COLORADO
Parks and Wildlife
Department of Natural Resources

Water Resources Section – Aquatic, Terrestrial, and Natural Resources Branch

January 11, 2023

Mr. Rob Viehl, Section Chief
Colorado Water Conservation Board
Stream and Lake Protection Section
1313 Sherman Street, 7th Floor
Denver, CO 80203

Subject: Instream Flow Recommendation for Herman Gulch in Water Division 1, Clear Creek County to be presented at the January 2023 CWCB Meeting

Dear Mr. Viehl:

The information contained in and referred to in this letter forms the scientific and biological basis for an instream flow (ISF) increase on Herman Gulch in Water Division 1. In 1984, the CWCB appropriated a water right on Herman Gulch of 2 cfs year-round. The decreed instream flow reach extends from the headwaters to the confluence with Clear Creek. Herman Gulch is a high-elevation montane stream that CPW reclaimed to support greenback cutthroat trout in 2016. In 2022, CPW staff observed natural reproduction of introduced greenback cutthroat trout making Herman Gulch the second known population of self-sustaining greenback in the state. This recent finding underscores the importance of flow protection and maintaining an adequate flow regime to support this important population of greenback cutthroat trout in Herman Gulch.

To assess whether the 1984 decreed instream flow right is sufficient to protect the Herman Gulch greenback population, CPW staff conducted field investigations starting in 2020. These investigations demonstrated the need for a seasonal increase above 2 cfs during the high flow period. Since then, outreach has been conducted to inform the public of this ISF reach at the 2020 ISF Workshop. Outreach was also conducted to the Clear Creek County Commissioners in November 2020 in conjunction with outreach efforts on Dry Gulch, a nearby tributary also reclaimed to support greenback cutthroat trout in 2017. Dry Gulch was recommended for appropriation in 2021. It is the CPW staff's opinion that the information contained in this letter is sufficient for the CWCB's staff to recommend an ISF appropriation to the Board on Herman Gulch and to specifically address the findings required in Rule 5(i) of the Instream Flow Program Rules.

CPW participates in the ISF Program and develops instream flow recommendations for the Board's consideration in an effort to address CPW's legislative declarations "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-

101 (1) C.R.S.), and "… that the natural, scenic, scientific, and outdoor recreation areas … 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 acquisition, development, and management of … lands, waters, and facilities." (See §33-10-101 (1) C.R.S.).

In addition to these broad statutory guidelines, CPW's current strategic planning document (CPW Strategic Plan, 2015) explains current agency goals to, "[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems." In order to, "protect and enhance water resources for fish and wildlife populations," by pursuing, "partnerships and agreements to enhance instream flows, protect reservoir levels, and influence water management activities," and to, "[a]dvocate for water quality and quantities to conserve aquatic resources." In addition to the CPW Strategic Plan, the agency's fish and wildlife conservation activities are also directed by the State Wildlife Action Plan (2002, Revised 2015). The goals and priorities from these documents direct CPW to advocate for the preservation of the state's fish and wildlife resources and natural environment, and therefore link CPW's mission to the goals and priorities of CWCB's Instream Flow and Natural Lake Level Program.

Recommended Segments

CPW is proposing an ISF recommendation on Herman Gulch from its headwaters (located at UTM 13S 422251.32 4396896.47) to the confluence with Clear Creek (UTM 13S 426667.37 4394857.42). The reach is approximately 3.5 miles in length. All of the proposed reach is on public lands managed by the USFS Arapahoe and Roosevelt National Forests.

Greenback Cutthroat Trout Conservation Goals

The greenback cutthroat trout was designated Colorado's state fish in 1994. This subspecies of cutthroat trout has been listed as a threatened species by both the state and federal government. Following the listing of the greenback cutthroat trout under the authorities on the Endangered Species Act of 1973, state and federal fish and wildlife managers have engaged in efforts to establish new populations of this subspecies around the state of Colorado. The greenback cutthroat trout recovery plan's overall goal is as follows:

"The objective of the greenback cutthroat trout recovery plan is the removal of this subspecies from the list of Threatened and Endangered Species. This subspecies will be considered recovered when 20 stable greenback cutthroat trout populations are documented representing a minimum of 50 hectares of lakes and ponds and 50 kilometers of stream habitat within its native range. A minimum of five of these will exist in the Arkansas River drainage. Once recovery objectives have been met, a long range management strategy will be implemented for the continued restoration of the species." (Greenback Cutthroat Trout Recovery Team, 1998)

Establishing new conservation populations of greenback cutthroat trout and protecting the habitat where these populations reside are both critical steps to the successful recovery of the species. CPW believes that flow protection with an instream flow water right is an important action in the overall preservation and conservation of greenback cutthroat trout. In the case of Herman Gulch, an increase in the current ISF water right is of particular importance since CPW's 2022 discovery of natural reproduction in Herman Gulch. This finding marks a successful reintroduction effort and transition to a sustainable, wild greenback population that requires a protected flow regime moving forward.

Natural Environment and Biological Summary

Herman Gulch originates at at the base of Pettingell Peak, and flows southeast surrounded by Mount Bethel to the south and Mount Machebeuf to the north. It flows into Clear Creek near Loveland Ski Area. The stream's hydrology is snowmelt-driven, with higher flows lasting into the late summer due to high-elevation snowpack reserves. The basin's mean elevation is almost 12,000 feet. The mean annual prepicitation for this basin is approximately 34 inches. The contributing basin is approximately 3.2 square miles and is high-alpine and forested.

The Herman Gulch is a first order stream. The channel is high-gradient and primarily single thread with some side channel formation. Substrate size ranges from medium-sized cobble to large boulder. Very few fine sediments have been observed in the stream. The reach has a mixture of high gradient riffles made of coarse substrate, long and undercut runs, and large pools formed by large boulders and woody debris. A significant avalanche cycle in 2019 has contributed significant woody debris to the creek, creating a dynamic condition with new log jams and scour pools. Suitable trout habitat is plentiful including large pools, smaller pocket pools, undercut banks, and abundant riparian cover in the forested, high-gradient reach of the creek. Riparian willows are dense in the lower-gradient transition zone from the alpine to the high-gradient forested cascading reach.

Herman Gulch was reclaimed in 2016 to remove all non-native trout species. This reclamation effort ensured that native, genetically pure greenback cutthroat trout could be stocked with no risk of hybridization or predation from non-native trout species. After stocking of greenback cutthroat in 2017 through 2019, a CPW fishery survey conducted in 2019 indicated the fishery was made up exclusively of greenback cutthroat trout. In 2022, CPW biologists found adult, young-of-the-year, and age one greenback cutthroat trout in the stream (see attached). This serves as evidence of natural recruitment of the population and indicates a successful and sustainable reclamation effort. A number of greenback cutthroat trout have been observed during staff site visits to collect R2Cross data in 2020 through 2022. These fish have been observed feeding, mainly in pocket pools enviornments and undercut glides. The macroinvertebrate community is abundant and diverse, including multiple types of caddisfly and mayfly, stonefly, diptera, and flatworm specifically noted in the field.

The creek sees high visitation throughout the summer and fall months because of its easy accessibility from I70, as well as wildflowers and fall foliage and the opportunity to walk alongside Herman Gulch to Herman Lake at the base of 13,000 foot peaks. Interpretive signs were recently installed at the trailhead to educate the public on the history and importance of greenback cutthroat trout and the Herman Gulch reclamation project.

R2Cross Background

Initial biological instream flow recommendations were developed using the R2Cross methodology (Espegren, 1996[1]). R2Cross uses field data that has been collected in a riffle habitat type. Riffles are often the limiting habitat type in streams during low flow events, so maintaining specific conditions across riffle habitat types will also maintain aquatic habitat in pools and runs for most life stages of fish and macroinvertebrates (Nehring, 1979[2]). The R2Cross model uses field data, including a survey of

[1]Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

[2]Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

cross-sectional channel geometry, a longitudinal slope of the water surface, and a flow measurement, as input to a single transect hydraulic model. R2Cross uses Ferguson's Variable-Power Equation (Ferguson, 2007[3]) to model a stage-discharge relationship and compute corresponding hydraulic parameters of average depth, average velocity, and percent wetted perimeter over modeled stages. Maintaining these three hydraulic parameters at specified levels should ensure conditions that allow movement of fish longitudinally across riffles and adequate depths, velocities, and oxygenation for production of macroinvertebrates and development of trout eggs.

Baseflow recommendations are typically developed based on the flows that meet two of three hydraulic criteria and summer flow recommendations are based on hydraulic criteria that meet three of three hydraulic criteria (as described in Nehring 1979 and Espergren 1996).

CPW staff collected the following cross-sectional data sets on Herman Gulch. Two sets of cross-sections were collected in 2021, cross-sections two and three. The results from cross-section two were not included in the final flow recommendation because they were determined to be analmalous. The results of the R2Cross analysis are summarized below.

	Bankfull Top Width	Date Measured	Flow Measured	Flow Meeting Two Criteria	Flow Meeting Three Criteria
1	12.2 ft	9/23/2020	0.927 cfs	0.49 cfs	6.84 cfs
3	13.4 ft	10/11/2021	1.24 cfs	0.57 cfs	5.57 cfs
4	14.8 ft	7/18/2022	4.942 cfs	1.14 cfs	5.58 cfs
Recommended Flow Rates:				**N/A**	**6.0 cfs**

The initial biological flow recommendation is 6.0 cfs during the summer, high flow period. This rate is protective by maintaining average velocity of 1 foot per second (fps), average depth of 0.2 feet, and at least 50 percent wetted perimeter of the stream channel on average during the summer period. CPW is not recommending an increase during the baseflow period.

In order to make a preliminary determination whether water is available for the R2Cross-based flow recommendations and to determine the appropriate seasonal transition dates, CPW examined basic hydrologic data and water rights information for Herman Gulch. Herman Gulch does not have any gage data, and because it is high-elevation and undeveloped, CPW relied upon regression estimates for monthly flow estimates to determine the seasonality of the flow recommendations. CPW is not aware of any active water rights within the reach.

Water Availability-Refined Flow Recommendation

CPW's analysis indicates that the following flows are needed to protect the natural environment to a reasonable degree. Based on the hydrology from CSUFlow18 (Eurich et al., 2021[4]), there appears to be

[3] Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. https://doi.org/10.1029/2006WR005422

[4] Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

water available to meet the biological flow needs during the summer period. Therefore, CPW's flow recommendation is the following:

- Spring Flow Recommendation (April 1 through April 30): **2.4 cfs** (*0.4 cfs increase*)
    - Maintains adequate depth and wetted perimeter as fish transition from overwintering habitat to more metabolic activity as flows rise before the beginning of spring runoff. Earlier spring runoff may be a reality in a changing climate.
- Summer Flow Recommendation (May 1 through July 31): **6.0 cfs** (*4.0 cfs increase*)
    - Maintains adequate depth, velocity, and wetted perimeter during the summer period when fish are most active. This higher flow rate will also support the flushing of fine sediment through the creek to maintain clean interstitial space in gravels for spawning and egg incubation.
- Late Summer Flow Recommendation (August 1 through August 31): **2.7 cfs** (*0.7 cfs increase*)
    - Maintains adequate depth and wetted perimeter that allow fish to move to more stable habitat as flows begin to recede and water temperatures may be high in the late summer.
- Baseflow Recommendation (September 1 through March 31): **2.0 cfs** (*no change)*
    - This flow rate is protective by maintaining adequate available habitat in riffles, glides, and pools to support fish during the fall and into overwintering periods.

The purpose of this letter is to formally transmit this ISF recommendation to CWCB for the Board's consideration. CPW believes there is a flow-dependent natural environment in Herman Gulch that can be preserved to a reasonable degree with an ISF water right in the recommended rates. Please refer to attachments which include; R2Cross field forms, R2Cross output, flow measurements, fish survey information, and photographs at each cross section location.

CPW personnel will be available at the January 2023 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Katie Birch

Katie Birch
CPW Instream Flow Program Coordinator
Attachments (as stated)

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Herman Gulch					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: Near Herman Gulch Trail					
DATE: 6/23/20	OBSERVERS: Birch Scheel				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY: Clear Creek	WATERSHED: Clear Creek		WATER DIVISION: 1		DOW WATER CODE:
MAP(S):	USGS: UTM 13S 426370				
	USFS: 4395859				

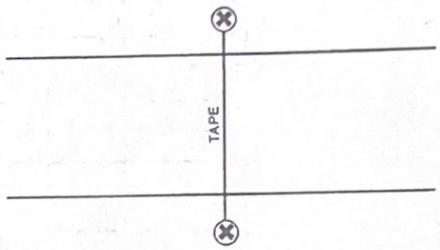
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES (NO)	METER TYPE: FlowTracker by KS (100' u/s of XS 2)			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: Small cobble + large cobble	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	X
⊗ Tape @ Stake RB	0.0	X
① WS @ Tape LB/RB	0.0	4.15 / 4.13
② WS Upstream	10	4.37
③ WS Downstream	4.9	3.9
SLOPE	0.47 / 14.9 = 0.0315	

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

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 (ft^2)	Discharge (cfs)
S/BF	0		3.5								
	0.5		3.7								
WS	0.6		4.15	Ø							
	0.6		4.55	0.45							
	1.2		4.5	0.4							
	1.8		4.5	0.35							
	2.4		4.45	0.3							
	3.0		4.46	0.35							
	3.6		4.45	0.32							
	4.2		4.47	0.35							
	4.8		4.34	0.2							
	5.4		4.34	0.2							
	6.0		4.4	0.25							
	6.6		4.4	0.25							
	7.2		4.35	0.2							
	7.8		4.35	0.2							
	8.4		4.35	0.2							
	9.0		4.35	0.25							
	9.6		4.3	0.2							
	10.2		4.4	0.3							
	10.9		4.27	0.1							
	11.8		4.4	0.25							
	12.4		4.3	0.15							
	13.0		4.2	0.05							
WS	13.4		4.13	Ø							
	15.3		4.05								
	16.5		4.0								
	16.6		3.75								
BF	16.7		3.45								
	17.4		3.25								
S	18.6		3.01								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Herman Gulch					CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Near Hermain Gulch Trail					
DATE: 9/25/20	OBSERVERS: Birch Schedl				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED: Clear Creek		WATER DIVISION: 1		DOW WATER CODE:
MAP(S):	USGS: UTM 13S 426348				
	USFS: 4395884				

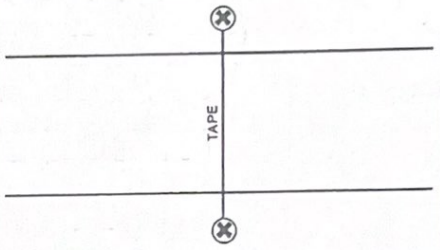
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / (NO)	METER TYPE: Flow Tracker by KS. In Glide 100 yds d/s XS 1			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: cobble to large boulder	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	X
⊗ Tape @ Stake RB	0.0	X
① WS @ Tape LB/RB	0.0	5.54 / 5.54
② WS Upstream	> 14.4'	5.31
③ WS Downstream		5.60
SLOPE	0.02 = 2%	

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

Q = 0.92 cfs

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Herman Gulch	CROSS-SECTION NO.: 1	DATE: 9/23/20	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 (ft^2)	Discharge (cfs)
	S	0		3.4								
		0.6		3.55								
		1.2		3.95								
		1.8		4.5								
	BF	2.1		4.63								
	WS	2.8		5.54	Ø							
		3.0		5.85	0.25							
		3.5		5.75	0.2							
		4.0		5.72	0.25							
		4.5		5.78	0.3							
		5.0		5.85	0.4							
		5.5		5.7	0.2							
		6.0		5.95	0.5							
		6.5		5.72	0.25							
		7.5		5.85	0.4							
		8.0		5.8	0.35							
		8.5		5.88	0.45							
		9.0		5.68	0.2							
		9.5		5.8	0.3							
		10.0		5.67	0.2							
		10.5		5.62	0.15							
		11.0		5.65	0.2							
		11.5		5.72	0.25							
		12.0		5.7	0.25							
		13.0		5.65	0.15							
		13.5		5.6	0.1							
	WS	13.9		5.54	Ø							
	BF	14.3		4.6								
		14.8		4.55								
		16		4.5								
		17.2		4.15								
	S	19.2		3.6								
	TOTALS:											

End of Measurement	Time: 12:17	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Herman Gulch

CROSS-SECTION NO.: XS 3 (2021)

CROSS-SECTION LOCATION: Located off Herman Gulch Trail

UTM 13S 426348 4395868

DATE: 10/11/21 OBSERVERS: Birch E. Joyce D. McDowell

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

COUNTY:	WATERSHED:	WATER DIVISION:	DOW WATER CODE:

MAP(S): USGS:

USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / (NO)

METER TYPE: Hach measured in nearby glide

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

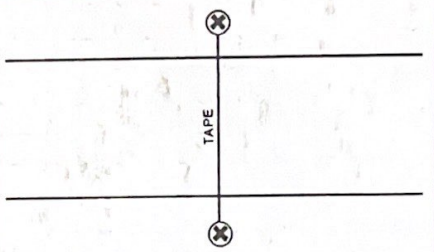
CHANNEL BED MATERIAL SIZE RANGE:

PHOTOGRAPHS TAKEN: (YES)/NO NUMBER OF PHOTOGRAPHS: 2

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	~~~
⊗ Tape @ Stake RB	0.0	~~~
① WS @ Tape LB/RB	0.0	4.99 / 4.99
② WS Upstream	18.2	4.82
③ WS Downstream	2.1	5.02
SLOPE		

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
3 fish (greenback) observed ≈5" in pool/undercut glide habitat																	

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

Q = 1.24 cfs

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Herman Gulch | CROSS-SECTION NO: 3 | DATE: 10/11/21 | 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 (ft^2)	Discharge (cfs)
S	0		3.79								
	2.2		4.19								
BF	4.6		4.32								
	5.7		4.71								
RWS	7.6		4.99	Ø							
	8.0		5.04	0.05							
	8.4		5.06	0.05							
Rok	8.8		4.98	Ø							
	9.2		5.15	0.2							
	9.6		5.19	0.22							
R	10.0		5.08	0.09							
	10.4		5.42	0.45							
	10.8		5.32	0.32							
	11.2		5.43	0.48							
	11.6		5.41	0.48							
	12.0		5.4	0.5							
	12.4		5.38	0.4							
	12.8		5.3	0.42							
	13.2		5.39	0.4							
	13.6		5.32	0.32							
	14.0		5.28	0.28							
	14.4		5.3	0.32							
	14.8		5.21	0.22							
	15.2		5.49	0.5							
	15.6		5.29	0.32							
LWS	16.0		4.99	Ø							
	17.7		4.88								
BF	18.0		4.31								
S	18.7		4.1								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Herman Gulch					CROSS-SECTION NO.: 4
CROSS-SECTION LOCATION: Near Herman Gulch trail					
DATE: 7/18/22	OBSERVERS: Birch Fields - Summer S Nicewicz				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:	WATER DIVISION:	DOW WATER CODE:		
MAP(S): USGS: UTM 13 426376 4395875	USFS:				

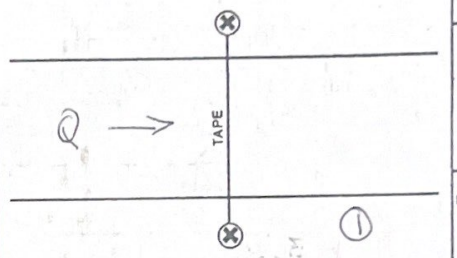
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / (NO)	METER TYPE: FT 2 - Laura "07182022" in d/s glide			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: cobble - lg boulder	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	4.81 / 4.82
② WS Upstream		4.71
③ WS Downstream	17.4	5.29
SLOPE	~~4.7~~ 3.3%	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL
Fish observed >6"																	
greenback																	
may(3) / caddis(4)																	

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

Q = 4.94 cfs cold, clear water
Very saturated floodplain. Fish observed in glide feeling. pocket pools in good condition. Few fine sediments
willow, bluebell, columbine undercut banks/riparian cover

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

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

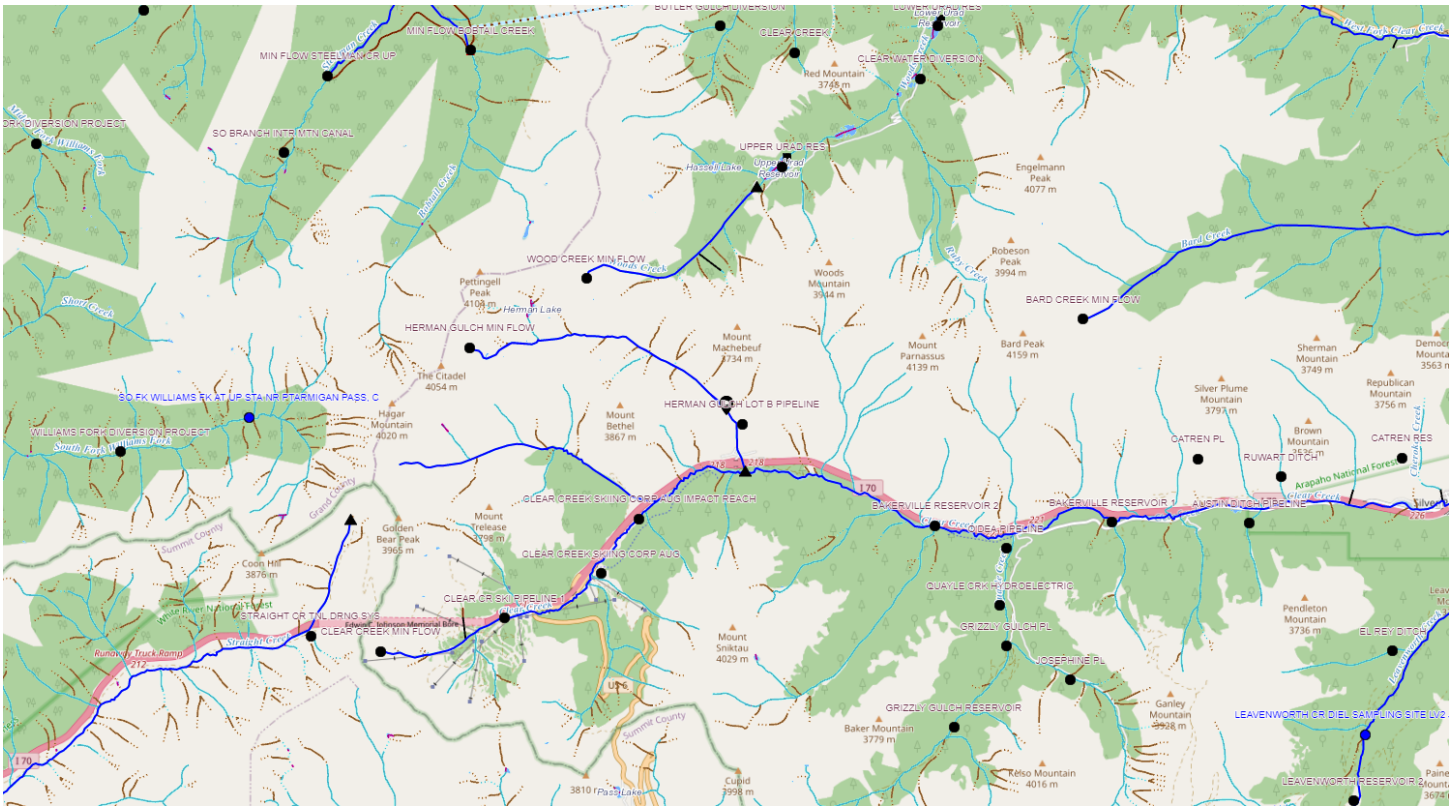
Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec): At Point	Velocity (ft/sec): Mean in Vertical	Area (ft^2)	Discharge (cfs)
Bankfull ↑	0.0		4.00								
(*) Bankfull ↓	0.5		4.19		→	0.8	WS	4.82			
	0.8		5.46	0.62							
	1.5		5.12	0.37							
	2.2		5.23	0.40							
	3.4		5.55	0.68							
	4.1		5.51	0.59							
	~~4.8~~										
	5.4		5.42	0.55							
	6.0		5.24	0.40							
	6.7		5.21	0.41							
	7.6		5.31	0.44							
	8.6		5.25	0.38							
	9.3		5.29	0.35							
	10.8		5.14	0.20							
	11.6		5.18	0.29							
	13.2		5.10	0.14							
	13.9		5.11	0.26							
	14.6		5.09	0.18							
~~Waterline~~	15.3		4.94	0.05							
WS	15.3		4.81	—							
(*) Bankfull ↓	15.4		4.37								
Bankfull ↑	16.2		4.09								
Stake	17.6		3 4.89								
			(4.9)								
TOTALS:											

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

R2Cross RESULTS

Stream Name: Herman Gulch
Stream Locations: Near Herman Gulch Trail
Fieldwork Date: 09/23/2020
Cross-section: 1
Observers: Birch Scheel
Coordinate System: UTM Zone 13
X (easting): 426348
Y (northing): 4395884
Date Processed: 11/22/2022
Slope: 0.0201
Discharge: Entered Value: 0.93 (cfs)
Computation method: Ferguson VPE
a1: 6.5
a2: 2.5
R2Cross data filename: R2Cross_Herman-Gulch-1_9-23-2020-Q=0.927.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 12.19

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.49
Percent Wetted Perimeter (%)	50.0	0.03
Mean Velocity (ft/s)	1.0	6.84

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	4.63	12.19	1.05	1.32	12.77	13.57	100.0	0.94	0.1	2.12	27.08
	4.68	12.13	1.01	1.27	12.22	13.46	99.21	0.91	0.1	2.02	24.65
	4.73	12.07	0.96	1.22	11.61	13.35	98.35	0.87	0.1	1.9	22.12
	4.78	12.01	0.92	1.17	11.01	13.23	97.48	0.83	0.1	1.79	19.72
	4.83	11.95	0.87	1.12	10.41	13.11	96.62	0.79	0.11	1.68	17.47
	4.88	11.89	0.83	1.07	9.82	12.99	95.75	0.76	0.11	1.56	15.36
	4.93	11.83	0.78	1.02	9.22	12.88	94.89	0.72	0.12	1.45	13.39
	4.98	11.77	0.73	0.97	8.63	12.76	94.02	0.68	0.12	1.34	11.57
	5.03	11.71	0.69	0.92	8.05	12.64	93.16	0.64	0.13	1.23	9.88
	5.08	11.66	0.64	0.87	7.46	12.53	92.29	0.6	0.13	1.12	8.34
	5.13	11.6	0.59	0.82	6.88	12.41	91.43	0.55	0.14	1.01	6.94
	5.18	11.54	0.55	0.77	6.3	12.29	90.56	0.51	0.15	0.9	5.68
	5.23	11.48	0.5	0.72	5.73	12.17	89.7	0.47	0.16	0.8	4.56
	5.28	11.42	0.45	0.67	5.15	12.06	88.83	0.43	0.17	0.69	3.57
	5.33	11.36	0.4	0.62	4.59	11.94	87.97	0.38	0.19	0.59	2.71
	5.38	11.3	0.36	0.57	4.02	11.82	87.1	0.34	0.21	0.49	1.99
	5.43	11.24	0.31	0.52	3.46	11.7	86.24	0.3	0.23	0.4	1.39
Waterline	5.48	11.18	0.26	0.47	2.9	11.59	85.37	0.25	0.27	0.31	0.91
	5.53	11.12	0.21	0.42	2.34	11.47	84.51	0.2	0.31	0.23	0.54
	5.58	10.83	0.17	0.37	1.79	11.15	82.13	0.16	0.38	0.16	0.29
	5.63	10.22	0.12	0.32	1.26	10.51	77.46	0.12	0.49	0.1	0.13
	5.68	8.36	0.09	0.27	0.79	8.62	63.54	0.09	0.61	0.07	0.06
	5.73	6.18	0.07	0.22	0.42	6.39	47.08	0.07	0.8	0.04	0.02
	5.78	3.55	0.05	0.17	0.19	3.68	27.14	0.05	0.99	0.03	0.01
	5.83	1.69	0.03	0.12	0.05	1.77	13.04	0.03	1.52	0.01	0.0

	5.88	0.35	0.03	0.07	0.01	0.39	2.85	0.03	1.53	0.01	0.0
	5.93	0.1	0.01	0.02	0.0	0.11	0.84	0.01	3.53	0.0	0.0
	5.93	0.06	0.01	0.01	0.0	0.07	0.51	0.01	5.34	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) =	0.93	(cfs)
Calculated Flow (Qc) =	0.92	(cfs)
(Qm-Qc)/Qm * 100 =	0.87%	
Measured Waterline (WLm) =	5.54	(ft)
Calculated Waterline (WLc) =	5.48	(ft)
(WLm-WLc)/WLm * 100 =	1.17%	
Max Measured Depth (Dm) =	0.5	(ft)
Max Calculated Depth (Dc) =	0.47	(ft)
(Dm-Dc)/Dm * 100 =	5.08%	
Mean Velocity =	0.32	(ft/s)
Manning's n =	0.264	
a1	6.5	
a2	2.5	
0.4 * Qm =	0.37	(cfs)
2.5 * Qm =	2.32	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	3.4		
	0.6	3.55		
	1.2	3.95		
	1.8	4.5		
Bankfull	2.1	4.63		
Waterline	2.8	5.54	0	
	3	5.75	0.25	
	3.5	5.75	0.2	
	4	5.72	0.25	
	4.5	5.78	0.3	
	5	5.85	0.4	
	5.5	5.7	0.2	
	6	5.95	0.5	
	6.5	5.72	0.25	
	7.5	5.85	0.4	
	8	5.8	0.35	
	8.5	5.88	0.45	
	9	5.68	0.2	
	9.5	5.8	0.3	
	10	5.67	0.2	
	10.5	5.62	0.15	
	11	5.65	0.2	
	11.5	5.72	0.25	
	12	5.7	0.25	
	13	5.65	0.15	
	13.5	5.6	0.1	
Waterline	13.9	5.54	0	
Bankfull	14.3	4.6		
	14.8	4.55		
	16	4.5		

	17.2	4.15
	19.2	3.6

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	0	0	0	0
0.29	0.25	0.09	0.03	3.02
0.5	0.2	0.1	0.03	3.45
0.5	0.25	0.12	0.04	4.32
0.5	0.3	0.15	0.05	5.18
0.5	0.4	0.2	0.06	6.91
0.52	0.2	0.1	0.03	3.45
0.56	0.5	0.25	0.08	8.64
0.55	0.25	0.19	0.06	6.48
1.01	0.4	0.3	0.1	10.36
0.5	0.35	0.17	0.06	6.04
0.51	0.45	0.23	0.07	7.77
0.54	0.2	0.1	0.03	3.45
0.51	0.3	0.15	0.05	5.18
0.52	0.2	0.1	0.03	3.45
0.5	0.15	0.07	0.02	2.59
0.5	0.2	0.1	0.03	3.45
0.5	0.25	0.12	0.04	4.32
0.5	0.25	0.19	0.06	6.48
1	0.15	0.11	0.04	3.89
0.5	0.1	0.04	0.01	1.55
0.4	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

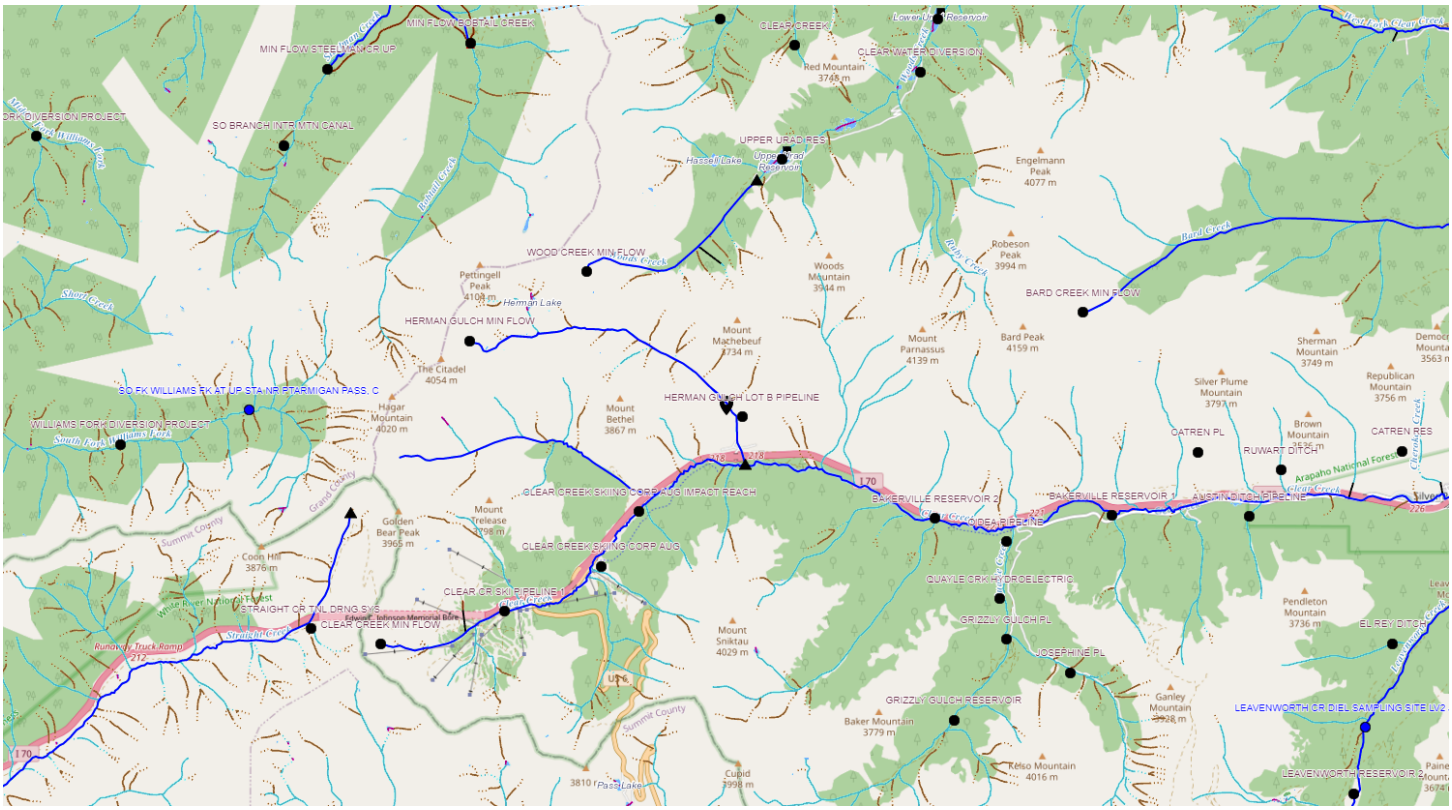
DISCLAIMER

"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.

R2Cross RESULTS

Stream Name: Herman Gulch
Stream Locations: Just above meadow clearing
Fieldwork Date: 10/11/2021
Cross-section: 3
Observers: EJ KB DM
Coordinate System: UTM Zone 13
X (easting): 426348
Y (northing): 4395868
Date Processed: 11/22/2022
Slope: 0.0099
Discharge: Entered Value: 1.24 (cfs)
Computation method: Ferguson VPE
a1: 6.5
a2: 2.5
R2Cross data filename: R2Cross_Herman-Gulch-3_10_11_21-Q=1.24.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 13.39

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.39
Percent Wetted Perimeter (%)	50.0	0.57
Mean Velocity (ft/s)	1.0	5.57

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	4.32	13.39	0.77	1.17	10.27	14.33	100.0	0.72	0.06	1.93	19.78
	4.33	13.37	0.76	1.16	10.18	14.31	99.82	0.71	0.06	1.91	19.46
	4.38	13.21	0.72	1.11	9.52	14.1	98.38	0.68	0.06	1.79	17.02
	4.43	13.04	0.68	1.06	8.86	13.9	96.94	0.64	0.07	1.66	14.75
	4.48	12.87	0.64	1.01	8.22	13.69	95.5	0.6	0.07	1.54	12.64
	4.53	12.7	0.6	0.96	7.58	13.48	94.06	0.56	0.07	1.41	10.7
	4.58	12.54	0.55	0.91	6.94	13.28	92.63	0.52	0.07	1.29	8.93
	4.63	12.37	0.51	0.86	6.32	13.07	91.19	0.48	0.08	1.16	7.32
	4.68	12.2	0.47	0.81	5.71	12.87	89.75	0.44	0.08	1.03	5.88
	4.73	11.97	0.43	0.76	5.1	12.6	87.87	0.41	0.09	0.91	4.64
	4.78	11.6	0.39	0.71	4.51	12.2	85.08	0.37	0.09	0.8	3.62
	4.83	11.24	0.35	0.66	3.94	11.8	82.3	0.33	0.1	0.7	2.74
	4.88	10.87	0.31	0.61	3.39	11.4	79.51	0.3	0.11	0.59	2.0
	4.93	9.81	0.29	0.56	2.87	10.33	72.07	0.28	0.12	0.54	1.54
Waterline	4.98	8.7	0.28	0.51	2.41	9.21	64.28	0.26	0.12	0.49	1.18
	5.03	7.72	0.26	0.46	2.0	8.2	57.21	0.24	0.13	0.44	0.89
	5.08	6.86	0.24	0.41	1.64	7.31	50.98	0.22	0.14	0.39	0.65
	5.13	6.45	0.2	0.36	1.31	6.85	47.79	0.19	0.16	0.31	0.41
	5.18	5.82	0.17	0.31	1.0	6.18	43.08	0.16	0.18	0.24	0.24
	5.23	5.42	0.13	0.26	0.72	5.72	39.93	0.13	0.22	0.17	0.12
	5.28	5.0	0.09	0.21	0.46	5.25	36.61	0.09	0.3	0.1	0.04
	5.33	3.54	0.07	0.16	0.25	3.73	26.0	0.07	0.37	0.06	0.02
	5.38	2.17	0.05	0.11	0.1	2.28	15.93	0.05	0.51	0.04	0.0
	5.43	0.85	0.03	0.06	0.02	0.9	6.3	0.03	0.78	0.02	0.0
	5.47	0.18	0.01	0.01	0.0	0.19	1.34	0.01	2.4	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) =	1.24	(cfs)
Calculated Flow (Qc) =	1.21	(cfs)
(Qm-Qc)/Qm * 100 =	2.20%	
Measured Waterline (WLm) =	4.99	(ft)
Calculated Waterline (WLc) =	4.98	(ft)
(WLm-WLc)/WLm * 100 =	0.27%	
Max Measured Depth (Dm) =	0.5	(ft)
Max Calculated Depth (Dc) =	0.51	(ft)
(Dm-Dc)/Dm * 100 =	-2.72%	
Mean Velocity =	0.5	(ft/s)
Manning's n =	0.12	
a1	6.5	
a2	2.5	
0.4 * Qm =	0.5	(cfs)
2.5 * Qm =	3.1	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	3.79		
	2.2	4.19		
Bankfull	4.6	4.32		
	5.7	4.71		
Waterline	7.6	4.99		
	8	5.04	0.05	
	8.4	5.06	0.05	
	8.8	4.98	0	
	9.2	5.15	0.2	
	9.6	5.19	0.22	
	10	5.08	0.09	
	10.4	5.42	0.45	
	10.8	5.32	0.32	
	11.2	5.43	0.48	
	11.6	5.41	0.48	
	12	5.49	0.5	
	12.4	5.38	0.4	
	12.8	5.3	0.42	
	13.2	5.39	0.4	
	13.6	5.32	0.32	
	14	5.28	0.28	
	14.4	5.3	0.32	
	14.8	5.21	0.22	
	15.2	5.49	0.5	
	15.6	5.29	0.32	
Waterline	16	4.99	0	
	17.7	4.88		
Bankfull	18	4.31		
	18.7	4.1		

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
0.4	0.05	0.02	0.01	0.83
0.4	0.05	0.02	0.01	0.83
0.41	0	0	0	0
0.43	0.2	0.08	0.04	3.32
0.4	0.22	0.09	0.05	3.65
0.41	0.09	0.04	0.02	1.5
0.52	0.45	0.18	0.09	7.47
0.41	0.32	0.13	0.07	5.32
0.41	0.48	0.19	0.1	7.97
0.4	0.48	0.19	0.1	7.97
0.41	0.5	0.2	0.1	8.31
0.41	0.4	0.16	0.08	6.64
0.41	0.42	0.17	0.09	6.98
0.41	0.4	0.16	0.08	6.64
0.41	0.32	0.13	0.07	5.32
0.4	0.28	0.11	0.06	4.65
0.4	0.32	0.13	0.07	5.32
0.41	0.22	0.09	0.05	3.65
0.49	0.5	0.2	0.1	8.31
0.45	0.32	0.13	0.07	5.32
0.5	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

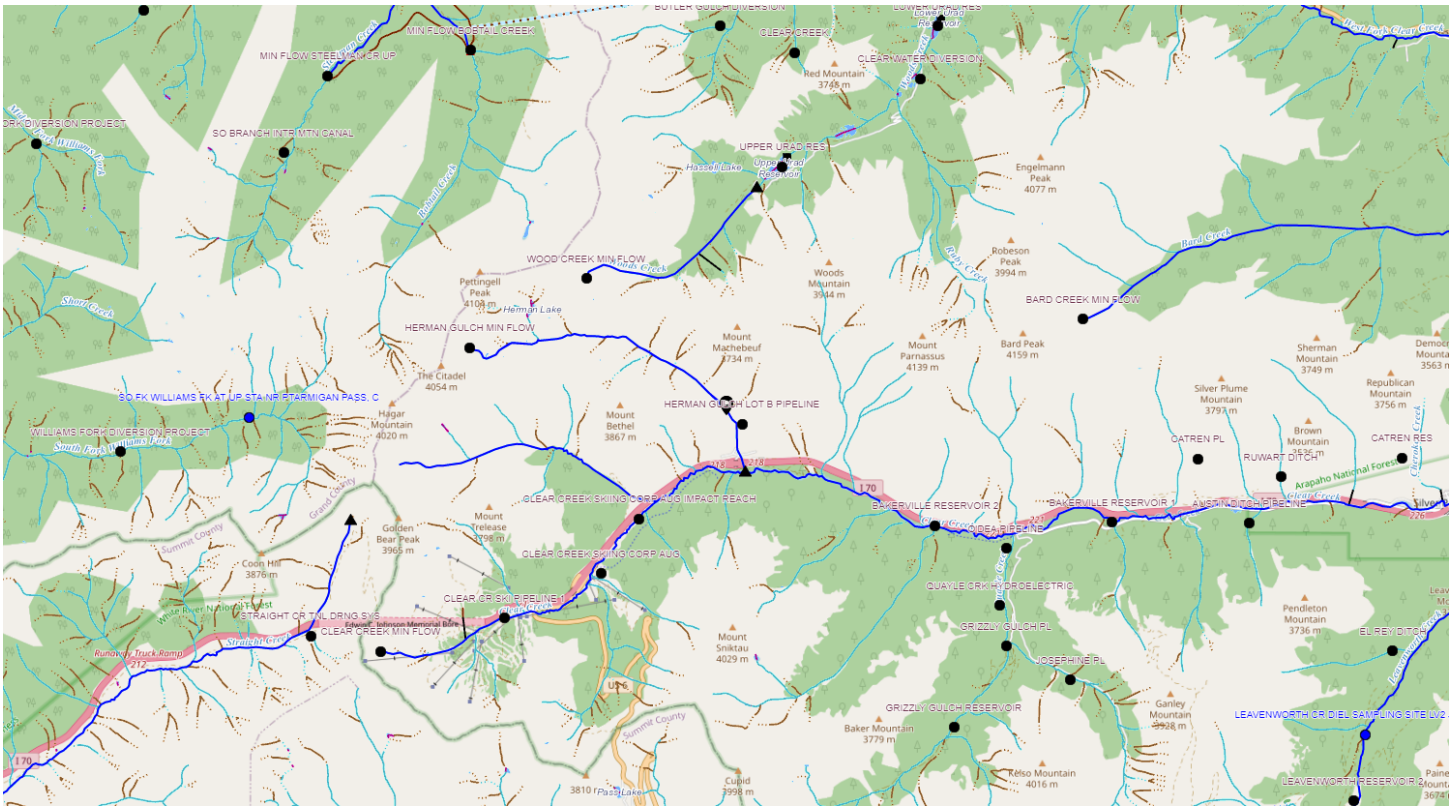
DISCLAIMER

"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.

R2Cross RESULTS

Stream Name: Herman Gulch
Stream Locations: Near Herman Gulch Trail
Fieldwork Date: 07/18/2022
Cross-section: 4
Observers: Birch Fields-Sommers Sidell Nicewicz
Coordinate System: UTM Zone 13
X (easting): 426376
Y (northing): 4395875
Date Processed: 11/22/2022
Slope: 0.0333
Discharge: Entered Value: 4.94 (cfs)
Computation method: Ferguson VPE
a1: 6.5
a2: 2.5
R2Cross data filename: R2Cross_Herman-Gulch-4_07-18-2022-Q=4.942.xlsx
R2Cross version: 2.0.2

LOCATION



ANALYSIS RESULTS

Habitat Criteria Results

Bankfull top width (ft) = 14.81

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	1.14
Percent Wetted Perimeter (%)	50.0	0.22
Mean Velocity (ft/s)	1.0	5.58

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	4.37	14.81	0.86	1.18	12.75	16.44	100.0	0.78	0.08	2.9	36.99
	4.38	14.81	0.85	1.17	12.63	16.42	99.89	0.77	0.08	2.87	36.23
	4.43	14.77	0.81	1.12	11.89	16.32	99.25	0.73	0.08	2.67	31.75
	4.48	14.74	0.76	1.07	11.16	16.21	98.6	0.69	0.09	2.47	27.57
	4.53	14.7	0.71	1.02	10.42	16.1	97.95	0.65	0.09	2.27	23.69
	4.58	14.67	0.66	0.97	9.69	16.0	97.3	0.61	0.09	2.08	20.11
	4.63	14.63	0.61	0.92	8.95	15.89	96.65	0.56	0.1	1.88	16.83
	4.68	14.6	0.56	0.87	8.22	15.78	96.0	0.52	0.1	1.69	13.86
	4.73	14.56	0.51	0.82	7.49	15.68	95.35	0.48	0.11	1.49	11.19
	4.78	14.53	0.47	0.77	6.77	15.57	94.7	0.43	0.12	1.3	8.83
	4.83	14.5	0.42	0.72	6.04	15.46	94.06	0.39	0.13	1.12	6.77
Waterline	4.88	14.5	0.37	0.67	5.32	15.36	93.46	0.35	0.14	0.94	5.0
	4.93	14.5	0.32	0.62	4.59	15.26	92.85	0.3	0.16	0.77	3.52
	4.98	14.32	0.27	0.57	3.87	15.02	91.36	0.26	0.18	0.61	2.37
	5.03	14.09	0.22	0.52	3.16	14.73	89.61	0.21	0.21	0.47	1.48
	5.08	13.86	0.18	0.47	2.46	14.44	87.85	0.17	0.25	0.33	0.82
	5.13	11.73	0.15	0.42	1.81	12.26	74.6	0.15	0.28	0.27	0.49
	5.18	8.94	0.14	0.37	1.29	9.4	57.2	0.14	0.3	0.24	0.31
	5.23	7.13	0.12	0.32	0.88	7.53	45.78	0.12	0.34	0.19	0.17
	5.28	4.59	0.13	0.27	0.58	4.9	29.79	0.12	0.34	0.2	0.11
	5.33	3.06	0.13	0.22	0.41	3.29	20.02	0.12	0.33	0.21	0.08
	5.38	2.68	0.1	0.17	0.26	2.83	17.23	0.09	0.41	0.13	0.03
	5.43	2.21	0.06	0.12	0.14	2.28	13.9	0.06	0.59	0.07	0.01
	5.48	1.32	0.04	0.07	0.05	1.34	8.12	0.04	0.89	0.03	0.0
	5.53	0.43	0.01	0.02	0.0	0.44	2.65	0.01	2.47	0.01	0.0

	5.54	0.3	0.01	0.01	0.0	0.3	1.82	0.01	3.38	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) =	4.94	(cfs)
Calculated Flow (Qc) =	4.97	(cfs)
(Qm-Qc)/Qm * 100 =	-0.55%	
Measured Waterline (WLm) =	4.82	(ft)
Calculated Waterline (WLc) =	4.88	(ft)
(WLm-WLc)/WLm * 100 =	-1.31%	
Max Measured Depth (Dm) =	0.68	(ft)
Max Calculated Depth (Dc) =	0.67	(ft)
(Dm-Dc)/Dm * 100 =	1.20%	
Mean Velocity =	0.93	(ft/s)
Manning's n =	0.143	
a1	6.5	
a2	2.5	
0.4 * Qm =	1.98	(cfs)
2.5 * Qm =	12.36	(cfs)

FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	0	4		
Bankfull	0.5	4.19		
Waterline	0.8	4.82	0	
	0.8	5.46	0.62	
	1.5	5.12	0.37	
	2.7	5.23	0.4	
	3.4	5.55	0.68	
	4.1	5.51	0.59	
	5.4	5.42	0.55	
	6	5.24	0.4	
	6.7	5.21	0.41	
	7.6	5.31	0.44	
	8.6	5.25	0.38	
	9.3	5.29	0.35	
	10.8	5.14	0.2	
	11.6	5.18	0.29	
	13.2	5.1	0.14	
	13.9	5.11	0.26	
	14.6	5.09	0.18	
	15.3	4.94	0.05	
Waterline	15.3	4.81	0	
Bankfull	15.4	4.37		
	16.2	4.09		
	17.6	3.89		

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
0.64	0.62	0.22	0.2	4.08
0.78	0.37	0.35	0.33	6.61
1.21	0.4	0.38	0.35	7.15
0.77	0.68	0.48	0.44	8.96
0.7	0.59	0.59	0.55	11.1
1.3	0.55	0.52	0.49	9.83
0.63	0.4	0.26	0.24	4.89
0.7	0.41	0.33	0.3	6.17
0.91	0.44	0.42	0.39	7.86
1	0.38	0.32	0.3	6.08
0.7	0.35	0.39	0.36	7.24
1.51	0.2	0.23	0.21	4.33
0.8	0.29	0.35	0.32	6.55
1.6	0.14	0.16	0.15	3.03
0.7	0.26	0.18	0.17	3.42
0.7	0.18	0.13	0.12	2.37
0.72	0.05	0.02	0.02	0.33
0.13	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.

Herman Gulch Fish Survey Data

Water **14287** **Herman Gulch** Date **9/13/2018**

Station **SP7817** **ABT 0.75 MI BLW HEADWATERS**

Drainage **South Platte River** UtmX **423426** UtmY **4396985** Elevation **3560 m**

Length **118 m** Width **1.74 m** Area **0.02 Ha**

Surveyors **Wright, Krone, Finley, Breda, Smith, Sanderson, Ja**

Gear **BPEF** Effort Metric **PASS** Protocol **THREE-PASS REMOVAL**

Total catch **33**

Species	Count	Length (mm)	Weight (gm)	Status	Mark	Tag ID	Habitat
BAC	1	165	58	1	Caudal Clip		
BAC	1	189	79	1	SDC		
BAC	1	145	31	1			
BAC	1	139	22	1	AC		
BAC	1	162	43	1	AC		
BAC	1	158	34	1	AC		
BAC	1	155	33	1	AC		
BAC	1	125	18	1	AC		
BAC	1	150	28	1	AC, PO		
BAC	1	147	27	1	AC		
BAC	1	177	56	1			
BAC	1	145	33	1	AC		
BAC	1	151	32	1	AC		
BAC	1	126	22	1	DC, AC		
BAC	1	161	37	1	TDC, AC		
BAC	1	142	26	1	AC		
BAC	1	150	28	1	DC		

Herman Gulch Fish Survey Data

Water **14287** **Herman Gulch** Date **9/13/2018**

Station **SP7817** **ABT 0.75 MI BLW HEADWATERS**

Species	Count	Length (mm)	Weight (gm)	Status	Mark	Tag ID	Habitat
BAC	1	140	24	1	AC		
BAC	1	139	24	1	AC		
BAC	1	156	36	1	AC		
BAC	1	135	20	1	DC, AC		
BAC	1	130	19	1	AC		
BAC	1	115	12	1	AC		
BAC	1	125	16	1	AC		
BAC	1	158	35	1	AC		
BAC	1	165	45	2	AC		
BAC	1	156	32	2	AC		
BAC	1	172	53	2			
BAC	1	147	27	2	AC		
BAC	1	128	16	2	DC, AC		
BAC	1	108	11	2	AC		
BAC	1	105	11	2	AC, scoliosis		
BAC	1	133	20	3	AC		

Notes: Widths taken every 50 feet of stream length - 4.9ft, 4.9ft, 7.7ft, 7.0ft, 5.8ft, 3.8ft, 7.1ft, 5.9ft, 4.3ft. Backpack Shocker Settings: 70Hz, 28%, 275Volts. Effort: Pass 1 - 1183 seconds, Pass 2 - 679 seconds, Pass 3 - 876 seconds.

BAC = Greenback Cutthroat Trout, Bear Creek

Length/Frequency

Water **14287** **Herman Gulch** Date **9/12/2018**

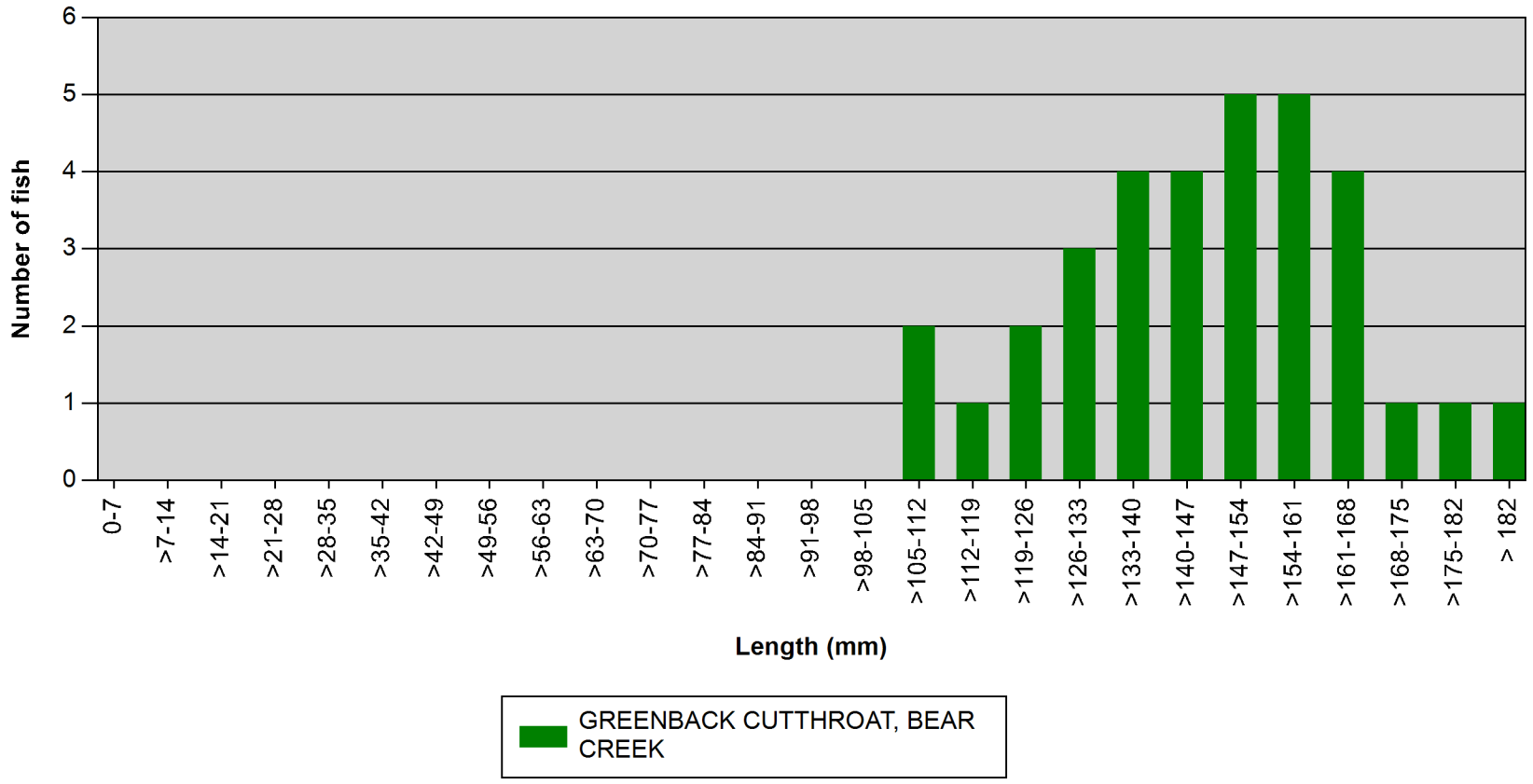
Station **SP7817** **ABT 0.75 MI BLW HEADWATERS**

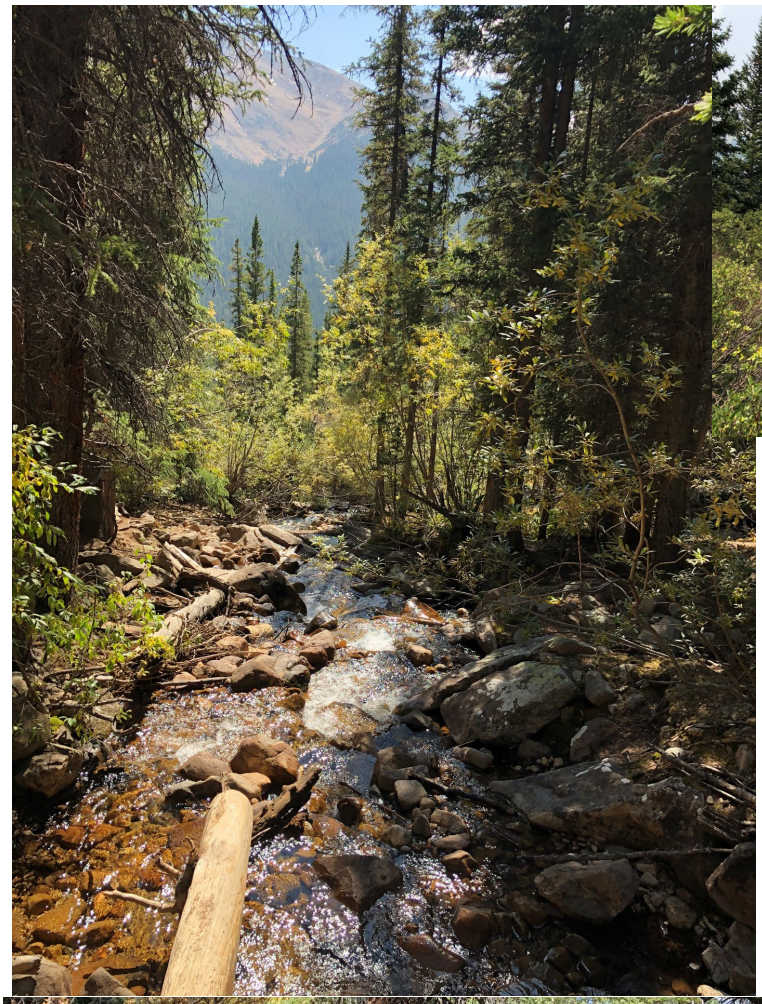
Drainage **South Platte River** UtmX **423521** UtmY **4396999** Elevation **3560 m**

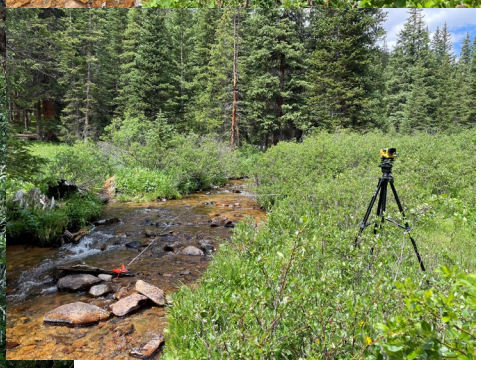
Length **118 m** Width **1.74 m** Area **0.02 Ha**

Surveyors **Wright, Krone, Finley, Breda, Smith, Sanderson**

Gear **BPEF** Effort Metric **PASS** Protocol **THREE-PASS REMOVAL**







Discharge Measurement Summary

Date Generated: Tue Sep 27 2022

File Information

File Name	HERMAN.1.WAD
Start Date and Time	2020/09/23 11:28:57

Site Details

Site Name	HERM 092320
Operator(s)	KS

System Information

Sensor Type	FlowTracker
Serial #	P5691
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.6%	4.3%
Velocity	2.8%	23.3%
Width	0.2%	0.2%
Method	2.8%	-
# Stations	2.8%	-
Overall	**5.0%**	**23.7%**

Summary

Averaging Int.	30	# Stations	18
Start Edge	LEW	Total Width	9.500
Mean SNR	31.6 dB	Total Area	2.770
Mean Temp	45.81 °F	Mean Depth	0.292
Disch. Equation	Mid-Section	Mean Velocity	0.3347
		Total Discharge	**0.9270**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:28	1.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*11:31*	*2.60*	*0.6*	*0.200*	*0.6*	*0.080*	*0.0541*	*1.00*	*0.0541*	*0.160*	*0.0087*	*0.9*
2	*11:33*	*3.00*	*0.6*	*0.200*	*0.6*	*0.080*	*0.0620*	*1.00*	*0.0620*	*0.090*	*0.0056*	*0.6*
3	*11:34*	*3.50*	*0.6*	*0.300*	*0.6*	*0.120*	*0.0000*	*1.00*	*0.0000*	*0.150*	*0.0000*	*0.0*
4	*11:37*	*4.00*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0984*	*1.00*	*0.0984*	*0.200*	*0.0197*	*2.1*
5	*11:38*	*4.50*	*0.6*	*0.400*	*0.6*	*0.160*	*0.2592*	*1.00*	*0.2592*	*0.200*	*0.0518*	*5.6*
6	*11:39*	*5.00*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0801*	*1.00*	*0.0801*	*0.200*	*0.0160*	*1.7*
7	*11:39*	*5.50*	*0.6*	*0.400*	*0.6*	*0.160*	*0.1010*	*1.00*	*0.1010*	*0.200*	*0.0202*	*2.2*
8	*11:42*	*6.00*	*0.6*	*0.500*	*0.6*	*0.200*	*0.5617*	*1.00*	*0.5617*	*0.250*	*0.1404*	*15.1*
9	*11:43*	*6.50*	*0.6*	*0.500*	*0.6*	*0.200*	*0.5000*	*1.00*	*0.5000*	*0.250*	*0.1250*	*13.5*
10	*11:46*	*7.00*	*0.6*	*0.400*	*0.6*	*0.160*	*-0.0003*	*1.00*	*-0.0003*	*0.200*	*-0.0001*	*0.0*
11	11:47	7.50	0.6	0.300	0.6	0.120	1.2762	1.00	1.2762	0.150	0.1914	20.6
12	11:48	8.00	0.6	0.300	0.6	0.120	1.2415	1.00	1.2415	0.150	0.1861	20.1
13	*11:49*	*8.50*	*0.6*	*0.400*	*0.6*	*0.160*	*0.2667*	*1.00*	*0.2667*	*0.200*	*0.0533*	*5.8*
14	*11:49*	*9.00*	*0.6*	*0.400*	*0.6*	*0.160*	*0.3734*	*1.00*	*0.3734*	*0.200*	*0.0747*	*8.1*
15	*11:50*	*9.50*	*0.6*	*0.200*	*0.6*	*0.080*	*0.3346*	*1.00*	*0.3346*	*0.100*	*0.0335*	*3.6*
16	*11:52*	*10.00*	*0.6*	*0.100*	*0.6*	*0.040*	*0.0092*	*1.00*	*0.0092*	*0.070*	*0.0006*	*0.1*
17	11:52	10.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

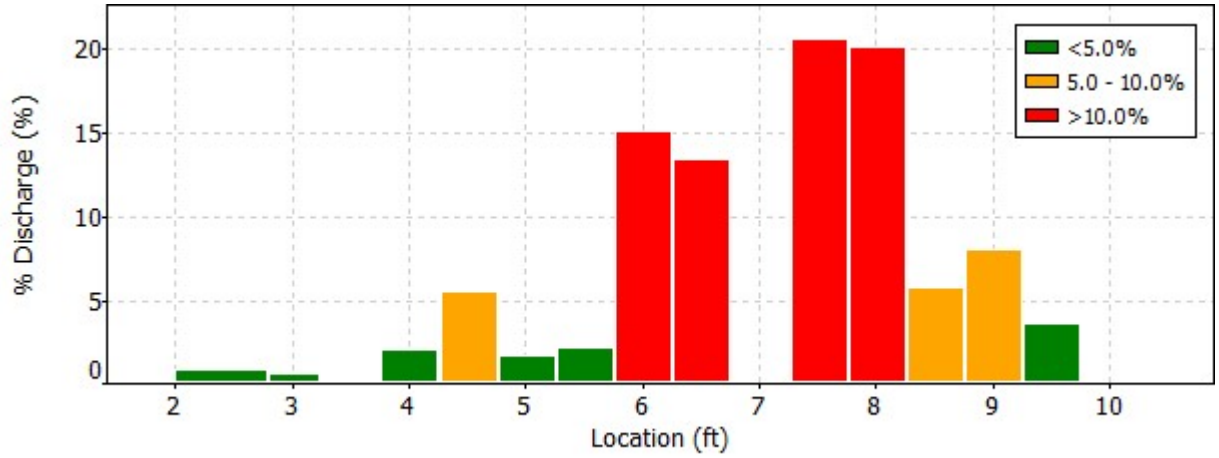
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

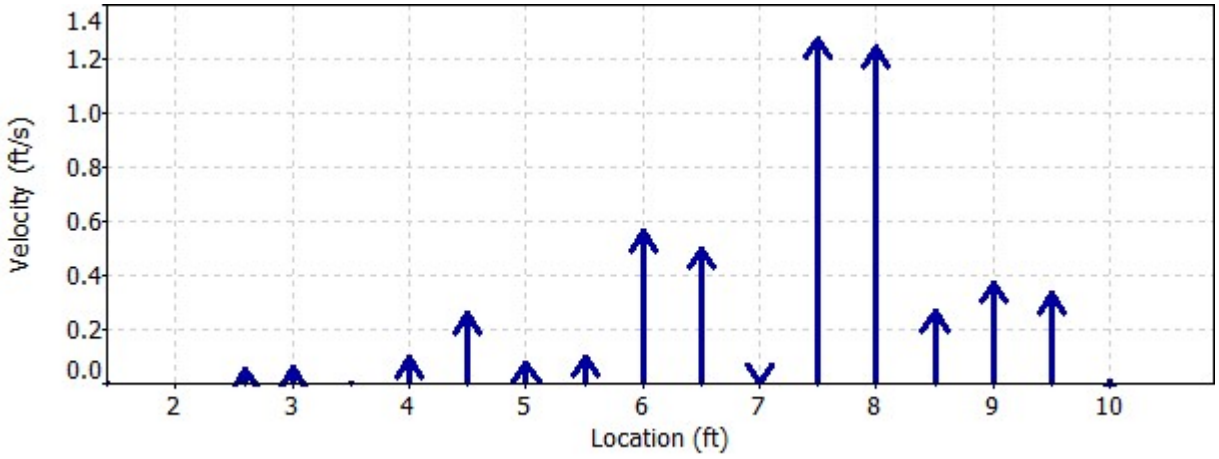
Discharge Measurement Summary

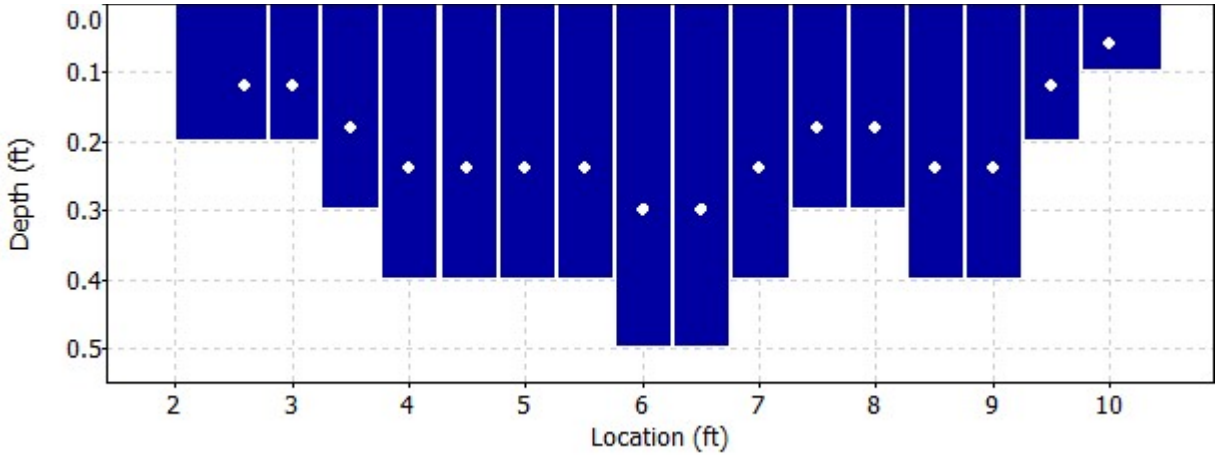
Date Generated: Tue Sep 27 2022

File Information	
File Name	HERMAN.1.WAD
Start Date and Time	2020/09/23 11:28:57

Site Details	
Site Name	HERM 092320
Operator(s)	KS







Discharge Measurement Summary

Date Generated: Tue Sep 27 2022

File Information		Site Details	
File Name	HERMAN.1.WAD	Site Name	HERM 092320
Start Date and Time	2020/09/23 11:28:57	Operator(s)	KS

Quality Control

St	Loc	%Dep	Message
1	2.60	0.6	High angle: 71
		0.6	SNR (20.8) is different from typical SNR (31.6)
		0.6	High SNR variation during measurement: 6.5,6.9
		0.6	Boundary QC is Poor; possible boundary interference
2	3.00	0.6	High angle: 40
		0.6	SNR (21.3) is different from typical SNR (31.6)
		0.6	High SNR variation during measurement: 6.9,6.5
		0.6	Boundary QC is Good; possible boundary interference
3	3.50	0.6	SNR (12.8) is different from typical SNR (31.6)
		0.6	Boundary QC is Fair; possible boundary interference
4	4.00	0.6	High angle: -38
		0.6	High SNR variation during measurement: 6.9,6.0
		0.6	Boundary QC is Good; possible boundary interference
5	4.50	0.6	High standard error: 0.034
		0.6	Boundary QC is Good; possible boundary interference
6	5.00	0.6	High SNR variation during measurement: 9.0,9.9
		0.6	Boundary QC is Fair; possible boundary interference
7	5.50	0.6	High angle: 61
		0.6	High SNR variation during measurement: 5.2,4.3
8	6.00	0.6	High standard error: 0.046
9	6.50	0.6	High standard error: 0.063
10	7.00	0.6	High number of spikes: 5
		0.6	SNR (52.9) is different from typical SNR (31.6)
		0.6	High SNR variation during measurement: 16.3,12.9
13	8.50	0.6	High angle: 30
14	9.00	0.6	High standard error: 0.041
		0.6	Boundary QC is Good; possible boundary interference
15	9.50	0.6	High angle: -27
		0.6	High SNR variation during measurement: 5.2,8.2
		0.6	High standard error: 0.043
		0.6	Boundary QC is Fair; possible boundary interference
16	10.00	0.6	SNR (17.6) is different from typical SNR (31.6)
		0.6	High SNR variation during measurement: 1.7,9.0
		0.6	Boundary QC is Fair; possible boundary interference

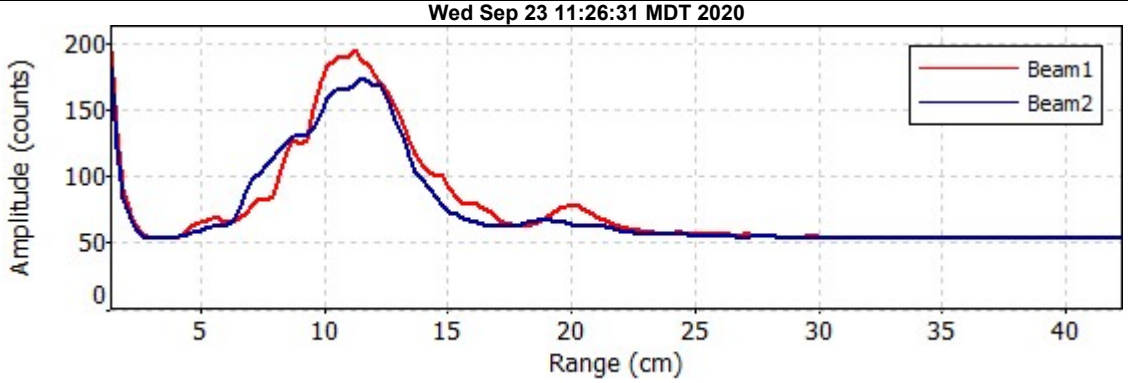
Discharge Measurement Summary

Date Generated: Tue Sep 27 2022

File Information		Site Details	
File Name	HERMAN.1.WAD	Site Name	HERM 092320
Start Date and Time	2020/09/23 11:28:57	Operator(s)	KS

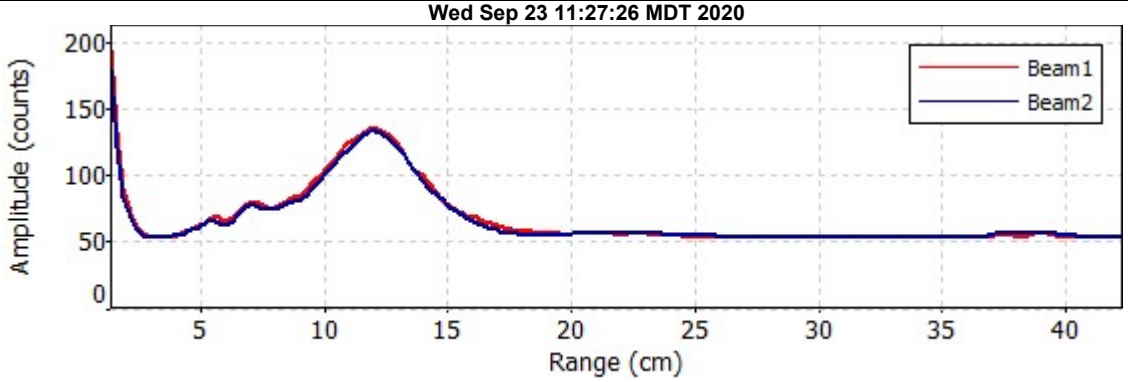
Automatic Quality Control Test (BeamCheck)

Wed Sep 23 11:26:31 MDT 2020



- Noise level check - Pass
- SNR check - Fail
  - High differences in beam SNR: 58.2,47.3
- Peak location check - Pass
- Peak shape check - Fail

Wed Sep 23 11:27:26 MDT 2020



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Profile Name: HERMAN
Operator Name: KB
15:07:15 10.11.2021

Stage Reference: 0.00 ft

Model: FH950
s/n: 210851004850
Boot: v1.00
Application: v1.06

Sensor Type: Velocity Only
s/n: 210900339474
Boot: v1.00
Application: v1.02

Filter: FPA Parameter: 10 s
Pre-filter: On Rank: 5
EMI: 60Hz.

Station Entry: Non-fixed
Flow Calculation: Mid-section
Start Edge: Right edge water
# of Stations: 26
Stream Width: 6.30 ft
Total Discharge: 1.24 ft^3/s
Total Area: 2.71 ft^2
Mean Depth: 0.43 ft

Measurement Results:

Time	Station	Location (ft)	Method	Depth (ft)	Edge Factor	Surface (ft/s)	0.2 (ft/s)	0.4 (ft/s)	0.6 (ft/s)	0.8 (ft/s)	Bed (ft/s)	Average Velocity (ft/s)	Area (ft^2)	Flow (ft^3/s)
14:45:31	1	9	0 point	0	-	0	0	0	0	0	0	0	0	0
14:47:35	2	9	1 point	0.2	-	0	0	0	0.22	0	0	0.22	0.03	0.01
14:48:38	3	9.3	1 point	0.3	-	0	0	0	0.29	0	0	0.29	0.09	0.02
14:49:43	4	9.6	1 point	0.3	-	0	0	0	0.2	0	0	0.2	0.09	0.02
14:50:31	5	9.9	1 point	0.2	-	0	0	0	0.53	0	0	0.53	0.06	0.03
14:51:16	6	10.2	1 point	0.6	-	0	0	0	0.81	0	0	0.81	0.18	0.14
14:52:05	7	10.5	1 point	0.55	-	0	0	0	0.2	0	0	0.2	0.16	0.03
14:52:45	8	10.8	1 point	0.6	-	0	0	0	0.51	0	0	0.51	0.18	0.09
14:53:30	9	11.1	1 point	0.55	-	0	0	0	0.62	0	0	0.62	0.16	0.1
14:54:39	10	11.4	1 point	0.5	-	0	0	0	0.75	0	0	0.75	0.12	0.09
14:55:46	11	11.6	1 point	0.6	-	0	0	0	0.45	0	0	0.45	0.12	0.05
14:56:53	12	11.8	1 point	0.6	-	0	0	0	0.56	0	0	0.56	0.15	0.08
14:57:50	13	12.1	1 point	0.5	-	0	0	0	0.24	0	0	0.24	0.15	0.03
14:58:30	14	12.4	1 point	0.45	-	0	0	0	0.53	0	0	0.53	0.13	0.07
14:59:16	15	12.7	1 point	0.3	-	0	0	0	0.49	0	0	0.49	0.09	0.04
15:00:23	16	13	1 point	0.4	-	0	0	0	0.15	0	0	0.15	0.12	0.02
15:01:07	17	13.3	1 point	0.35	-	0	0	0	0.27	0	0	0.27	0.1	0.03
15:01:46	18	13.6	1 point	0.35	-	0	0	0	0.16	0	0	0.16	0.1	0.02
15:02:17	19	13.9	1 point	0.3	-	0	0	0	0.27	0	0	0.27	0.09	0.02
15:02:54	20	14.2	1 point	0.4	-	0	0	0	0.1	0	0	0.1	0.12	0.01
15:03:25	21	14.5	1 point	0.4	-	0	0	0	0.67	0	0	0.67	0.12	0.08
15:04:00	22	14.8	1 point	0.4	-	0	0	0	0.51	0	0	0.51	0.12	0.06
15:05:03	23	15.1	1 point	0.4	-	0	0	0	1.04	0	0	1.04	0.14	0.14
15:05:39	24	15.5	1 point	0	-	0	0	0	0.14	0	0	0.14	0	0
15:06:27	25	14.8	1 point	0.1	-	0	0	0	0.24	0	0	0.24	0.06	0.01
15:06:49	26	15.3	0 point	0	-	0	0	0	0	0	0	0	0	0

Discharge Measurement Summary

Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.ft
Comment	

Start time	7/18/2022 4:33 PM
End time	7/18/2022 4:56 PM
Start location latitude	39.709
Start location longitude	-105.859
Calculations engine	FlowTracker2

Sensor type	Top Setting
Handheld serial number	FT2H2113010
Probe serial number	FT2P2114008
Probe firmware	1.30
Handheld software	1.6.4

# Stations	Avg interval (s)	Total discharge (ft³/s)
18	40	4.942

Total width (ft)	Total area (ft²)	Wetted Perimeter (ft)
7.200	4.123	7.330

Mean SNR (dB)	Mean depth (ft)	Mean velocity (ft/s)
46.734	0.573	1.199

Mean temp (°F)	Max depth (ft)	Max velocity (ft/s)
49.241	0.800	1.759

Discharge Uncertainty		
Category	**ISO**	**IVE**
Accuracy	1.0%	1.0%
Depth	0.4%	4.1%
Velocity	0.8%	4.0%
Width	0.1%	0.1%
Method	2.0%	
# Stations	2.8%	
Overall	**3.7%**	**5.8%**

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

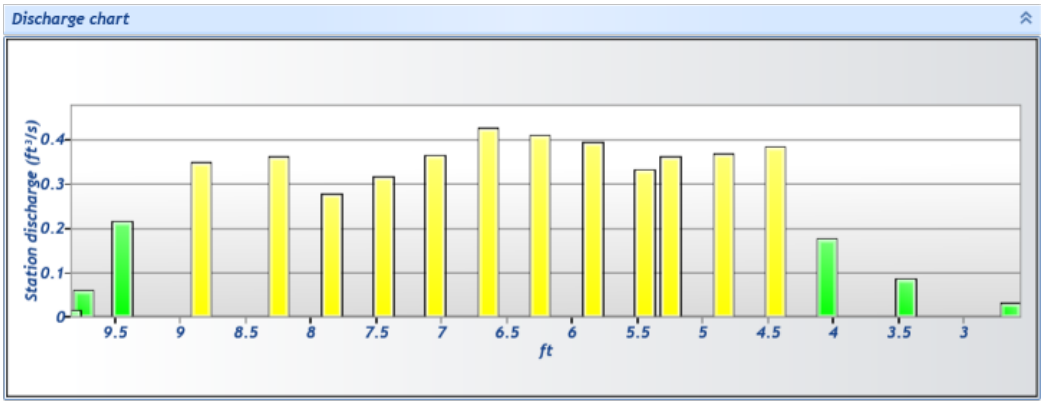
No changes were made to this file
Quality control warnings

Discharge Measurement Summary

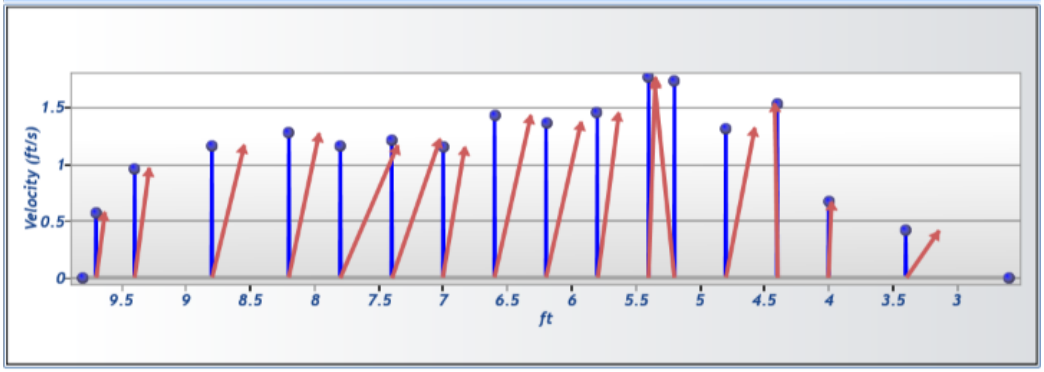
Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.ft
Comment	

Station Warning Settings	
Station discharge OK	Station discharge < 5.000%
Station discharge caution	5.000% >= Station discharge < 10.000%
Station discharge warning	Station discharge >= 10.000%

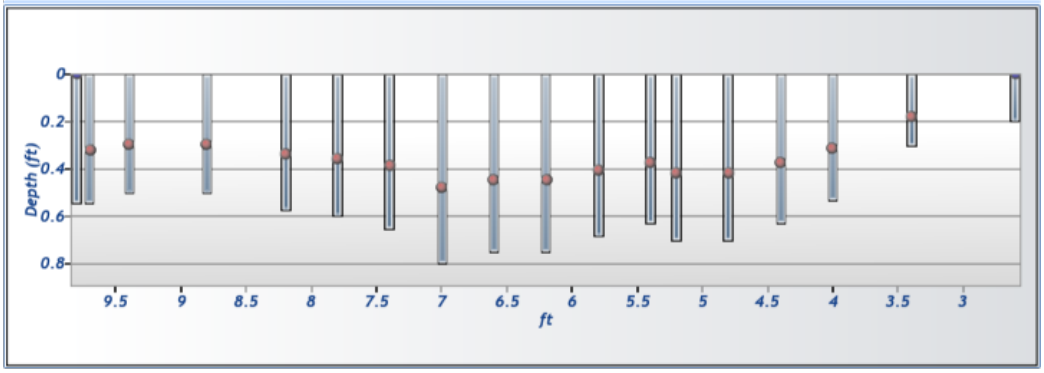
Discharge chart



Velocity chart



Depth chart



Discharge Measurement Summary

Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.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	
17	4:52 PM	2.600	None	0.200	0.000	0.000	0	0.000	1.000	0.414	0.080	0.033	0.670	✓
16	4:51 PM	3.400	0.6	0.300	0.600	0.180	80	0.414	1.000	0.414	0.210	0.087	1.760	✓
15	4:56 PM	4.000	0.6	0.530	0.600	0.318	80	0.669	1.000	0.669	0.265	0.177	3.586	✓
14	4:49 PM	4.400	0.6	0.630	0.600	0.378	80	1.529	1.000	1.529	0.252	0.385	7.795	✓
13	4:53 PM	4.800	0.6	0.700	0.600	0.420	80	1.315	1.000	1.315	0.280	0.368	7.449	✓
12	4:48 PM	5.200	0.6	0.700	0.600	0.420	80	1.728	1.000	1.728	0.210	0.363	7.344	✓
11	4:54 PM	5.400	0.6	0.630	0.600	0.378	80	1.759	1.000	1.759	0.189	0.332	6.727	✓
10	4:47 PM	5.800	0.6	0.680	0.600	0.408	80	1.446	1.000	1.446	0.272	0.393	7.956	✓
9	4:45 PM	6.200	0.6	0.750	0.600	0.450	80	1.367	1.000	1.367	0.300	0.410	8.296	✓
8	4:44 PM	6.600	0.6	0.750	0.600	0.450	80	1.424	1.000	1.424	0.300	0.427	8.648	✓
7	4:42 PM	7.000	0.6	0.800	0.600	0.480	80	1.143	1.000	1.143	0.320	0.366	7.403	✓
6	4:41 PM	7.400	0.6	0.650	0.600	0.390	80	1.216	1.000	1.216	0.260	0.316	6.396	✓
5	4:39 PM	7.800	0.6	0.600	0.600	0.360	80	1.162	1.000	1.162	0.240	0.279	5.645	✓
4	4:38 PM	8.200	0.6	0.570	0.600	0.342	80	1.268	1.000	1.268	0.285	0.361	7.311	✓
3	4:37 PM	8.800	0.6	0.500	0.600	0.300	80	1.162	1.000	1.162	0.300	0.349	7.057	✓
2	4:36 PM	9.400	0.6	0.500	0.600	0.300	80	0.964	1.000	0.964	0.225	0.217	4.389	✓
1	4:33 PM	9.700	0.6	0.540	0.600	0.324	80	0.574	1.000	0.574	0.108	0.062	1.254	✓
0	4:33 PM	9.800	None	0.540	0.000	0.000	0	0.000	1.000	0.574	0.027	0.015	0.314	✓

Discharge Measurement Summary

Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.ft
Comment	

Quality Control Settings	
Maximum depth change	50.000%
Maximum spacing change	100.000%
SNR threshold	10.000 dB
Standard error threshold	0.033 ft/s
Spike threshold	10.000%
Maximum velocity angle	20.000 deg
Maximum tilt angle	5.000 deg

Quality control warnings

St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Warnings
16	4:51 PM	3.400	0.6	0.300	0.600	0.180	Velocity Angle > QC
15	4:56 PM	4.000	0.6	0.530	0.600	0.318	Standard Error > QC
14	4:49 PM	4.400	0.6	0.630	0.600	0.378	Standard Error > QC
13	4:53 PM	4.800	0.6	0.700	0.600	0.420	Standard Error > QC
12	4:48 PM	5.200	0.6	0.700	0.600	0.420	Standard Error > QC
11	4:54 PM	5.400	0.6	0.630	0.600	0.378	Standard Error > QC
10	4:47 PM	5.800	0.6	0.680	0.600	0.408	Standard Error > QC
9	4:45 PM	6.200	0.6	0.750	0.600	0.450	Standard Error > QC
7	4:42 PM	7.000	0.6	0.800	0.600	0.480	Standard Error > QC
5	4:39 PM	7.800	0.6	0.600	0.600	0.360	Velocity Angle > QC

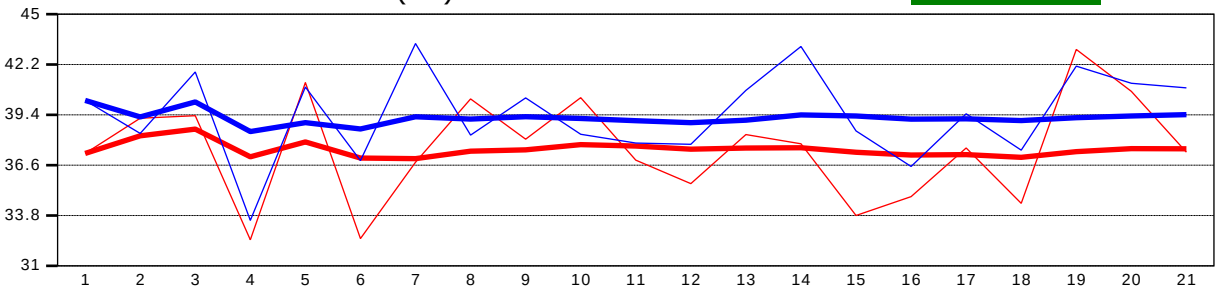
Discharge Measurement Summary

Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.ft
Comment	

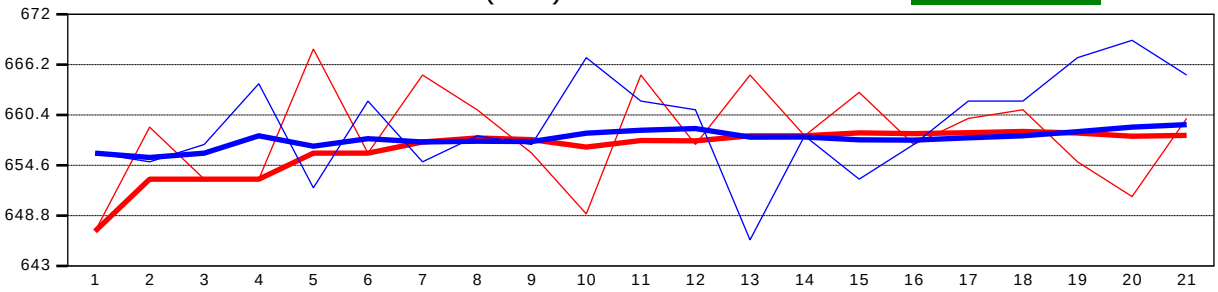
Beam 1	
Beam 2	

Automated beam check Start time 7/18/2022 4:33:05 PM

Automated beam check SNR(dB) PASS



Automated beam check Noise level(cnts) PASS



Automated beam check Quality control warnings

No quality control warnings

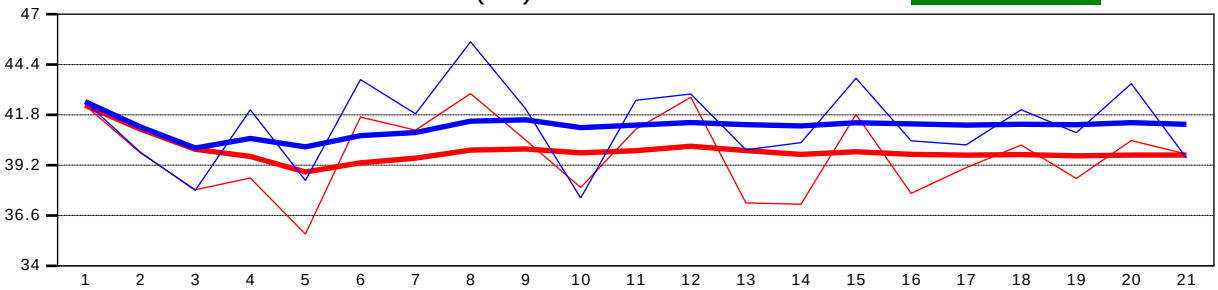
Discharge Measurement Summary

Site name	Herman Gulch
Site number	07182022
Operator(s)	Lfs
File name	Herman Gulch_20220718-165859.ft
Comment	

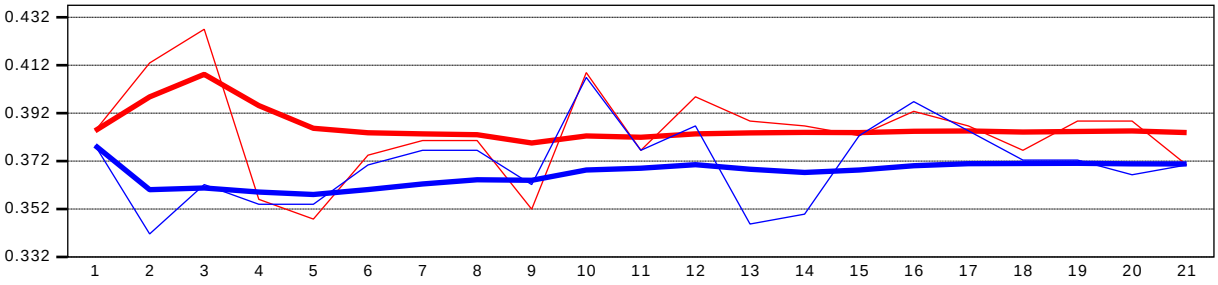
Beam 1	
Beam 2	

Automated beam check Start time 7/18/2022 4:33:05 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