1.14	0.03	2.73	114.13
	4.0	35.05	1.14	1.95	40.11	35.61	79.0	1.13	0.03	2.69	108.01
	4.05	34.01	1.13	1.9	38.38	34.56	76.67	1.11	0.03	2.66	102.17
	4.1	32.96	1.11	1.85	36.7	33.5	74.33	1.1	0.03	2.63	96.61
	4.15	31.92	1.1	1.8	35.08	32.45	72.0	1.08	0.03	2.6	91.32
	4.2	30.87	1.09	1.75	33.51	31.4	69.67	1.07	0.03	2.58	86.3
	4.25	29.83	1.07	1.7	32.0	30.35	67.33	1.05	0.03	2.55	81.55
	4.3	28.78	1.06	1.65	30.53	29.3	65.0	1.04	0.03	2.52	77.06
	4.35	27.74	1.05	1.6	29.12	28.24	62.66	1.03	0.03	2.5	72.82
	4.4	26.69	1.04	1.55	27.76	27.19	60.33	1.02	0.03	2.48	68.84
	4.45	26.06	1.01	1.5	26.44	26.55	58.91	1.0	0.03	2.43	64.22
	4.5	25.71	0.98	1.45	25.15	26.19	58.1	0.96	0.03	2.35	59.2
	4.55	25.37	0.94	1.4	23.87	25.82	57.29	0.92	0.03	2.28	54.36
	4.6	25.02	0.9	1.35	22.61	25.46	56.48	0.89	0.03	2.2	49.71
	4.65	24.67	0.87	1.3	21.37	25.1	55.69	0.85	0.03	2.12	45.25
	4.7	24.33	0.83	1.25	20.14	24.74	54.9	0.81	0.03	2.03	40.97
	4.75	23.99	0.79	1.2	18.94	24.39	54.11	0.78	0.04	1.95	36.88

	4.8	23.65	0.75	1.15	17.74	24.03	53.32	0.74	0.04	1.86	32.98
	4.85	23.31	0.71	1.1	16.57	23.68	52.53	0.7	0.04	1.77	29.28
	4.9	22.97	0.67	1.05	15.41	23.32	51.74	0.66	0.04	1.67	25.78
	4.95	22.63	0.63	1.0	14.27	22.97	50.95	0.62	0.04	1.57	22.47
	5.0	22.28	0.59	0.95	13.15	22.61	50.17	0.58	0.04	1.47	19.37
	5.05	21.94	0.55	0.9	12.05	22.26	49.38	0.54	0.04	1.37	16.48
	5.1	21.6	0.51	0.85	10.96	21.9	48.59	0.5	0.04	1.26	13.8
Waterline	5.15	19.87	0.5	0.8	9.88	20.15	44.71	0.49	0.04	1.23	12.19
	5.2	19.56	0.45	0.75	8.9	19.83	43.99	0.45	0.04	1.12	9.97
	5.25	19.25	0.41	0.7	7.93	19.5	43.26	0.41	0.04	1.0	7.95
	5.3	18.94	0.37	0.65	6.97	19.17	42.53	0.36	0.05	0.88	6.15
	5.35	18.63	0.32	0.6	6.03	18.85	41.82	0.32	0.05	0.76	4.57
	5.4	16.82	0.31	0.55	5.15	17.02	37.75	0.3	0.05	0.71	3.64
	5.45	15.75	0.28	0.5	4.33	15.93	35.34	0.27	0.06	0.62	2.68
	5.5	15.01	0.24	0.45	3.57	15.18	33.67	0.23	0.06	0.51	1.83
	5.55	13.14	0.22	0.4	2.86	13.29	29.49	0.22	0.06	0.46	1.31
	5.6	11.95	0.19	0.35	2.23	12.08	26.8	0.18	0.07	0.37	0.83
	5.65	10.01	0.17	0.3	1.69	10.11	22.44	0.17	0.08	0.32	0.54
	5.7	8.56	0.14	0.25	1.22	8.65	19.2	0.14	0.09	0.26	0.31
	5.75	5.45	0.16	0.2	0.85	5.52	12.24	0.15	0.08	0.29	0.24
	5.8	5.08	0.11	0.15	0.58	5.14	11.41	0.11	0.1	0.19	0.11
	5.85	4.73	0.07	0.1	0.34	4.77	10.58	0.07	0.15	0.09	0.03
	5.9	3.37	0.04	0.05	0.13	3.39	7.51	0.04	0.23	0.04	0.01
	5.93	2.41	0.01	0.01	0.03	2.41	5.36	0.01	0.57	0.01	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	12.17	(cfs)
Calculated Flow (Qc) =	12.19	(cfs)
(Qm-Qc)/Qm * 100 =	-0.09%	
Measured Waterline (WLm) =	5.14	(ft)
Calculated Waterline (WLc) =	5.15	(ft)
(WLm-WLc)/WLm * 100 =	-0.09%	
Max Measured Depth (Dm) =	0.8	(ft)
Max Calculated Depth (Dc) =	0.8	(ft)
(Dm-Dc)/Dm * 100 =	-0.02%	
Mean Velocity =	1.23	(ft/s)
Manning's n =	0.041	
0.4 * Qm =	4.87	(cfs)
2.5 * Qm =	30.43	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	1	2.75		
Bankfull	3.65	3.55		
	8.05	4.62		
Waterline	10.1	5.14	0	0
	11	5.45	0.3	0.55
	12	5.55	0.4	0.07
	13	5.7	0.55	1.23
	14	5.75	0.6	1.5
	15	5.75	0.6	1.36
	16	5.65	0.5	1.45
	17	5.75	0.6	0.65
	18	5.95	0.8	1.43
	19	5.95	0.8	1.72
	20	5.85	0.7	1.65
	21	5.95	0.8	1.57
	22	5.95	0.8	1.24
	23	5.5	0.35	1.53
	24	5.55	0.4	1.22
	25	5.65	0.5	1.27
	26	5.6	0.45	1.31
	27	5.4	0.25	0.71
	28	5.35	0.2	0.17
	29	5.45	0.3	0.33
	30	5.15	0	0
Waterline	31.4	5.15	0	0
	33.5	4.42		
Bankfull	58.5	2.93		
	65.6	1.96		

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (ft^2)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.95	0.3	0.28	0.16	1.29
1	0.4	0.4	0.03	0.23
1.01	0.55	0.55	0.68	5.56
1	0.6	0.6	0.9	7.39
1	0.6	0.6	0.82	6.7
1	0.5	0.5	0.72	5.96
1	0.6	0.6	0.39	3.2
1.02	0.8	0.8	1.14	9.4
1	0.8	0.8	1.38	11.3
1	0.7	0.7	1.16	9.49
1	0.8	0.8	1.26	10.32
1	0.8	0.8	0.99	8.15
1.1	0.35	0.35	0.54	4.4
1	0.4	0.4	0.49	4.01
1	0.5	0.5	0.64	5.22
1	0.45	0.45	0.59	4.84
1.02	0.25	0.25	0.18	1.46
1	0.2	0.2	0.03	0.28
1	0.3	0.3	0.1	0.81
1.04	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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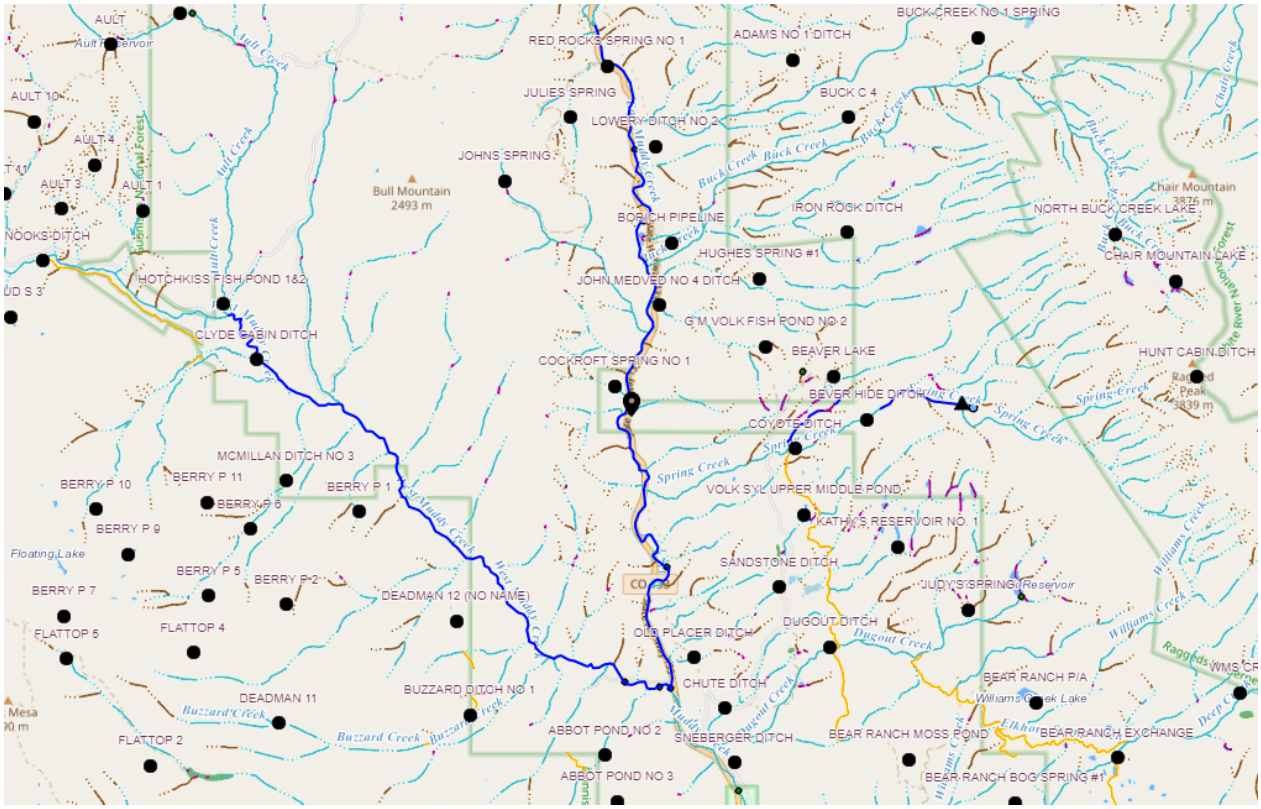
R2Cross RESULTS

Stream Name: East Muddy Creek
Stream Locations: Approx 1.57 miles upstream from Paonia Reservoir
Fieldwork Date: 09/24/2019
Cross-section: 1
Observers: J. Sondergard
Coordinate System: UTM Zone 13
X (easting): 295348.2
Y (northing): 4322971.9
Date Processed: 05/29/2023
Slope: 0.009
Discharge: R2Cross data file: 11.58 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: East Muddy Creek 9-24-19 #1.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 50.54

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.5	17.19
Percent Wetted Perimeter (%)	55.3	3.52
Mean Velocity (ft/s)	1.0	13.42

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)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	2.74	50.54	1.71	2.76	86.19	51.49	100.0	1.67	0.04	4.68	403.78
	2.75	50.41	1.7	2.75	85.69	51.36	99.74	1.67	0.04	4.67	400.23
	2.8	49.73	1.67	2.7	83.19	50.67	98.41	1.64	0.04	4.6	382.51
	2.85	49.05	1.65	2.65	80.72	49.99	97.08	1.61	0.04	4.53	365.26
	2.9	48.38	1.62	2.6	78.28	49.3	95.75	1.59	0.04	4.45	348.48
	2.95	47.7	1.59	2.55	75.88	48.62	94.42	1.56	0.04	4.38	332.15
	3.0	47.03	1.56	2.5	73.51	47.93	93.08	1.53	0.04	4.3	316.28
	3.05	46.35	1.54	2.45	71.18	47.25	91.75	1.51	0.04	4.23	300.86
	3.1	45.67	1.51	2.4	68.87	46.56	90.42	1.48	0.04	4.15	285.88
	3.15	45.0	1.48	2.35	66.61	45.88	89.09	1.45	0.04	4.07	271.35
	3.2	44.33	1.45	2.3	64.37	45.2	87.78	1.42	0.04	4.0	257.2
	3.25	43.68	1.42	2.25	62.17	44.54	86.5	1.4	0.04	3.91	243.39
	3.3	43.03	1.39	2.2	60.01	43.88	85.22	1.37	0.05	3.83	230.01
	3.35	42.38	1.37	2.15	57.87	43.22	83.94	1.34	0.05	3.75	217.06
	3.4	41.73	1.34	2.1	55.77	42.56	82.66	1.31	0.05	3.67	204.53
	3.45	41.08	1.31	2.05	53.7	41.9	81.37	1.28	0.05	3.58	192.42
	3.5	40.43	1.28	2.0	51.66	41.24	80.09	1.25	0.05	3.5	180.72
	3.55	39.79	1.25	1.95	49.65	40.58	78.81	1.22	0.05	3.41	169.43
	3.6	39.14	1.22	1.9	47.68	39.92	77.53	1.19	0.05	3.33	158.55
	3.65	38.49	1.19	1.85	45.74	39.26	76.25	1.16	0.05	3.24	148.07
	3.7	37.84	1.16	1.8	43.83	38.6	74.97	1.14	0.05	3.15	137.99
	3.75	37.19	1.13	1.75	41.96	37.94	73.69	1.11	0.05	3.06	128.31
	3.8	36.54	1.1	1.7	40.11	37.28	72.41	1.08	0.05	2.97	119.02
	3.85	35.89	1.07	1.65	38.3	36.62	71.12	1.05	0.05	2.87	110.11
	3.9	35.24	1.04	1.6	36.53	35.96	69.84	1.02	0.05	2.78	101.59

	3.95	34.59	1.01	1.55	34.78	35.3	68.56	0.99	0.05	2.69	93.45
	4.0	34.14	0.97	1.5	33.06	34.85	67.67	0.95	0.05	2.57	85.09
	4.05	33.75	0.93	1.45	31.37	34.44	66.88	0.91	0.05	2.45	76.99
	4.1	33.35	0.89	1.4	29.69	34.03	66.08	0.87	0.06	2.33	69.28
	4.15	32.96	0.85	1.35	28.03	33.62	65.29	0.83	0.06	2.21	61.98
	4.2	32.56	0.81	1.3	26.39	33.21	64.5	0.79	0.06	2.09	55.08
	4.25	32.17	0.77	1.25	24.77	32.81	63.71	0.76	0.06	1.96	48.59
	4.3	31.77	0.73	1.2	23.18	32.4	62.91	0.72	0.06	1.83	42.52
	4.35	31.38	0.69	1.15	21.6	31.99	62.12	0.68	0.06	1.71	36.85
	4.4	30.98	0.65	1.1	20.04	31.58	61.33	0.63	0.07	1.58	31.6
	4.45	30.58	0.6	1.05	18.5	31.17	60.54	0.59	0.07	1.45	26.77
	4.5	30.19	0.56	1.0	16.98	30.77	59.75	0.55	0.07	1.32	22.35
	4.55	29.79	0.52	0.95	15.48	30.36	58.95	0.51	0.08	1.19	18.36
	4.6	29.4	0.48	0.9	14.0	29.95	58.16	0.47	0.08	1.06	14.77
Waterline	4.65	29.01	0.43	0.85	12.54	29.54	57.37	0.42	0.09	0.93	11.61
	4.7	28.73	0.39	0.8	11.1	29.24	56.78	0.38	0.09	0.79	8.8
	4.75	28.45	0.34	0.75	9.67	28.94	56.2	0.33	0.1	0.66	6.42
	4.8	28.18	0.29	0.7	8.25	28.64	55.61	0.29	0.11	0.54	4.44
	4.85	27.9	0.25	0.65	6.85	28.34	55.03	0.24	0.13	0.42	2.86
	4.9	26.57	0.21	0.6	5.49	26.96	52.35	0.2	0.15	0.33	1.79
	4.95	25.9	0.16	0.55	4.18	26.26	50.99	0.16	0.18	0.23	0.95
	5.0	22.24	0.13	0.5	2.97	22.53	43.76	0.13	0.21	0.17	0.51
	5.05	17.73	0.11	0.45	1.97	17.96	34.89	0.11	0.25	0.13	0.26
	5.1	13.48	0.09	0.4	1.19	13.65	26.51	0.09	0.3	0.09	0.11
	5.15	5.84	0.11	0.35	0.66	5.95	11.56	0.11	0.24	0.13	0.09
	5.2	3.36	0.13	0.3	0.43	3.45	6.69	0.12	0.22	0.16	0.07
	5.25	2.22	0.13	0.25	0.29	2.28	4.43	0.13	0.22	0.16	0.05
	5.3	1.82	0.1	0.2	0.19	1.87	3.64	0.1	0.26	0.12	0.02
	5.35	1.43	0.08	0.15	0.11	1.47	2.85	0.07	0.34	0.07	0.01
	5.4	0.95	0.05	0.1	0.05	0.98	1.9	0.05	0.48	0.04	0.0
	5.45	0.48	0.03	0.05	0.01	0.49	0.95	0.02	0.85	0.01	0.0
	5.49	0.14	0.01	0.01	0.0	0.15	0.28	0.01	2.33	0.0	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	11.58	(cfs)
Calculated Flow (Qc) =	11.59	(cfs)
(Qm-Qc)/Qm * 100 =	-0.10%	
Measured Waterline (WLm) =	4.64	(ft)
Calculated Waterline (WLc) =	4.65	(ft)
(WLm-WLc)/WLm * 100 =	-0.10%	
Max Measured Depth (Dm) =	0.85	(ft)
Max Calculated Depth (Dc) =	0.85	(ft)
(Dm-Dc)/Dm * 100 =	-0.02%	
Mean Velocity =	0.92	(ft/s)
Manning's n =	0.086	
0.4 * Qm =	4.63	(cfs)
2.5 * Qm =	28.96	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	2.9	1.79		
Bankfull	5.3	2.74		
	17.25	3.96		
Waterline	20.45	4.64	0	0
	21.4	4.85	0.2	0
	22	5.1	0.45	0.63
	23	5.15	0.5	1.23
	24	5.1	0.45	0.6
	25	5	0.35	1.05
	26	5.15	0.5	1.34
	27	5.05	0.4	1.68
	28	5.15	0.5	1.4
	29	5.15	0.5	0.67
	30	5.05	0.4	1.52
	31	5.15	0.5	2.11
	32	5.05	0.4	1.78
	33	4.95	0.3	2.26
	34	5.05	0.4	1.55
	35	4.95	0.3	1.09
	36	5.05	0.4	0.48
	37	4.9	0.25	0.86
	38	4.85	0.2	0.69
	39	5.15	0.5	0.01
	40	5.15	0.5	0.31
	41	5.25	0.6	0.1
	42	5.05	0.4	0.24
	43	4.95	0.3	1.07
	44	5.05	0.4	1.4
	45	5.2	0.55	0.6
	46	5.15	0.5	0.55

	47	5.35	0.7	0.76
	48	5.5	0.85	0.9
	49	5.15	0.5	0.22
Waterline	49.5	4.65	0	0
	54.2	3.18		
Bankfull	56.25	2.63		
	56.85	2.12		

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (ft^2)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.97	0.2	0.15	0	0
0.65	0.45	0.36	0.23	1.96
1	0.5	0.5	0.61	5.31
1	0.45	0.45	0.27	2.33
1	0.35	0.35	0.37	3.17
1.01	0.5	0.5	0.67	5.78
1	0.4	0.4	0.67	5.8
1	0.5	0.5	0.7	6.04
1	0.5	0.5	0.34	2.89
1	0.4	0.4	0.61	5.25
1	0.5	0.5	1.05	9.11
1	0.4	0.4	0.71	6.15
1	0.3	0.3	0.68	5.85
1	0.4	0.4	0.62	5.35
1	0.3	0.3	0.33	2.82
1	0.4	0.4	0.19	1.66
1.01	0.25	0.25	0.21	1.86
1	0.2	0.2	0.14	1.19
1.04	0.5	0.5	0.01	0.04
1	0.5	0.5	0.15	1.34
1	0.6	0.6	0.06	0.52
1.02	0.4	0.4	0.1	0.83
1	0.3	0.3	0.32	2.77
1	0.4	0.4	0.56	4.83
1.01	0.55	0.55	0.33	2.85
1	0.5	0.5	0.28	2.37

1.02	0.7	0.7	0.53	4.59
1.01	0.85	0.85	0.77	6.61
1.06	0.5	0.38	0.08	0.71
0.71	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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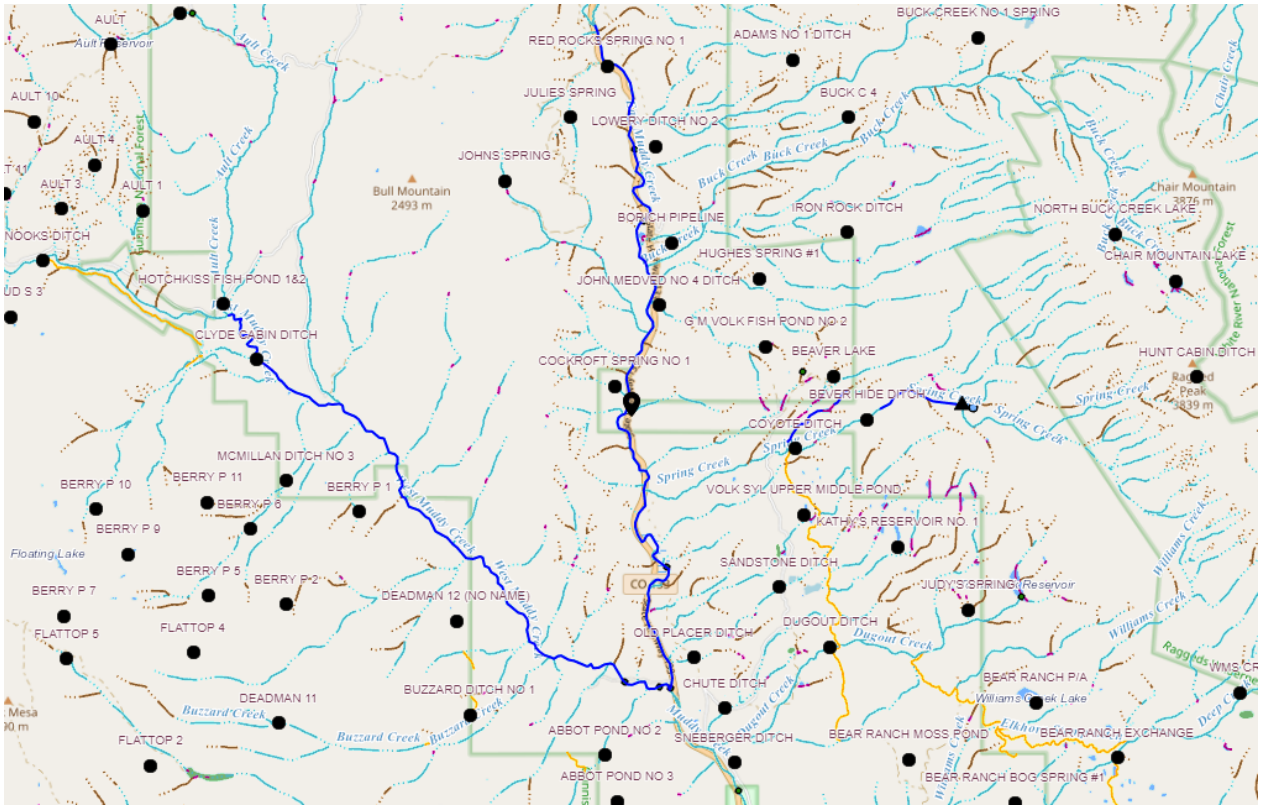
R2Cross RESULTS

Stream Name: East Muddy Creek
Stream Locations: Approx. 1.0 mile upstream from confluence with Spring Creek
Fieldwork Date: 06/01/2018
Cross-section: 2
Observers: R. Smith, J Sondergard
Coordinate System: UTM Zone 13
X (easting): 295345
Y (northing): 4323005
Date Processed: 05/29/2023
Slope: 0.0048
Discharge: R2Cross data file: 43.24 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: East Muddy Creek 6-1-18 #2 New.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 42.37

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.4	6.8
Percent Wetted Perimeter (%)	51.2	1.53
Mean Velocity (ft/s)	1.0	15.59

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)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	3.43	42.37	1.41	2.17	59.78	43.44	100.0	1.38	0.05	2.78	166.19
	3.45	42.1	1.4	2.15	58.93	43.16	99.36	1.37	0.05	2.76	162.5
	3.5	41.42	1.37	2.1	56.85	42.47	97.78	1.34	0.05	2.7	153.53
	3.55	40.74	1.35	2.05	54.79	41.78	96.19	1.31	0.05	2.64	144.85
	3.6	40.06	1.32	2.0	52.77	41.09	94.61	1.28	0.05	2.59	136.47
	3.65	39.38	1.29	1.95	50.79	40.41	93.02	1.26	0.05	2.53	128.38
	3.7	38.69	1.26	1.9	48.84	39.72	91.43	1.23	0.05	2.47	120.58
	3.75	38.01	1.23	1.85	46.92	39.03	89.85	1.2	0.05	2.41	113.06
	3.8	37.33	1.21	1.8	45.03	38.34	88.26	1.17	0.05	2.35	105.83
	3.85	36.65	1.18	1.75	43.18	37.65	86.67	1.15	0.05	2.29	98.88
	3.9	35.79	1.16	1.7	41.37	36.78	84.68	1.12	0.05	2.24	92.72
	3.95	34.89	1.14	1.65	39.61	35.87	82.57	1.1	0.05	2.2	86.96
	4.0	34.0	1.11	1.6	37.88	34.97	80.52	1.08	0.05	2.15	81.42
	4.05	33.15	1.09	1.55	36.2	34.11	78.52	1.06	0.05	2.1	76.06
	4.1	32.29	1.07	1.5	34.57	33.24	76.53	1.04	0.05	2.05	70.97
	4.15	31.43	1.05	1.45	32.98	32.38	74.54	1.02	0.05	2.01	66.12
	4.2	30.77	1.02	1.4	31.42	31.7	72.98	0.99	0.05	1.94	61.07
	4.25	30.1	0.99	1.35	29.9	31.03	71.43	0.96	0.05	1.88	56.27
	4.3	29.43	0.97	1.3	28.41	30.35	69.87	0.94	0.05	1.82	51.7
	4.35	28.77	0.94	1.25	26.96	29.67	68.31	0.91	0.05	1.76	47.35
Waterline	4.4	28.1	0.91	1.2	25.53	29.0	66.75	0.88	0.06	1.69	43.24
	4.45	27.7	0.87	1.15	24.14	28.58	65.8	0.84	0.06	1.61	38.89
	4.5	27.3	0.83	1.1	22.76	28.17	64.85	0.81	0.06	1.53	34.77
	4.55	27.05	0.79	1.05	21.41	27.9	64.23	0.77	0.06	1.43	30.69
	4.6	26.8	0.75	1.0	20.06	27.63	63.61	0.73	0.06	1.34	26.86

	4.65	26.62	0.7	0.95	18.72	27.42	63.13	0.68	0.06	1.24	23.21
	4.7	26.43	0.66	0.9	17.4	27.21	62.65	0.64	0.07	1.14	19.83
	4.75	26.25	0.61	0.85	16.08	27.0	62.17	0.6	0.07	1.04	16.73
	4.8	26.07	0.57	0.8	14.77	26.79	61.68	0.55	0.07	0.94	13.89
	4.85	25.73	0.52	0.75	13.48	26.4	60.78	0.51	0.08	0.85	11.44
	4.9	25.39	0.48	0.7	12.2	26.01	59.87	0.47	0.08	0.76	9.24
	4.95	25.05	0.44	0.65	10.94	25.61	58.97	0.43	0.09	0.67	7.29
	5.0	24.71	0.39	0.6	9.69	25.22	58.06	0.38	0.09	0.58	5.59
	5.05	23.98	0.35	0.55	8.48	24.44	56.26	0.35	0.1	0.5	4.23
	5.1	23.24	0.31	0.5	7.3	23.65	54.45	0.31	0.11	0.42	3.09
	5.15	22.5	0.27	0.45	6.15	22.87	52.65	0.27	0.12	0.35	2.14
	5.2	21.76	0.23	0.4	5.05	22.08	50.84	0.23	0.14	0.27	1.39
	5.25	20.86	0.19	0.35	3.98	21.14	48.67	0.19	0.16	0.21	0.83
	5.3	18.95	0.16	0.3	2.96	19.2	44.2	0.15	0.19	0.15	0.46
	5.35	16.71	0.12	0.25	2.07	16.9	38.92	0.12	0.23	0.11	0.23
	5.4	12.47	0.1	0.2	1.29	12.61	29.03	0.1	0.27	0.08	0.11
	5.45	9.57	0.08	0.15	0.74	9.66	22.24	0.08	0.34	0.05	0.04
	5.5	5.67	0.06	0.1	0.33	5.71	13.16	0.06	0.43	0.04	0.01
	5.55	3.33	0.03	0.05	0.11	3.36	7.73	0.03	0.69	0.02	0.0
	5.58	1.7	0.01	0.01	0.02	1.71	3.93	0.01	1.6	0.0	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	43.24	(cfs)
Calculated Flow (Qc) =	43.24	(cfs)
(Qm-Qc)/Qm * 100 =	0.01%	
Measured Waterline (WLm) =	4.28	(ft)
Calculated Waterline (WLc) =	4.4	(ft)
(WLm-WLc)/WLm * 100 =	-2.92%	
Max Measured Depth (Dm) =	1.2	(ft)
Max Calculated Depth (Dc) =	1.2	(ft)
(Dm-Dc)/Dm * 100 =	0.00%	
Mean Velocity =	1.69	(ft/s)
Manning's n =	0.056	
0.4 * Qm =	17.3	(cfs)
2.5 * Qm =	108.1	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	2.94		
Bankfull	4	3.43		
	8	3.86		
Waterline	12	4.15		
	14.5	4.4	0	0
	15	4.5	0.1	0.13
	16	5	0.6	0.81
	17	5.1	0.7	1.56
	18	5.2	0.8	1.7
	19	5.3	0.9	1.99
	20	5.3	0.9	1.09
	21	5.4	1	1.88
	22	5.4	1	2.01
	23	5.3	0.9	1.58
	24	5.4	1	2.03
	25	5.5	1.1	2.86
	26	5.4	1	2.14
	27	5.5	1.1	2.06
	28	5.5	1.1	1.9
	29	5.4	1	1.52
	30	5.5	1.1	2.38
	31	5.6	1.2	1.51
	32	5.5	1.1	1.99
	33	5.6	1.2	2.19
	34	5.6	1.2	1.6
	35	5.3	0.9	2.29
	36	5.6	1.2	1.54
	37	5.5	1.1	1.41
	38	4.8	0.4	0.98
	39	5.4	1	1.06

	40	5.4	1	0.69
	41	5.2	0.8	0.31
	42	4.6	0.2	0
Waterline	42.6	4.4	0	0
	44	3.98		
Bankfull	46.5	3.4		

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (ft^2)	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
0.51	0.1	0.07	0.01	0.02
1.12	0.6	0.6	0.49	1.12
1	0.7	0.7	1.09	2.52
1	0.8	0.8	1.36	3.15
1	0.9	0.9	1.79	4.14
1	0.9	0.9	0.98	2.27
1	1	1	1.88	4.35
1	1	1	2.01	4.65
1	0.9	0.9	1.42	3.29
1	1	1	2.03	4.7
1	1.1	1.1	3.15	7.28
1	1	1	2.14	4.95
1	1.1	1.1	2.27	5.24
1	1.1	1.1	2.09	4.83
1	1	1	1.52	3.52
1	1.1	1.1	2.62	6.05
1	1.2	1.2	1.81	4.19
1	1.1	1.1	2.19	5.06
1	1.2	1.2	2.63	6.08
1	1.2	1.2	1.92	4.44
1.04	0.9	0.9	2.06	4.77
1.04	1.2	1.2	1.85	4.27
1	1.1	1.1	1.55	3.59
1.22	0.4	0.4	0.39	0.91
1.17	1	1	1.06	2.45

1	1	1	0.69	1.6
1.02	0.8	0.8	0.25	0.57
1.17	0.2	0.16	0	0
0.63	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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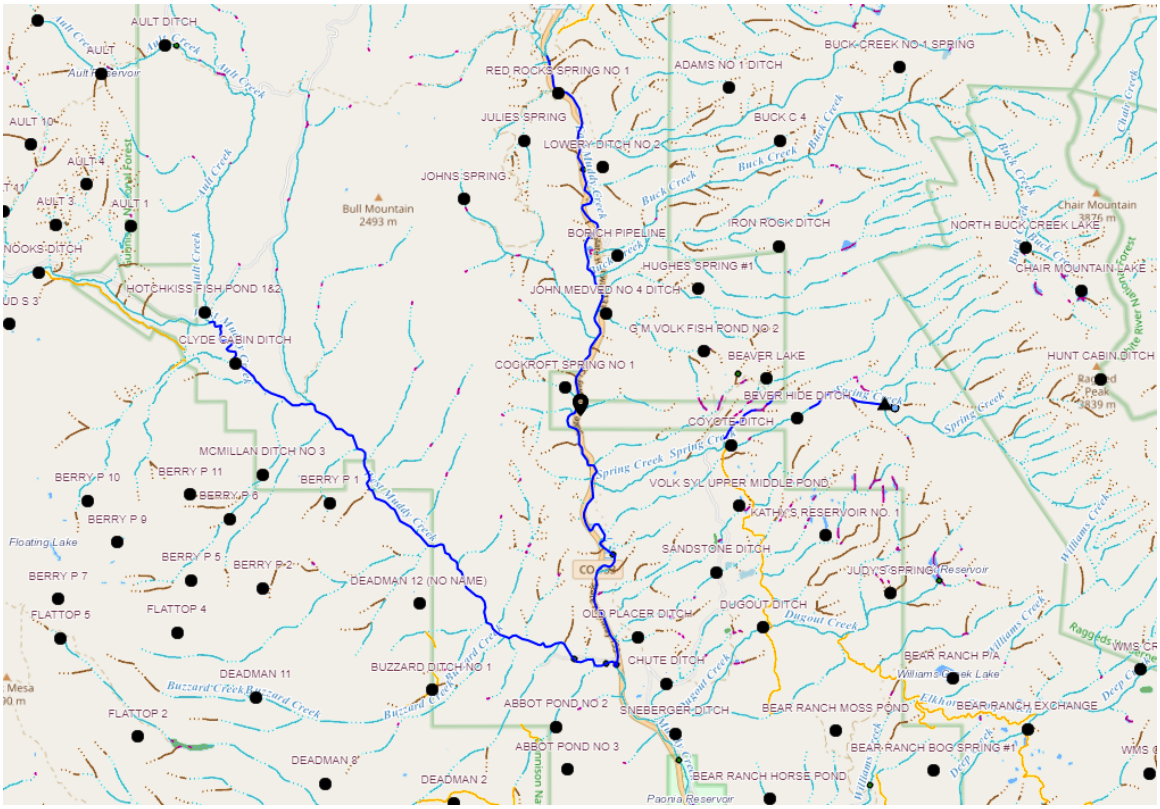
R2Cross RESULTS

Stream Name: East Muddy Creek
Stream Locations: Approx 1.0 mile upstream from confluence with Spring Creek
Fieldwork Date: 06/01/2018
Cross-section: 1
Observers: R. Smith, J. Sondergard
Coordinate System: UTM Zone 13
X (easting): 295335
Y (northing): 4322956
Date Processed: 05/29/2023
Slope: 0.0056
Discharge: R2Cross data file: 45.34 (cfs)
Computation method: Ferguson VPE
R2Cross data filename: East Muddy Creek 6-1-18 #1 New.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 49.9

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.5	15.16
Percent Wetted Perimeter (%)	55.0	32.41
Mean Velocity (ft/s)	1.0	10.7

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)	Manning's n	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	3.55	49.9	1.58	2.5	78.65	50.41	100.0	1.56	0.04	4.02	315.88
	3.6	49.32	1.55	2.45	76.28	49.82	98.82	1.53	0.04	3.95	301.34
	3.65	48.7	1.52	2.4	73.83	49.2	97.59	1.5	0.04	3.88	286.52
	3.7	48.09	1.48	2.35	71.41	48.58	96.36	1.47	0.04	3.81	272.08
	3.75	47.48	1.45	2.3	69.02	47.96	95.13	1.44	0.04	3.74	258.03
	3.8	46.86	1.42	2.25	66.66	47.33	93.9	1.41	0.04	3.67	244.37
	3.85	46.25	1.39	2.2	64.33	46.71	92.66	1.38	0.04	3.59	231.1
	3.9	45.64	1.36	2.15	62.03	46.09	91.43	1.35	0.04	3.52	218.21
	3.95	44.91	1.33	2.1	59.77	45.36	89.98	1.32	0.04	3.45	206.2
	4.0	44.18	1.3	2.05	57.54	44.62	88.51	1.29	0.04	3.38	194.59
	4.05	43.44	1.27	2.0	55.35	43.88	87.04	1.26	0.04	3.31	183.36
	4.1	42.71	1.25	1.95	53.2	43.14	85.57	1.23	0.04	3.24	172.5
	4.15	41.98	1.22	1.9	51.08	42.4	84.1	1.2	0.04	3.17	162.01
	4.2	41.18	1.19	1.85	49.0	41.59	82.5	1.18	0.04	3.1	152.13
	4.25	40.33	1.16	1.8	46.96	40.73	80.8	1.15	0.04	3.04	142.8
	4.3	39.48	1.14	1.75	44.97	39.88	79.1	1.13	0.04	2.98	133.83
	4.35	38.62	1.11	1.7	43.01	39.02	77.4	1.1	0.04	2.91	125.21
	4.4	37.89	1.08	1.65	41.1	38.27	75.92	1.07	0.04	2.84	116.61
	4.45	37.18	1.05	1.6	39.23	37.56	74.51	1.04	0.04	2.76	108.23
	4.5	36.48	1.02	1.55	37.38	36.85	73.1	1.01	0.04	2.68	100.19
	4.55	35.77	0.99	1.5	35.58	36.14	71.69	0.98	0.04	2.6	92.5
	4.6	35.07	0.96	1.45	33.81	35.43	70.28	0.95	0.04	2.52	85.13
	4.65	34.37	0.93	1.4	32.07	34.72	68.87	0.92	0.04	2.44	78.09
	4.7	33.44	0.91	1.35	30.38	33.78	67.02	0.9	0.04	2.37	71.9
	4.75	32.5	0.88	1.3	28.73	32.84	65.15	0.87	0.04	2.3	66.06

	4.8	31.57	0.86	1.25	27.13	31.9	63.28	0.85	0.04	2.23	60.53
	4.85	30.63	0.83	1.2	25.57	30.95	61.4	0.83	0.05	2.16	55.31
	4.9	29.69	0.81	1.15	24.06	30.01	59.53	0.8	0.05	2.09	50.39
Waterline	4.95	28.81	0.78	1.1	22.6	29.13	57.78	0.78	0.05	2.02	45.66
	5.0	28.3	0.75	1.05	21.17	28.6	56.73	0.74	0.05	1.92	40.61
	5.05	27.8	0.71	1.0	19.77	28.09	55.72	0.7	0.05	1.81	35.82
	5.1	27.3	0.67	0.95	18.39	27.58	54.71	0.67	0.05	1.7	31.33
	5.15	26.85	0.63	0.9	17.04	27.12	53.8	0.63	0.05	1.59	27.08
	5.2	26.44	0.59	0.85	15.71	26.69	52.95	0.59	0.05	1.47	23.1
	5.25	26.02	0.55	0.8	14.4	26.26	52.1	0.55	0.06	1.35	19.44
	5.3	25.6	0.51	0.75	13.1	25.84	51.25	0.51	0.06	1.23	16.09
	5.35	25.19	0.47	0.7	11.84	25.41	50.4	0.47	0.06	1.1	13.06
	5.4	24.53	0.43	0.65	10.59	24.74	49.08	0.43	0.06	0.99	10.5
	5.45	23.86	0.39	0.6	9.38	24.06	47.74	0.39	0.07	0.88	8.23
	5.5	23.51	0.35	0.55	8.2	23.7	47.02	0.35	0.07	0.75	6.14
	5.55	23.18	0.3	0.5	7.03	23.35	46.33	0.3	0.08	0.62	4.36
	5.6	22.85	0.26	0.45	5.88	23.01	45.64	0.26	0.09	0.49	2.91
	5.65	22.51	0.21	0.4	4.75	22.66	44.95	0.21	0.1	0.37	1.77
	5.7	22.18	0.16	0.35	3.63	22.31	44.26	0.16	0.13	0.26	0.94
	5.75	21.05	0.12	0.3	2.55	21.17	42.0	0.12	0.16	0.17	0.43
	5.8	15.66	0.11	0.25	1.67	15.75	31.25	0.11	0.18	0.14	0.23
	5.85	12.16	0.08	0.2	0.98	12.23	24.25	0.08	0.23	0.09	0.09
	5.9	7.89	0.06	0.15	0.5	7.94	15.75	0.06	0.27	0.06	0.03
	5.95	4.64	0.04	0.1	0.19	4.66	9.25	0.04	0.4	0.03	0.01
	6.0	1.78	0.04	0.05	0.07	1.79	3.55	0.04	0.39	0.03	0.0
	6.04	1.23	0.01	0.01	0.02	1.23	2.43	0.01	0.98	0.01	0.0

This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method

MODEL SUMMARY

Measured Flow (Qm) =	45.34	(cfs)
Calculated Flow (Qc) =	45.53	(cfs)
(Qm-Qc)/Qm * 100 =	-0.44%	
Measured Waterline (WLm) =	4.92	(ft)
Calculated Waterline (WLc) =	4.95	(ft)
(WLm-WLc)/WLm * 100 =	-0.46%	
Max Measured Depth (Dm) =	1.1	(ft)
Max Calculated Depth (Dc) =	1.1	(ft)
(Dm-Dc)/Dm * 100 =	-0.20%	
Mean Velocity =	2.01	(ft/s)
Manning's n =	0.047	
0.4 * Qm =	18.13	(cfs)
2.5 * Qm =	113.34	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
Bankfull	0	3.5		
	4	4.17		
	8	4.65		
Waterline	11.9	4.95	0	0
	13	5.15	0.2	0.33
	14	5.35	0.4	1.19
	15	5.45	0.5	2.19
	16	5.75	0.8	1.68
	17	5.85	0.9	2.3
	18	5.75	0.8	1.92
	19	5.75	0.8	2.43
	20	5.85	0.9	1.89
	21	5.75	0.8	2.48
	22	5.95	1	2.53
	23	5.85	0.9	2.86
	24	5.85	0.9	2.64
	25	5.75	0.8	2.58
	26	5.85	0.9	2.56
	27	5.95	1	2.34
	28	5.95	1	2.42
	29	5.85	0.9	1.65
	30	5.95	1	1.71
	31	5.85	0.9	1.57
	32	6.05	1.1	1.63
	33	6.05	1.1	1.46
	34	5.95	1	1.81
	35	5.95	1	2
	36	5.75	0.8	1.73
	37	5.75	0.8	1.64
	38	5.7	0.75	1.65

	39	5.4	0.45	1.46
	40	5.1	0.2	0.54
Waterline	40.9	4.9	0	0
	44	4.36		
	48	3.9		
Bankfull	50.2	3.55		

COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (ft^2)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
1.12	0.2	0.21	0.07	0.15
1.02	0.4	0.4	0.48	1.05
1	0.5	0.5	1.09	2.42
1.04	0.8	0.8	1.34	2.96
1	0.9	0.9	2.07	4.57
1	0.8	0.8	1.54	3.39
1	0.8	0.8	1.94	4.29
1	0.9	0.9	1.7	3.75
1	0.8	0.8	1.98	4.38
1.02	1	1	2.53	5.58
1	0.9	0.9	2.57	5.68
1	0.9	0.9	2.38	5.24
1	0.8	0.8	2.06	4.55
1	0.9	0.9	2.3	5.08
1	1	1	2.34	5.16
1	1	1	2.42	5.34
1	0.9	0.9	1.49	3.27
1	1	1	1.71	3.77
1	0.9	0.9	1.41	3.12
1.02	1.1	1.1	1.79	3.96
1	1.1	1.1	1.61	3.54
1	1	1	1.81	3.99
1	1	1	2	4.41
1.02	0.8	0.8	1.38	3.05
1	0.8	0.8	1.31	2.89
1	0.75	0.75	1.24	2.73

1.04	0.45	0.45	0.66	1.45
1.04	0.2	0.19	0.1	0.23
0.92	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

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General Site Field Visit Data Report *(Filters: Name begins with East Muddy Creek; Division = 4;)*

Type		Div	Name	CWCB Case Number	Segment ID	Visit Date	Location Description	Watershed Name
Stream		4	East Muddy Creek		21/4/A-005	4/7/2021	From McClure Pass to Paonia Reservior	North Fork Gunnison
	Remarks	Date	Remark					
		07/04/21 00:00	Site Investigation: potential locations for CWCB temp gage, USGS and DWR gages on Muddy Creek, tributaries above and below confluence with West Muddy, photos.					
	GPS Log	No GPS Log records for this visit.						
	Photo Log	No Photo Log records for this visit.						
		4	East Muddy Creek		21/4/A-005	4/8/2021	At DWR gage and confluence with West Muddy Creek. Collaborated with DWR, Josh Casper, about the segments and potential temporary gage locations.	North Fork Gunnison
	Remarks	Date	Remark					
		08/04/21 00:00	Determined no good gage location on East Muddy Creek with public access between Spring Creek trib and confluence with West Muddy Creek.					
	GPS Log	No GPS Log records for this visit.						
	Photo Log	No Photo Log records for this visit.						

Discharge Measurment Field Visit Data Report *(Filters: Name begins with East Muddy Creek; Division = 4;)*

Div	Name	CWCB Case Number	Segment ID	Meas. Date	UTM	Location	Flow Amount (cfs)	Meas #	Rating	Station ID
4	East Muddy Creek		21/4/A-005	11/06/2023	UTMx: 295498 UTMy: 4322126	measurment taken near the bridge	16.94			

Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
Site number	Bridge at rv park
Operator(s)	Lfs
File name	Bridge at rv park_20231106-140228.ft
Comment	

Start time	11/6/2023 12:40 PM
End time	11/6/2023 1:00 PM
Start location latitude	-
Start location longitude	-
Calculations engine	FlowTracker2

Sensor type	Top Setting
Handheld serial number	FT2H2322005
Probe serial number	FT2P2317010
Probe firmware	1.30
Handheld software	1.7

# Stations	Avg interval (s)	Total discharge (ft³/s)
20	40	16.9441

Total width (ft)	Total area (ft²)	Wetted Perimeter (ft)
42.700	38.4120	50.940

Mean SNR (dB)	Mean depth (ft)	Mean velocity (ft/s)
38	0.900	0.4411

Mean temp (°F)	Max depth (ft)	Max velocity (ft/s)
41.525	2.000	0.6266

Discharge Uncertainty		
Category	**ISO**	**IVE**
Accuracy	1.0%	1.0%
Depth	0.2%	3.1%
Velocity	0.5%	2.4%
Width	0.1%	0.1%
Method	1.6%	
# Stations	2.8%	
Overall	**3.4%**	**4.0%**

Discharge equation	Mid Section
Discharge uncertainty	IVE
Discharge reference	Rated

Data Collection Settings	
Salinity	0.000 PSS-78
Temperature	-
Sound speed	-
Mounting correction	0.000 %

Summary overview

No changes were made to this file
Quality control warnings

Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
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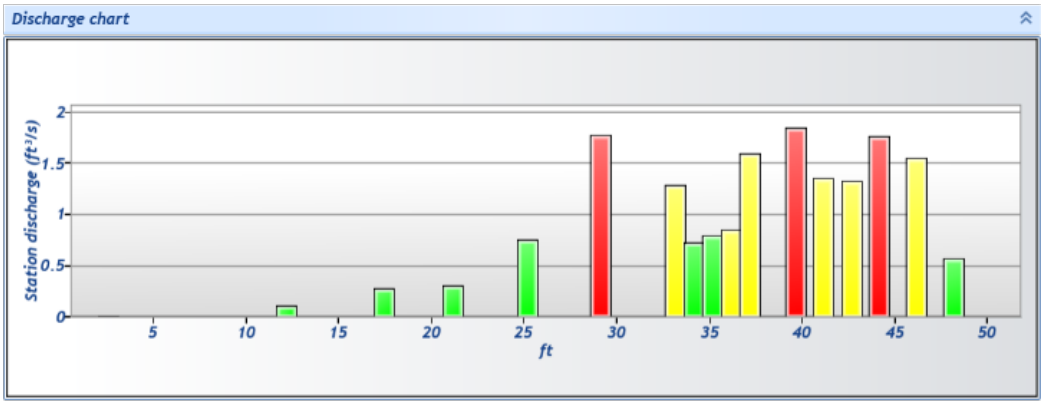
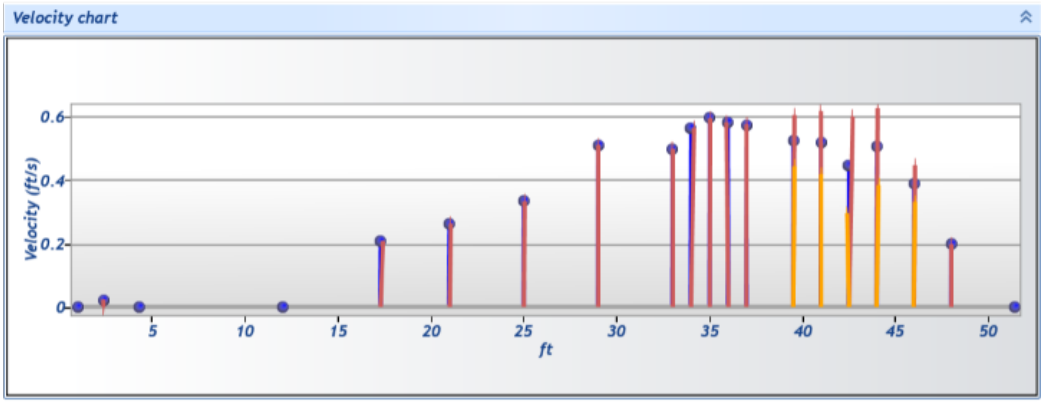
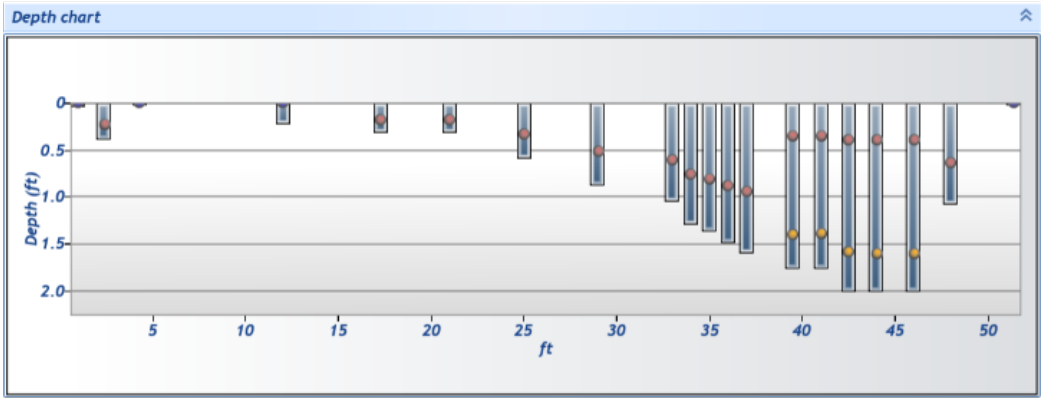
Comment	

Station Warning Settings	
Station discharge OK	Station discharge < 5.00%
Station discharge caution	5.00% >= Station discharge < 10.00%
Station discharge warning	Station discharge >= 10.00%







Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
Site number	Bridge at rv park
Operator(s)	Lfs
File name	Bridge at rv park_20231106-140228.ft
Comment	

Measurement results

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Samples	Velocity (ft/s)	Correction	Mean Velocity (ft/s)	Area (ft²)	Flow (ft³/s)	%Q	
0	1:40 PM	1.000	None	0.030	0.0000	0.000	0	0.0000	1.0000	0.0240	0.0210	0.0005	0.00	✓
1	1:41 PM	2.400	0.6	0.370	0.6000	0.222	16	0.0240	1.0000	0.0240	0.6105	0.0146	0.09	✓
2	1:41 PM	4.300	None	0.010	0.0000	0.000	0	0.0000	1.0000	0.0240	0.0095	0.0002	0.00	✓
3	1:42 PM	12.000	None	0.200	0.0000	0.000	0	0.0000	1.0000	0.2086	0.5300	0.1106	0.65	✓
4	1:43 PM	17.300	0.6	0.300	0.6000	0.180	25	0.2086	1.0000	0.2086	1.3500	0.2817	1.66	✓
5	1:44 PM	21.000	0.6	0.300	0.6000	0.180	17	0.2637	1.0000	0.2637	1.1550	0.3046	1.80	✓
6	1:45 PM	25.000	0.6	0.570	0.6000	0.342	21	0.3332	1.0000	0.3332	2.2800	0.7597	4.48	✓
7	1:46 PM	29.000	0.6	0.870	0.6000	0.522	28	0.5107	1.0000	0.5107	3.4800	1.7773	10.49	✓
8	1:47 PM	33.000	0.6	1.030	0.6000	0.618	18	0.4980	1.0000	0.4980	2.5750	1.2825	7.57	✓
9	1:47 PM	34.000	0.6	1.280	0.6000	0.768	18	0.5646	1.0000	0.5646	1.2800	0.7227	4.26	✓
10	1:48 PM	35.000	0.6	1.350	0.6000	0.810	20	0.5946	1.0000	0.5946	1.3500	0.8028	4.74	✓
11	1:49 PM	36.000	0.6	1.470	0.6000	0.882	15	0.5816	1.0000	0.5816	1.4700	0.8550	5.05	✓
12	1:50 PM	37.000	0.6	1.580	0.6000	0.948	29	0.5760	1.0000	0.5760	2.7650	1.5926	9.40	✓
13	1:50 PM	39.500	0.2/0.8	1.760	0.2000	0.352	13	0.6046	1.0000	0.5239	3.5200	1.8442	10.88	✓
13	1:50 PM	39.500	0.2/0.8	1.760	0.8000	1.408	17	0.4432	1.0000	0.5239	3.5200	1.8442	10.88	✓
14	1:52 PM	41.000	0.2/0.8	1.750	0.2000	0.350	36	0.6171	1.0000	0.5179	2.6250	1.3595	8.02	✓
14	1:52 PM	41.000	0.2/0.8	1.750	0.8000	1.400	14	0.4187	1.0000	0.5179	2.6250	1.3595	8.02	✓
15	1:53 PM	42.500	0.2/0.8	1.990	0.2000	0.398	14	0.6001	1.0000	0.4478	2.9850	1.3366	7.89	✓
15	1:53 PM	42.500	0.2/0.8	1.990	0.8000	1.592	29	0.2954	1.0000	0.4478	2.9850	1.3366	7.89	✓
16	1:55 PM	44.000	0.2/0.8	2.000	0.2000	0.400	18	0.6266	1.0000	0.5051	3.5000	1.7680	10.43	✓
16	1:55 PM	44.000	0.2/0.8	2.000	0.8000	1.600	25	0.3837	1.0000	0.5051	3.5000	1.7680	10.43	✓
17	1:57 PM	46.000	0.2/0.8	2.000	0.2000	0.400	12	0.4465	1.0000	0.3888	4.0000	1.5550	9.18	✓
17	1:57 PM	46.000	0.2/0.8	2.000	0.8000	1.600	21	0.3311	1.0000	0.3888	4.0000	1.5550	9.18	✓
18	1:59 PM	48.000	0.6	1.070	0.6000	0.642	13	0.1983	1.0000	0.1983	2.8890	0.5728	3.38	✓
19	2:00 PM	51.400	None	0.010	0.0000	0.000	0	0.0000	1.0000	0.1983	0.0170	0.0034	0.02	✓

Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
Site number	Bridge at rv park
Operator(s)	Lfs
File name	Bridge at rv park_20231106-140228.ft
Comment	

Quality Control Settings	
Maximum depth change	50.00%
Maximum spacing change	100.00%
SNR threshold	10 dB
Standard error threshold	0.0328 ft/s
Spike threshold	10.00%
Maximum velocity angle	20.0 deg
Maximum tilt angle	5.0 deg

Quality control warnings

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Warnings
1	1:41 PM	2.400	0.6	0.370	0.6000	0.222	SNR Threshold Variation
4	1:43 PM	17.300	0.6	0.300	0.6000	0.180	Velocity Angle > QC
7	1:46 PM	29.000	0.6	0.870	0.6000	0.522	High Stn % Discharge
10	1:48 PM	35.000	0.6	1.350	0.6000	0.810	Stn Spacing > QC
13	1:50 PM	39.500	0.2/0.8	1.760	0.2000	0.352	High % Spikes,High Stn % Discharge
13	1:50 PM	39.500	0.2/0.8	1.760	0.8000	1.408	High % Spikes,High Stn % Discharge
16	1:55 PM	44.000	0.2/0.8	2.000	0.2000	0.400	High Stn % Discharge
16	1:55 PM	44.000	0.2/0.8	2.000	0.8000	1.600	High Stn % Discharge
19	2:00 PM	51.400	None	0.010	0.0000	0.000	Water Depth > QC

Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
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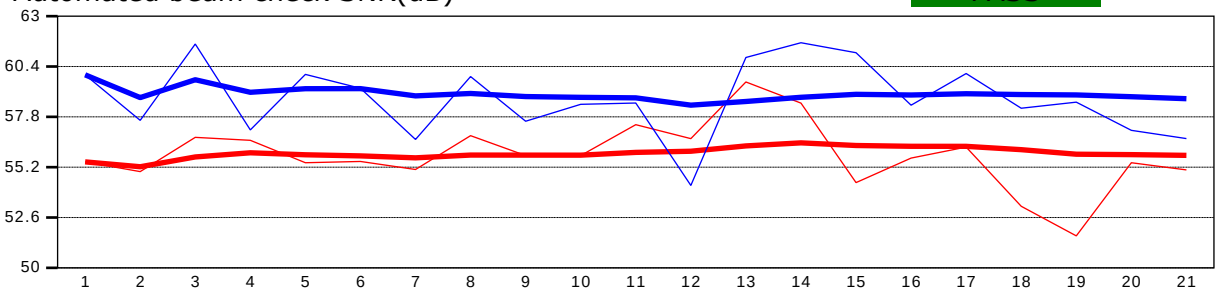
File name	Bridge at rv park_20231106-140228.ft
Comment	

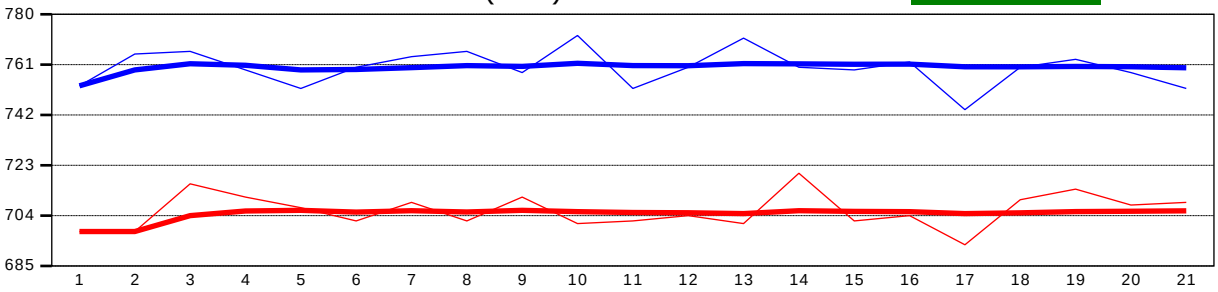
Beam 1	
Beam 2	

Automated beam check Start time 11/6/2023 1:40:25 PM

Automated beam check SNR(dB) PASS



Automated beam check Noise level(cnts) PASS



Automated beam check Quality control warnings

No quality control warnings

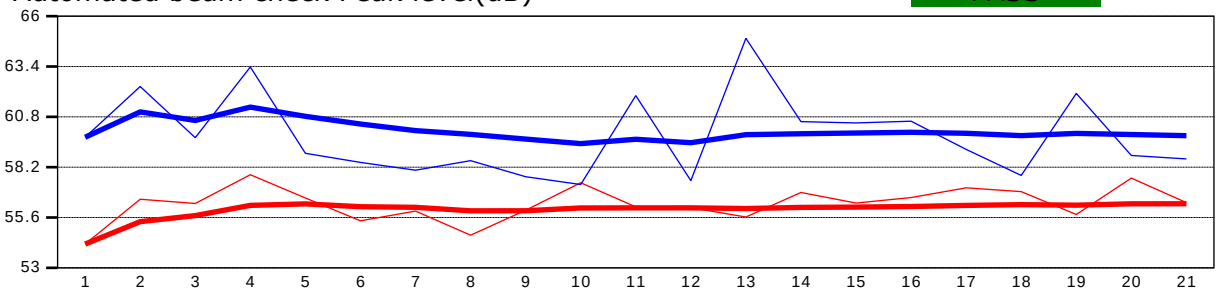
Discharge Measurement Summary

Site name	EMUDDY Bridge at rv park
Site number	Bridge at rv park
Operator(s)	Lfs
File name	Bridge at rv park_20231106-140228.ft
Comment	

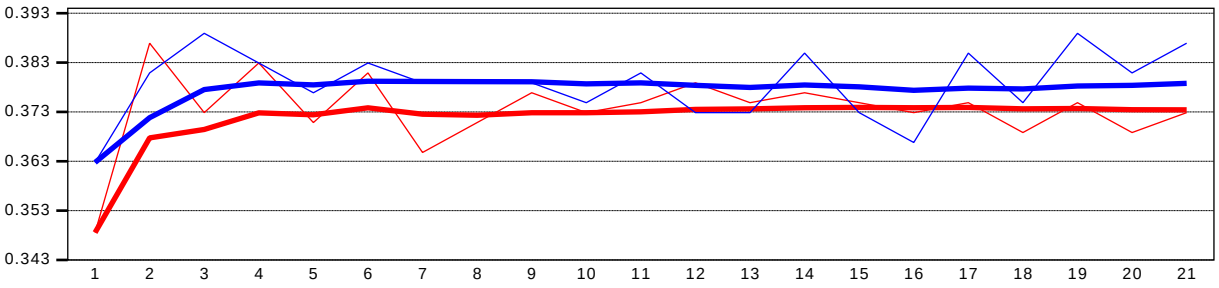
Beam 1	
Beam 2	

Automated beam check Start time 11/6/2023 1:40:25 PM

Automated beam check Peak level(dB) PASS



Automated beam check Peak position(ft) PASS



Automated beam check Quality control warnings

No quality control warnings