COLORADO
Parks and Wildlife
Department of Natural Resources

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13 November 2015

Ms. Linda Bassi, Chief
Stream and Lake Protection Section
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
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SUBJ: Instream Flow Recommendations for Streams on the Soapstone Prairie Natural Area (City of Fort Collins) and Red Mountain Open Space (Larimer County) Properties; Boxelder Creek, Sand Creek and Lonetree Creek, Larimer County and Weld County, Water Division 1, for January, 2016 CWCB Meeting

Dear Linda:

The information contained in and referred to in this letter and the associated instream flow file folders that are ready for posting to the CWCB website, form the basis for the instream flow recommendations for Boxelder Creek, Sand Creek, and Lonetree Creek. It is Colorado Parks and Wildlife's (CPW) intent that these three streams be considered by the Colorado Water Conservation Board (CWCB or Board) at their January, 2016 regular meeting. The investigations related to these instream flow recommendations were conducted by City of Fort Collins' Natural Areas Program, Larimer County Open Space and Colorado Parks and Wildlife personnel; these investigations were initiated in 2013 and continued into 2015. It is the CPW staff's opinion that the information contained in this letter is sufficient for the Board's staff to initiate instream flow appropriations on the above referenced water bodies and to specifically address the findings required in Rule 5(i) of the Instream Flow Rules.

The State of Colorado's Instream Flow (ISF) Program was created in 1973 when the Colorado General Assembly passed Senate Bill 97 which called for the recognition of "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). This statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISF Program, the statute directs the Board to request and consider instream flow recommendations from other local, state and federal agencies. These three stream segments should be considered for inclusion into the ISF Program because they have natural environments that can be preserved to a reasonable degree with an instream flow water right.

The CPW is forwarding these stream flow recommendations to the Board to meet 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 ... 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 statutory directives, the current CPW strategic planning documents (*DOW Strategic Plan*, 2010 and *A Path Forward*, 2014) state that "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations...by protecting and enhancing the quality and quantity of aquatic habitats." and that "Ensuring the long term viability of native fish and wildlife ... and sport fish populations." - these statements encapsulate CPW's primary objectives and provide a guide to the agency's linkage to the goals and objectives of the CWCB ISF Program.

Background

Several years ago, CPW personnel initiated work with staff from the City of Fort Collins Natural Areas Program (City) and Larimer County's (County) Open Space Department to develop ISF recommendations on several streams located on the Soapstone Prairie Natural Area and the Red Mountain Open Space properties north of Fort Collins in Larimer and Weld Counties. These natural area properties are largely prairie grassland with several perennial water features that are somewhat unique for this area and elevation. ISF and natural lake level appropriations on two streams and four ponds (Spottlewood Creek, Graves Creek, and Spottlewood Ponds 1-4) on Soapstone Prairie were secured in the 2014 - 15 appropriation cycle. It is important to note that Boxelder Creek, Sand Creek, and Lonetree Creek are very similar streams - both in terms of biology and hydrology.

Prairie Hydrology

Recall that the 2015 streams and ponds were all situated in spring driven hydrologic systems with very stable flows and relatively stable temperature regimes. Their hydrology was not snowmelt driven like other Colorado streams but were sustained by diffuse spring sources that were scattered throughout the drainages. The hydrology of Boxelder Creek, Sand Creek, and Lonetree Creek is very similar. While it is true that some snow accumulates in the area, it is limited and rapidly melts or sublimates (due to persistent winds). Spring, summer, and early fall hydrology is influenced by storm events that are common to the Colorado Front Range. These storm events cause short term increases in stream flow but measurements show that these streams rapidly return to spring driven baseflows. It is important to note that Sand Creek and Boxelder Creek have higher elevation, forested headwaters and as such, they display some snowmelt driven hydrologic characteristics and some spring flow characteristics. Another characteristic of these stream systems is that they flow and dry up at predictable points along their course.

Due to the above described hydrology, a water availability investigation for these streams was somewhat difficult. There are no nearby similar gages that we could use and no applicable models for streams in this elevation band with similar hydrologic drivers. Water availability determinations were made utilizing staff professional judgment, the best available information, consultations with water users and other state officials, CWCB temporary gage measurements and staff spot measurements during the period of our investigations of these streams.

Lonetree Creek and Sand Creek both have headwaters in Wyoming and the flow into Colorado southwest of Cheyenne, Wyoming. Similarly, Boxelder Creek has its headwaters very close to the state line, but for the most part, the Boxelder basin is entirely within Colorado. All three creeks flow in a southerly direction toward Ft. Collins, Colorado. All three creeks have perennial flow in the headwaters but go underground or become intermittent before they flow into any major tributary of the Cache la Poudre River.

Biology

As stated above, Lonetree Creek starts in Wyoming and flows parallel to Interstate 25 (on the west side) for about four miles in Colorado before it goes under the highway and on towards the southeast; while in Colorado, it is entirely in Weld County. There is rarely any contiguous perennial streamflow in Lonetree Creek on the east side of the interstate. In 2010, Colorado State University (Cathcart and Stacy) conducted a fish inventory on Lonetree Creek. Six species of fish were collected (five of which are native to the eastern slope of Colorado). One of the species found in Lonetree Creek was the Iowa Darter, a state listed species of special concern. Lonetree Creek is being investigated as a potential reintroduction site for other native fish such as northern redbelly dace and/or common shiner. Lonetree Creek supports aquatic macroinvertebrates and lush riparian wetlands which are undoubtedly important for terrestrial and avian species.

Also stated above is the fact that the other two creeks that are the subject of this recommendation letter are very similar in terms of their hydrology and biology. They are both large enough, cold enough, and high enough in elevation that they have trout populations. Therefore, they are more typical of Colorado streams than the other streams we have studied on the Ft. Collins and Larimer County properties.

Sand Creek is, by far, the largest stream in the Red Mountain Open Space. Sand Creek arises in Wyoming and then flows through a deep canyon (Haygood Canyon) in the northwest corner of the Red Mountain Open Space property. The stream then flows through prairie grassland habitats before it goes underground and becomes intermittent. Sand Creek currently supports a wild population of brook trout and also supports a small population of the non-native fathead minnow in the lower reaches. CPW is currently engaged in discussions with Wyoming Game and Fish regarding a reclamation project and reintroduction of native cutthroat trout in the Sand Creek basin. The Sand Creek basin has also been the subject of a detailed botanical inventory by Larimer County personnel (see attached inventory documentation).

Boxelder Creek is formed by the confluence of two major tributaries (the North Branch and South Branch) southwest of Cheyenne, Wyoming. The South Branch is entirely in Colorado and the North Branch flows out of Wyoming; therefore, there is a very small portion of the Boxelder Creek watershed in Wyoming. Boxelder Creek also supports a brook trout fishery and is also being investigated as a potential reintroduction site for greenback cutthroat trout. Larimer County and CSU data indicates that Boxelder Creek supports an excellent and diverse aquatic macroinvertebrate community as well as lush riparian wetlands which are undoubtedly important for terrestrial and avian species (see attached).

As stated above, the purpose of this letter is to formally transmit ISF recommendations from CPW to CWCB for the Board's consideration for the 2016 appropriation year. Please refer to the following fact sheets and the recommendation summary table (attached) for additional information.

CPW personnel will be present at the January, 2016 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Jay W. Skinner
CPW Instream Flow Program Coordinator

FACT SHEET

Lonetree Creek

Upper Terminus: A point where Lonetree Creek enters Colorado from Wyoming (see Recommendation Summary Table for legal description)

Lower Terminus: A point where surface flow ceases - in the vicinity of the I - 25 bridge in Section 6 (see Recommendation Summary Table for legal description)

Natural Environment:

Lonetree Creek is known to have a rather diverse native fish community including Iowa Darter (state listed species of special concern), brook sticklebacks, white suckers, creek chubs, central stonerollers, and the non-native fathead minnow. Portions of Lonetree Creek are also being studied and investigated as a possible future reintroduction site for northern redbelly dace and/or common shiner. Its stable hydrology and temperature regime and its relative isolation make it particularly suitable for active native fishery management activities. Lonetree Creek has a diverse community of macroinvertebrates and a productive riparian zone. Due to the relative rarity of water features such as this on the high prairie, it is reasonable to assume that this feature is important to both terrestrial wildlife and avian species.

R2CROSS Results:

During 2014, CPW, CWCB, and City of Fort Collins personnel collected R2CROSS data at two sites within the proposed ISF segment. Due to the gradient of Lonetree Creek, the water velocity at the cross sections did not reach the 1.00 fps criterion so the resulting flow recommendations were developed using only the average depth and percent wetted perimeter criteria. The results of the R2CROSS modeling are summarized below:

Date	Q Measured	40% - 250%	Flow meeting two criteria
6/11/2014	0.86 cfs	0.3 - 2.2 cfs	1.3 cfs
6/11/2014	0.21 cfs	0.1 - 0.5 cfs	0.3 cfs
		AVERAGE	0.8 cfs

Due to the spring driven nature of Lonetree Creek's hydrology and the nature of the natural environment present, CPW is of the opinion that it is appropriate to recommend a single year-round instream flow amount of 0.8 cfs to be sufficient to preserve the natural environment to a reasonable degree. This flow recommendation is subject to revision in light of site specific water availability data collected by CWCB staff.

Central stoneroller (Campostoma anomalum) C. Nate Cathcart photo 2010

Lone Tree Creek Fish Inventory

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Introduction

Understanding fish assemblages in stream ecosystems is useful for creating management plans (CDOW 2006), using indices of biotic integrity (Whittier et al. 2007), and conserving native species. Management agencies must be aware of the diversity of biota, including fish, on their lands in order to choose practices that will limit negative effects on sensitive species. Being aware of the presence or absence of species of concern requires current, and often multi-year, field surveys in addition to historical data (Smith and Jones 2007).

The Meadow Springs Ranch property in Weld County is managed as a biosolids accumulation facility for wastewater from the city of Fort Collins, CO (Figure 1). The property is composed of shortgrass prairie, mostly undeveloped, and contains multiple spring-fed streams. Plains stream fish in eastern Colorado were described by the Colorado Division of Wildlife (CDOW) as facing many threats to their habitat, including trouble maintaining base flows, water quality, riparian land use, invasive plant and animal species, and instream barriers (CDOW 2006). In this report, the CDOW encourages the collection of species distribution information for fish monitoring.

The objective of this study was to document the fish assemblage of Lone Tree Creek on the Meadow Springs Ranch as well as provide a general description of the aquatic habitat available. This fish inventory will add to the understanding of northern Colorado plains fishes since Lone Tree Creek had not been historically sampled or had not been recorded as such (Harry Vermillion personal communication). Furthermore, the anticipated use of this information is for

integration into the land use management of Meadow Springs Ranch by the City of Fort Collins Department of Natural Resources.

Methods

Study Site

The Meadow Springs Ranch (MSR), located roughly 15 miles north of Wellington, CO, is a 26,000 acre property owned by the City of Fort Collins and operated as a biosolids accumulation area for wastewater treatment from the city. Approximately 1,900 dry tons of biosolids are applied to the property each year, while soil and groundwater quality are routinely monitored by Fort Collins Utilities staff (City of Fort Collins Utilities). Lone Tree Creek is a groundwater and spring-fed stream that flows south through the property just west of Interstate-25. The sample reach was at 5950 ft in elevation at the downstream end. Lone Tree Creek meanders through the plains and grasslands and contains substrates of gravel, sand, silt, and vegetation in pools, runs, and riffles.

Both pools and riffles were sampled in order to cover the diversity of habitats encountered and the differences in species within. We sampled 8 pools and 3 riffles in two reaches on MSR, separated by a short reach on private ranch property that we were unable to sample. The reaches were specified by Erica Saunders (Environmental Planner, City of Fort Collins Natural Areas Program) as areas of interest for fish monitoring. The total length of habitats sampled was 0.37 miles.

Fish Sampling and Habitat Measurement

Fish were sampled on May 22, 2010 using a backpack electrofishing unit (Smith-Root LR-24, 200V pulsed DC current). All fish were identified to species and numbers of each species at each site were recorded. One thorough electrofishing pass was conducted in a zigzag pattern from bank to bank through each sample location, and this was presumed to be adequate to encounter all fish species present. GPS coordinates (UTM, NAD83, WGS84) of sampling locations were taken at the most downstream point of pool or riffle. Coordinates were recorded with a Garmin Rino GPS unit and are summarized along with lengths, widths, and depths of each habitat sampled in Table 1.

Results

Six species of fish were captured in the electrofishing survey (Appendix I): brook stickleback (*Culaea inconstans*), white sucker (*Catostomus commersonii*), fathead minnow (*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Campostoma anomalum*), and Iowa darter (*Etheostoma exile*). The respective percentages of each species captured were: fathead minnow (59%), brook stickleback (25%), creek chub (10%), Iowa darter (3%), central stoneroller (2%), and white sucker (1%). Table 2 shows individual species data per site.

Discussion

Of all 11 locations sampled, only two sites held all six species. Furthermore, the two sites containing all six species collected were the most downstream sites (Figure 2). Sampling efforts show brook stickleback are the most widely

distributed species while other species are possibly restricted to more downstream reaches. Fathead minnow were the most abundant fish species collected although they were limited to three sites, most notably one pool (MDS002; Table 2). The brook stickleback is not native to the watershed while all other species found are native. The Iowa darter, while comprising only three percent of the total catch, is notable due to its status as a tier 2 species of special concern in Colorado (Hanson and Bentley 2008). The rarest species in Lone Tree Creek was the ubiquitous white sucker. One possible explanation for the low numbers of white sucker is lack of suitable temperatures. Suckers are known to migrate in the spring for spawning and this time period may be why the few individuals were collected.

In May, water levels are higher and provide the connectivity necessary for fishes from lower reaches to reach upper reaches. Accordingly, fish species may not have yet had adequate time to recolonize the upper reaches. The temporal effects on the spatial dynamics of the stream would need to be addressed by sampling in the fall to fully understand the species and habitat present in the creek. Given the expected population growth of Fort Collins and the Front Range, continued monitoring of plains fishes and their habitats is required to properly manage these natural systems. This monitoring will then help managers reach conservation goals for the areas of concern.

Acknowledgements

We thank Erica Saunders for providing the opportunity to sample on Meadow Springs Ranch. We also thank Carl Saunders for lending his electrofishing

prowess and the undergraduates (J. Anderson, Z. Underwood) and graduate students (C. Craft, E. Gardunio) of the Colorado State University student subunit of the American Fisheries Society. We also thank Harry Crockett and Ryan Fitzpatrick of the Colorado Division of Wildlife for loaning electrofishing equipment and continuing to support the professional endeavors of the student subunit of the AFS.

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Table 1. Site descriptions for Lone Tree Creek on the Meadow Springs Ranch, Weld County, Colorado.

Site	Site type	length (m)	Width (m)	Max Depth (cm)	latitude (N)	longitude (W)
MDS001	Pool	91.2	7.9	94	40.96825	104.92555
MDS002	Pool	76.0	18.3	137	40.96946	104.92706
MDS003	Riffle	30.0	4.1	-	40.96945	104.92709
MDS004	Pool	11.0	6.4	20	40.9716	104.92558
MDS005	Pool	57.6	11.9	64	40.9713	104.92524
MDS006	Pool	31.5	5.5	66	40.9713	104.92524
MDS007	Pool	39.6	11.6	58	40.9713	104.92524
MDS008	Riffle	77.0	-	-	40.97478	104.91959
MDS009	Pool	54.0	16.2	30	40.97581	104.91994
MDS010	Pool	32.4	7.6	46	40.97577	104.91993
MDS011	Riffle	93.8	-	-	40.97732	104.92043

Table 2. Fish sampling data with number of individuals captured for each species relative to each sample location and habitat. Sites are in order from downstream to upstream. Species codes are as follows: brook stickleback (BST), creek chub (CRC), central stoneroller (CST), fathead minnow (FMW), Iowa darter (IOD), and white sucker (WHS).

		Species						
Site	Habitat	BST	CRC	CST	FMW	IOD	WHS	No. of species
MDS001	Pool	6	31	6	23	2	2	6
MDS002	Pool	14	7	2	215	9	3	6
MDS003	Riffle	19	1					2
MDS004	Pool	39	1					2
MDS005	Pool	3						1
MDS006	Pool	10						1
MDS007	Pool	1			2			2
MDS008	Riffle							0
MDS009	Pool	5						1
MDS010	Pool	3		1				2
MDS011	Riffle	1						1

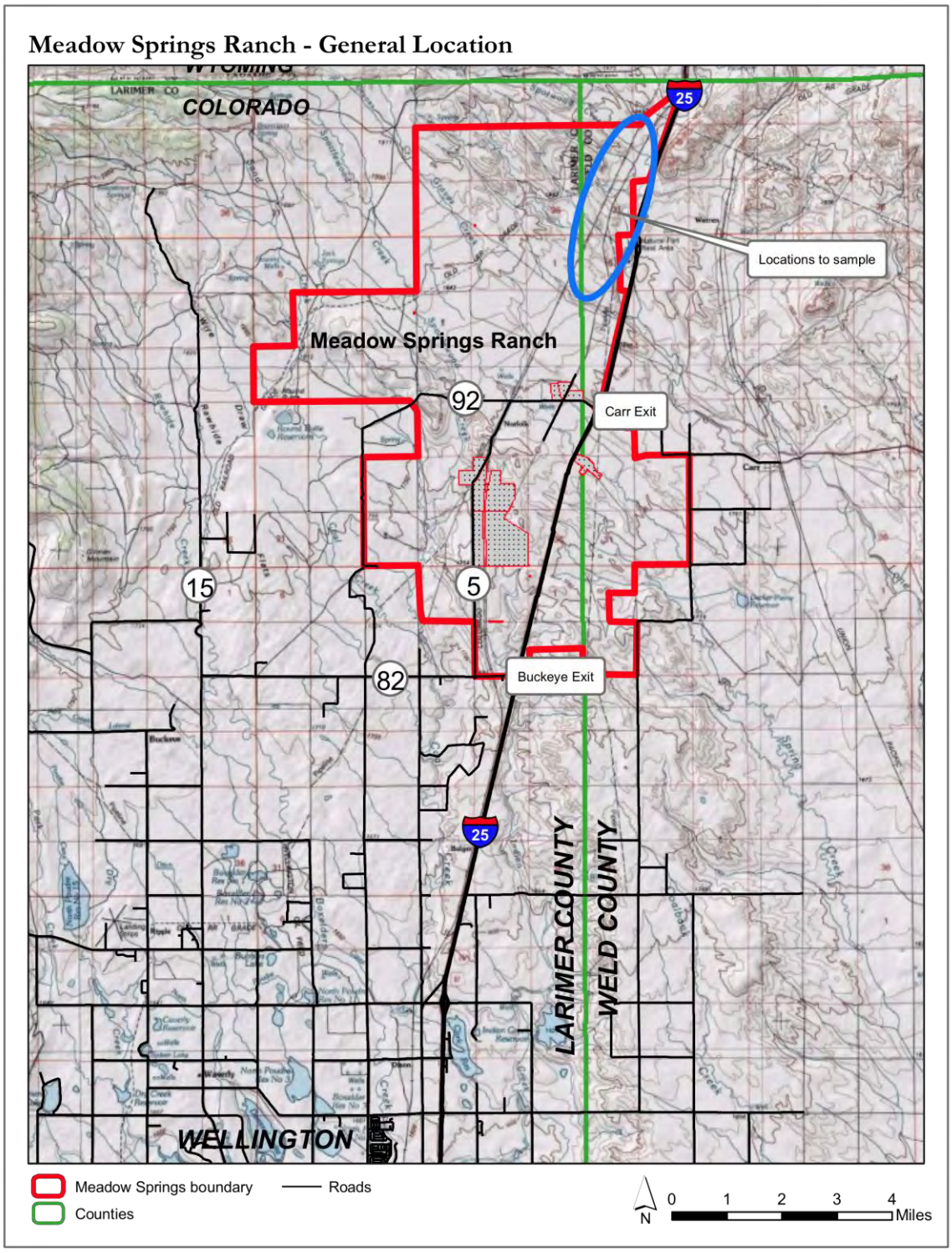


Figure 1. Map of the location of Meadow Springs Ranch in Laramie and Weld Counties, CO.

Figure 2. Fish sampling locations along Lone Tree Creek inside the Meadow Springs Ranch, Weld County, Colorado on 22 May 2010.

Appendix I

Life History of Fishes in Lone Tree Creek, Larimer County, Colorado

Sucker Family (Catostomidae)

Catostomus commersonii – white sucker

Spawning occurs over gravel and coarse sand from late-May into August in Colorado (Carlander 1969). White sucker reach sexual maturity at age 2 in males and age 4 in females and have been reported to live to age 17 in Colorado (Carlander 1969; Etnier and Starnes 2001). Natural hybrids of white and longnose suckers are known to occur although different spawning times could act as a preventative mechanism (Stewart and Watkinson 2004). White suckers have one of the most widespread ranges of suckers occurring from Labrador southward to New Mexico and north to the Northwest Territories and British Columbia. White sucker can also be important energy sources for the ecosystem. They are widespread in Colorado and are tolerant of a wide range of environmental conditions (Becker 1983).

Minnow Family (Cyprinidae)

Campostoma anomalum – central stoneroller

Central stoneroller inhabit clear, cool streams with coarse substrates. Central stoneroller spawn in the spring and build nests with gravel by rolling stones together (Becker 1983). Their nests are regularly used by other cyprinids (i.e. creek chub) during spawning seasons. During spawning, males become heavily tuberculated over their dorsolateral region from head to caudal peduncle. Central

stoneroller may reach age 6 although ages 3 and 4 are more common life expectancies. Maturity is variable from age 1 to age 4 but it is generally accepted that age-2 and age-3 central stonerollers are sexually mature. Their range extends from the eastern USA to Colorado and extends south into Mexico and north into Ontario.

Pimephales promelas – fathead minnow

Fathead minnow spawn on sand from May through August and can spawn multiple times (Carlander 1969). However, in Colorado plains streams they likely spawn any month that water temperatures are suitable (K. Fausch and K. Bestgen, unpublished observations). Maturity appears variable at age 1 to age 2 but has been recorded as early as age 0 as far north as Minnesota (Carlander 1969; Becker 1983). Fish often live to age 2 with few individuals surviving to age 3. The fathead minnow is one of the most abundant and widespread cyprinids in North America. Their range spans from the Maine to California and from Alberta southward to Mexico, because of its wide range of tolerances to various water quality parameters and habitats (Becker 1983).

Semotilus atromaculatus – creek chub

Creek chub spawn from May to July in gravel nests created by males (Becker 1983). Creek chub can reach age 8 although few live past age 4. Maturity is reached at age 1 in females and age 3 in males, which could possibly account for faster growth of males. Creek chub are an efficient predator on invertebrates and small

fish, making them an intermediate and top predator in small stream food webs (Stewart and Watkinson 2004). This species prefers cool, and clear to slightly turbid water with coarse gravel and sand substrates. Creek chub are found from Quebec to Florida and westward to Wyoming (Becker 1983).

Stickleback family (Gasterosteidae)

Culaea inconstans – brook stickleback

Brook stickleback prefer slower, cool, clear waters with vegetation. These fish commonly reach age 2 and age 3. Mature fish spawn in the spring and early summer. Males build nests using vegetation. Brook stickleback are distributed from northeastern USA west to Montana and Nebraska and then south to Kentucky. They are found throughout Canada.

Darter Family (Percidae)

Etheostoma exile – Iowa darter (**Tier 1 threatened species in Colorado**)

This species occurs in cool, clear, slower-moving streams and rivers with aquatic vegetation. It can reach age 4 although most populations are composed mainly of age 1 and age 2 fish (Becker 1983; Woodling 2006; Walford and Bestgen 2008). Adult fish spawn at temperatures from 12º-15ºC from late April to early June in Colorado (Simon and Faber 1987). Adhesive eggs are attached to vegetation and exposed tree roots.

The Iowa darter is thought to be a glacial relict at the western edge of its range, native only to the South Platte River basin in Colorado (Scott and Crossman

1973; Walford and Bestgen 2008). The natural distribution extends from the Great Lakes basin to Alberta and south to Colorado. A Colorado state species of special concern, Li (1968) documented a decline of the Iowa darter in the South Platte basin in the 1960's, presumably from habitat degradation.

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Lonetree Creek
XS LOCATION:	Lower
XS NUMBER:	0
DATE:	6.11.14
OBSERVERS:	0
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

CHANNEL PROFILE DATA

SLOPE:	0.04

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……..…….....DATE.....

STREAM NAME: Lonetree Creek
XS LOCATION: Lower
XS NUMBER: 0

DATA POINTS= 18

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	0.00	5.70			0.00		0.00	0.00	0.0%
1 gl	2.00	6.85			0.00		0.00	0.00	0.0%
	3.00	7.60			0.00		0.00	0.00	0.0%
wl	3.00	7.61	0.00	0.00	0.00		0.00	0.00	0.0%
	3.30	7.70	0.05	0.20	0.31	0.05	0.02	0.00	1.4%
	3.60	7.85	0.30	0.20	0.34	0.30	0.09	0.02	8.7%
	3.90	7.95	0.40	0.20	0.32	0.40	0.12	0.02	11.5%
	4.20	8.15	0.30	0.20	0.36	0.30	0.09	0.02	8.7%
	4.50	7.90	0.30	0.20	0.39	0.30	0.09	0.02	8.7%
	4.80	7.75	0.20	0.20	0.34	0.20	0.06	0.01	5.8%
	5.10	7.75	0.40	0.20	0.30	0.40	0.12	0.02	11.5%
	5.40	8.05	0.45	0.20	0.42	0.45	0.14	0.03	13.0%
	5.70	8.00	0.40	0.20	0.30	0.40	0.12	0.02	11.5%
	6.00	8.00	0.40	0.20	0.30	0.40	0.20	0.04	19.2%
wl	6.70	7.61	0.00	0.00	0.80		0.00	0.00	0.0%
	7.60	7.35			0.00		0.00	0.00	0.0%
	9.00	7.15			0.00		0.00	0.00	0.0%
1 gl	11.00	6.75			0.00		0.00	0.00	0.0%
TOTALS ----------					4.18	0.45 (Max.)	1.04	0.21	100.0%

Manning's n = 0.5877
Hydraulic Radius= 0.24874202

STREAM NAME: Lonetree Creek
XS LOCATION: Lower
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.04	0.98	-6.0%
7.36	1.04	2.05	97.1%
7.38	1.04	1.95	87.8%
7.40	1.04	1.86	78.7%
7.42	1.04	1.77	69.7%
7.44	1.04	1.67	61.0%
7.46	1.04	1.59	52.4%
7.48	1.04	1.50	44.0%
7.50	1.04	1.41	35.8%
7.52	1.04	1.33	27.8%
7.54	1.04	1.25	20.0%
7.56	1.04	1.17	12.3%
7.57	1.04	1.13	8.6%
7.58	1.04	1.09	4.9%
7.59	1.04	1.05	1.2%
7.60	1.04	1.02	-2.4%
7.61	1.04	0.98	-6.0%
7.62	1.04	0.94	-9.5%
7.63	1.04	0.91	-13.0%
7.64	1.04	0.87	-16.4%
7.65	1.04	0.83	-19.8%
7.66	1.04	0.80	-23.1%
7.68	1.04	0.73	-29.7%
7.70	1.04	0.67	-36.0%
7.72	1.04	0.60	-42.1%
7.74	1.04	0.54	-48.1%
7.76	1.04	0.48	-53.7%
7.78	1.04	0.43	-58.7%
7.80	1.04	0.38	-63.5%
7.82	1.04	0.33	-68.0%
7.84	1.04	0.29	-72.2%
7.86	1.04	0.25	-76.2%

WATERLINE AT ZERO
AREA ERROR = 7.593

STREAM NAME: Lonetree Creek
XS LOCATION: Lower
XS NUMBER: 0

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.85	8.50	0.65	1.30	5.52	9.32	100.0%	0.59	1.97	0.36
	6.89	8.23	0.63	1.26	5.15	9.03	96.9%	0.57	1.79	0.35
	6.94	7.91	0.60	1.21	4.75	8.69	93.2%	0.55	1.61	0.34
	6.99	7.59	0.57	1.16	4.36	8.35	89.6%	0.52	1.43	0.33
	7.04	7.28	0.55	1.11	3.99	8.01	86.0%	0.50	1.27	0.32
	7.09	6.96	0.52	1.06	3.64	7.68	82.3%	0.47	1.12	0.31
	7.14	6.64	0.50	1.01	3.30	7.34	78.7%	0.45	0.98	0.30
	7.19	6.24	0.48	0.96	2.97	6.91	74.2%	0.43	0.86	0.29
	7.24	5.82	0.46	0.91	2.67	6.48	69.5%	0.41	0.75	0.28
	7.29	5.41	0.44	0.86	2.39	6.04	64.8%	0.40	0.65	0.27
	7.34	4.99	0.43	0.81	2.13	5.60	60.1%	0.38	0.57	0.27
	7.39	4.73	0.40	0.76	1.89	5.32	57.0%	0.36	0.48	0.25
	7.44	4.49	0.37	0.71	1.66	5.05	54.2%	0.33	0.40	0.24
	7.49	4.25	0.34	0.66	1.44	4.79	51.4%	0.30	0.33	0.23
	7.54	4.01	0.31	0.61	1.23	4.53	48.5%	0.27	0.26	0.21
WL	7.59	3.77	0.28	0.56	1.04	4.26	45.7%	0.24	0.21	0.20
	7.64	3.53	0.24	0.51	0.86	4.00	42.9%	0.21	0.16	0.18
	7.69	3.27	0.21	0.46	0.69	3.72	39.9%	0.18	0.11	0.16
	7.74	3.07	0.17	0.41	0.53	3.50	37.5%	0.15	0.08	0.14
	7.79	2.45	0.16	0.36	0.40	2.82	30.3%	0.14	0.05	0.14
	7.84	2.11	0.13	0.31	0.28	2.43	26.0%	0.12	0.03	0.12
	7.89	1.73	0.11	0.26	0.19	1.99	21.3%	0.09	0.02	0.10
	7.94	1.38	0.08	0.21	0.11	1.58	16.9%	0.07	0.01	0.08
	7.99	1.09	0.04	0.16	0.05	1.22	13.1%	0.04	0.00	0.06
	8.04	0.33	0.05	0.11	0.02	0.41	4.4%	0.04	0.00	0.06
	8.09	0.15	0.03	0.06	0.00	0.19	2.0%	0.02	0.00	0.04
	8.14	0.02	0.00	0.01	0.00	0.02	0.2%	0.00	0.00	0.01

STREAM NAME: Lonetree Creek
XS LOCATION: Lower
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.21	cfs
CALCULATED FLOW (Qc)=	0.21	cfs
(Qm-Qc)/Qm * 100 =	1.3	%
MEASURED WATERLINE (WLm)=	7.61	ft
CALCULATED WATERLINE (WLc)=	7.59	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.56	ft
(Dm-Dc)/Dm * 100	-23.7	%
MEAN VELOCITY=	0.20	ft/sec
MANNING'S N=	0.588	
SLOPE=	0.04	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.5	cfs

RECOMMENDED INSTREAM FLOW:
============================

FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

RATIONALE FOR RECOMMENDATION:
============================

RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………......…....…....……....... DATE:.......….…........……………

CWCB REVIEW BY: ..……………………….....………………………………………………...…............. DATE:..................…………….....

STREAM NAME: Lonetree Creek
XS LOCATION: Lower
XS NUMBER: 0

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

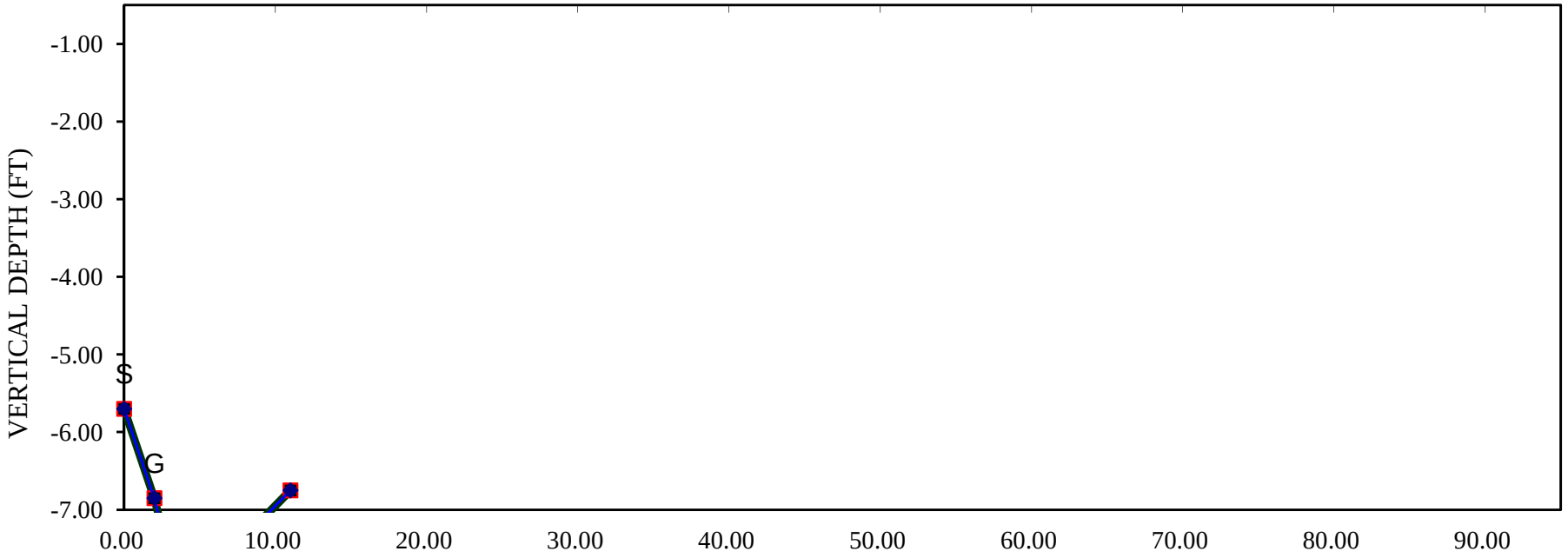
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

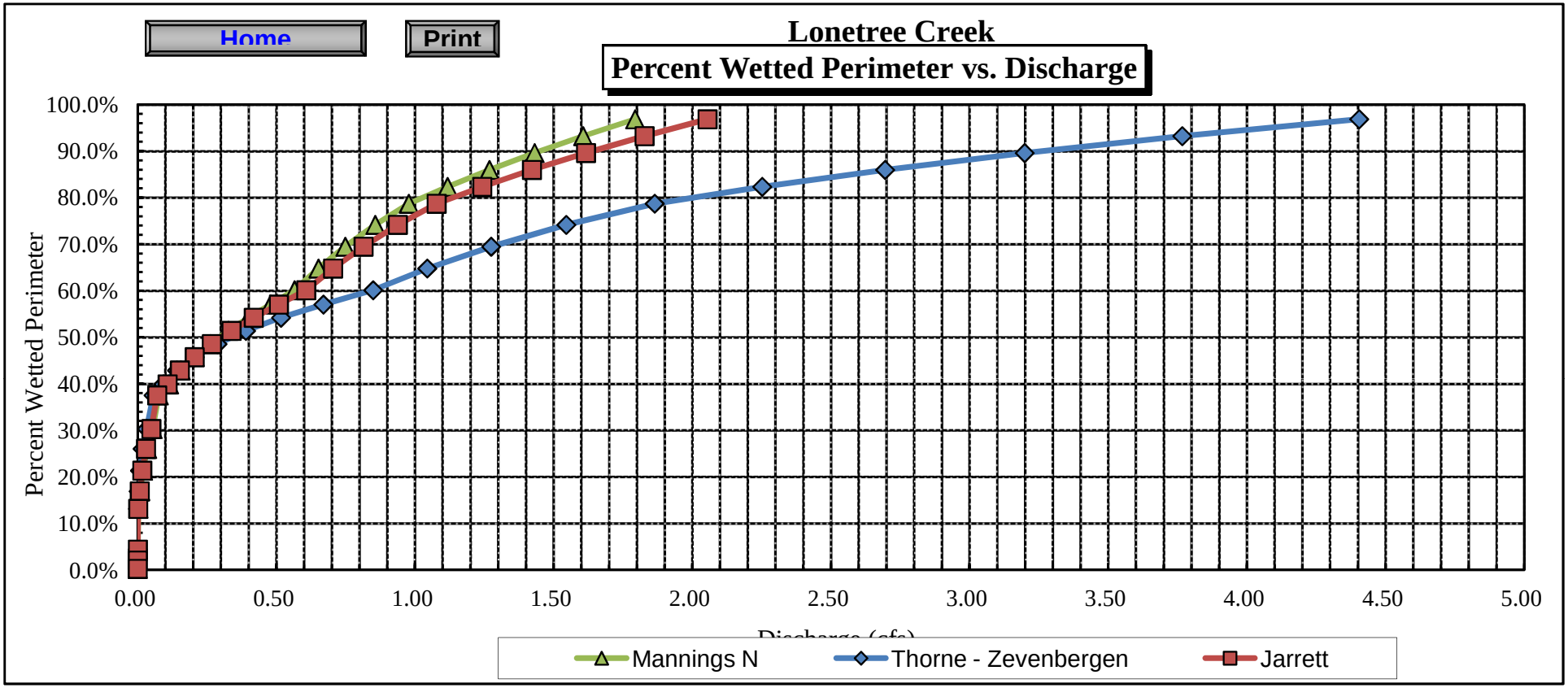
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.85	8.50	0.65	1.30	5.52	9.32	100.0%	0.59	2.27	0.41
	6.89	8.23	0.63	1.26	5.15	9.03	96.9%	0.57	2.05	0.40
	6.94	7.91	0.60	1.21	4.75	8.69	93.2%	0.55	1.83	0.38
	6.99	7.59	0.57	1.16	4.36	8.35	89.6%	0.52	1.62	0.37
	7.04	7.28	0.55	1.11	3.99	8.01	86.0%	0.50	1.42	0.36
	7.09	6.96	0.52	1.06	3.64	7.68	82.3%	0.47	1.24	0.34
	7.14	6.64	0.50	1.01	3.30	7.34	78.7%	0.45	1.08	0.33
	7.19	6.24	0.48	0.96	2.97	6.91	74.2%	0.43	0.94	0.32
	7.24	5.82	0.46	0.91	2.67	6.48	69.5%	0.41	0.81	0.30
	7.29	5.41	0.44	0.86	2.39	6.04	64.8%	0.40	0.70	0.29
	7.34	4.99	0.43	0.81	2.13	5.60	60.1%	0.38	0.61	0.29
	7.39	4.73	0.40	0.76	1.89	5.32	57.0%	0.36	0.51	0.27
	7.44	4.49	0.37	0.71	1.66	5.05	54.2%	0.33	0.42	0.25
	7.49	4.25	0.34	0.66	1.44	4.79	51.4%	0.30	0.34	0.23
	7.54	4.01	0.31	0.61	1.23	4.53	48.5%	0.27	0.27	0.22
WL	7.59	3.77	0.28	0.56	1.04	4.26	45.7%	0.24	0.21	0.20
	7.64	3.53	0.24	0.51	0.86	4.00	42.9%	0.21	0.15	0.18
	7.69	3.27	0.21	0.46	0.69	3.72	39.9%	0.18	0.11	0.16
	7.74	3.07	0.17	0.41	0.53	3.50	37.5%	0.15	0.07	0.13
	7.79	2.45	0.16	0.36	0.40	2.82	30.3%	0.14	0.05	0.12
	7.84	2.11	0.13	0.31	0.28	2.43	26.0%	0.12	0.03	0.11
	7.89	1.73	0.11	0.26	0.19	1.99	21.3%	0.09	0.02	0.09
	7.94	1.38	0.08	0.21	0.11	1.58	16.9%	0.07	0.01	0.07
	7.99	1.09	0.04	0.16	0.05	1.22	13.1%	0.04	0.00	0.04
	8.04	0.33	0.05	0.11	0.02	0.41	4.4%	0.04	0.00	0.04
	8.09	0.15	0.03	0.06	0.00	0.19	2.0%	0.02	0.00	0.03
	8.14	0.02	0.00	0.01	0.00	0.02	0.2%	0.00	0.00	0.00

Home Print

Lonetree Creek

CROSS SECTION DATA ANALYSIS




Home
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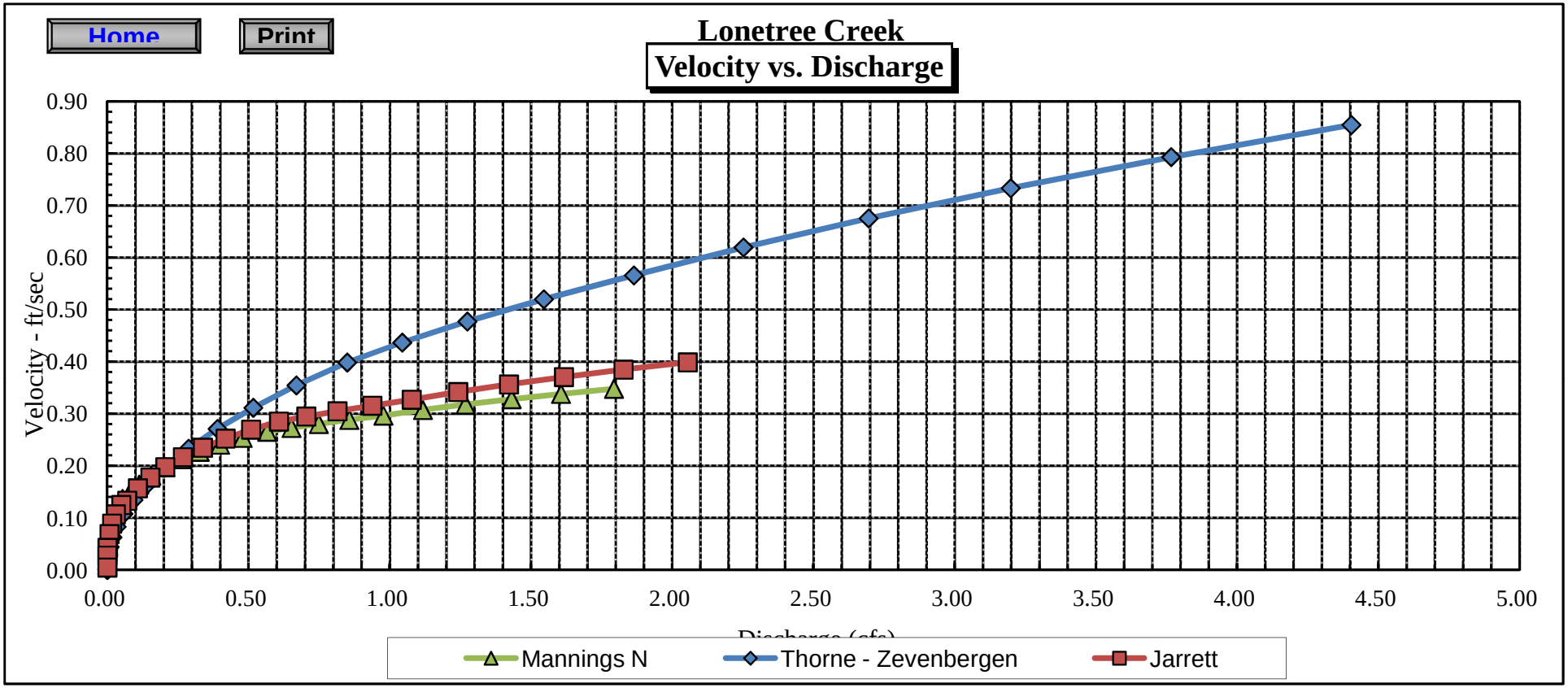
Lonetree Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
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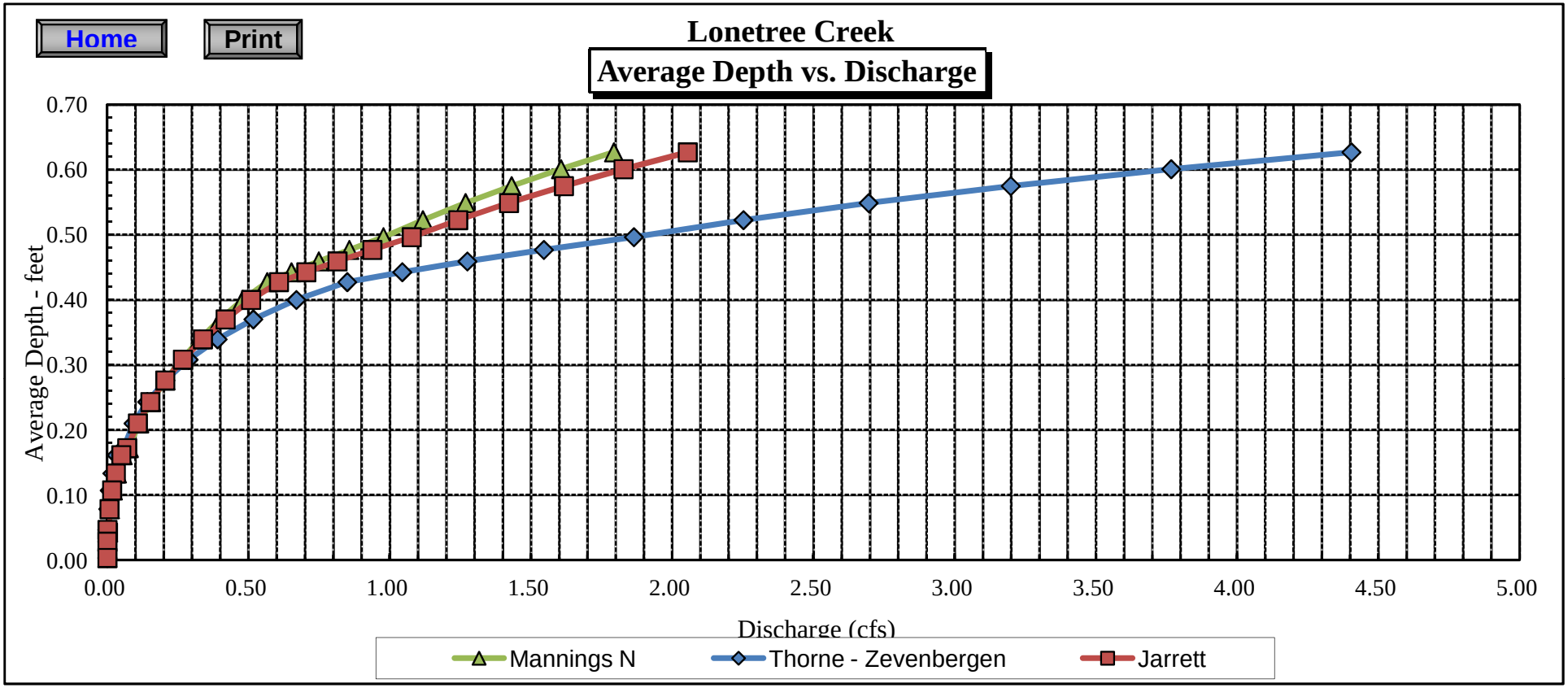
Lonetree Creek
Velocity vs. Discharge
Velocity - ft/sec
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
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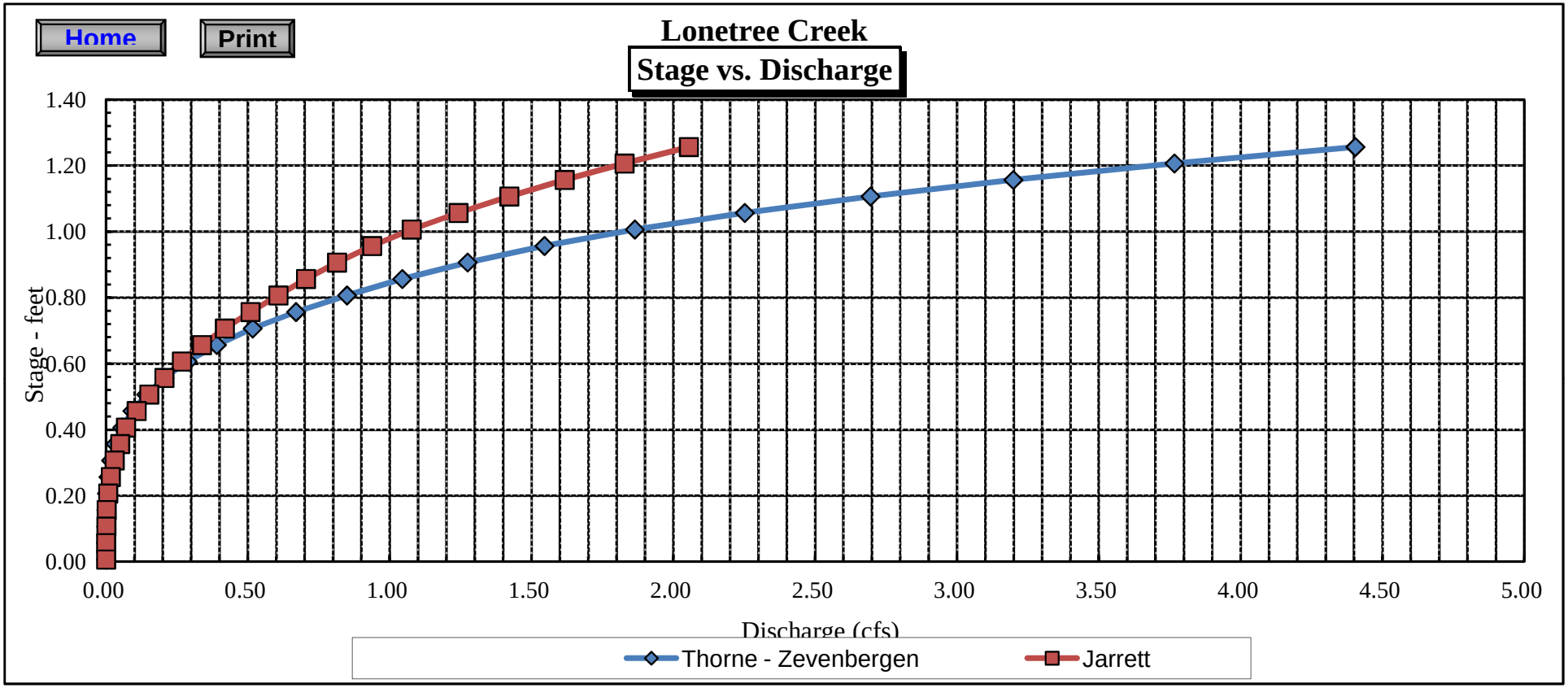
Lonetree Creek
Average Depth vs. Discharge
Average Depth - feet
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Lonetree Creek
Stage vs. Discharge
Stage - feet
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Lonetree Creek
XS LOCATION:	Upper
XS NUMBER:	0
DATE:	6.11.14
OBSERVERS:	0
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

CHANNEL PROFILE DATA

SLOPE:	0.012

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……..…….....DATE.....

STREAM NAME: Lonetree Creek
XS LOCATION: Upper
XS NUMBER: 0

DATA POINTS= 27

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	0.00	6.30			0.00		0.00	0.00	0.0%
1 gl	1.00	6.40			0.00		0.00	0.00	0.0%
	2.30	6.65			0.00		0.00	0.00	0.0%
	3.00	6.90			0.00		0.00	0.00	0.0%
wl	3.50	7.14	0.00	0.00	0.00		0.00	0.00	0.0%
	3.80	7.40	0.20	0.33	0.40	0.20	0.06	0.02	2.3%
	4.10	7.50	0.30	0.33	0.32	0.30	0.09	0.03	3.5%
	4.40	7.60	0.40	0.33	0.32	0.40	0.12	0.04	4.6%
	4.70	7.70	0.50	0.33	0.32	0.50	0.15	0.05	5.8%
	5.00	7.75	0.55	0.33	0.30	0.55	0.17	0.05	6.3%
	5.30	7.90	0.70	0.33	0.34	0.70	0.21	0.07	8.1%
	5.60	7.75	0.55	0.33	0.34	0.55	0.17	0.05	6.3%
	5.90	7.85	0.65	0.33	0.32	0.65	0.20	0.06	7.5%
	6.20	7.90	0.70	0.33	0.30	0.70	0.21	0.07	8.1%
	6.50	7.95	0.75	0.33	0.30	0.75	0.23	0.07	8.6%
	6.80	7.95	0.75	0.33	0.30	0.75	0.23	0.07	8.6%
	7.10	7.85	0.65	0.33	0.32	0.65	0.20	0.06	7.5%
	7.40	7.70	0.50	0.33	0.34	0.50	0.15	0.05	5.8%
	7.70	7.70	0.50	0.33	0.30	0.50	0.15	0.05	5.8%
	8.00	7.60	0.40	0.33	0.32	0.40	0.12	0.04	4.6%
	8.30	7.50	0.30	0.33	0.32	0.30	0.09	0.03	3.5%
	8.60	7.45	0.25	0.33	0.30	0.25	0.09	0.03	3.4%
wl	9.00	7.19	0.00	0.00	0.48		0.00	0.00	0.0%
	10.00	6.95			0.00		0.00	0.00	0.0%
	12.00	6.90			0.00		0.00	0.00	0.0%
	13.40	6.50			0.00		0.00	0.00	0.0%
1 gl	15.00	6.25			0.00		0.00	0.00	0.0%
TOTALS ----------					5.91	0.75 (Max.)	2.61	0.86	100.0%

Manning's n = 0.2859
Hydraulic Radius= 0.44116847

STREAM NAME: Lonetree Creek
XS LOCATION: Upper
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.61	2.79	7.0%
6.92	2.61	4.40	68.6%
6.94	2.61	4.24	62.5%
6.96	2.61	4.09	57.0%
6.98	2.61	3.96	51.8%
7.00	2.61	3.83	46.7%
7.02	2.61	3.69	41.7%
7.04	2.61	3.57	36.7%
7.06	2.61	3.44	31.9%
7.08	2.61	3.32	27.2%
7.10	2.61	3.19	22.5%
7.12	2.61	3.08	18.0%
7.13	2.61	3.02	15.7%
7.14	2.61	2.96	13.5%
7.15	2.61	2.90	11.3%
7.16	2.61	2.85	9.2%
7.17	2.61	2.79	7.0%
7.18	2.61	2.74	4.9%
7.19	2.61	2.68	2.8%
7.20	2.61	2.63	0.7%
7.21	2.61	2.57	-1.4%
7.22	2.61	2.52	-3.4%
7.24	2.61	2.41	-7.5%
7.26	2.61	2.30	-11.6%
7.28	2.61	2.20	-15.6%
7.30	2.61	2.10	-19.6%
7.32	2.61	1.99	-23.5%
7.34	2.61	1.89	-27.4%
7.36	2.61	1.79	-31.3%
7.38	2.61	1.69	-35.1%
7.40	2.61	1.59	-38.9%
7.42	2.61	1.50	-42.6%

WATERLINE AT ZERO
AREA ERROR = 7.198

STREAM NAME: Lonetree Creek
XS LOCATION: Upper
XS NUMBER: 0

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.40	13.04	0.76	1.55	9.90	13.66	100.0%	0.72	4.55	0.46
	6.45	12.48	0.74	1.50	9.29	13.10	95.8%	0.71	4.21	0.45
	6.50	11.90	0.73	1.45	8.68	12.51	91.5%	0.69	3.87	0.45
	6.55	11.46	0.71	1.40	8.09	12.06	88.2%	0.67	3.53	0.44
	6.60	11.02	0.68	1.35	7.53	11.61	85.0%	0.65	3.21	0.43
	6.65	10.59	0.66	1.30	6.99	11.16	81.7%	0.63	2.91	0.42
	6.70	10.27	0.63	1.25	6.47	10.83	79.2%	0.60	2.61	0.40
	6.75	9.96	0.60	1.20	5.96	10.50	76.8%	0.57	2.33	0.39
	6.80	9.64	0.57	1.15	5.47	10.17	74.4%	0.54	2.06	0.38
	6.85	9.33	0.54	1.10	5.00	9.84	72.0%	0.51	1.81	0.36
	6.90	9.01	0.50	1.05	4.54	9.50	69.6%	0.48	1.58	0.35
	6.95	6.96	0.59	1.00	4.14	7.45	54.5%	0.56	1.59	0.39
	7.00	6.59	0.58	0.95	3.80	7.06	51.7%	0.54	1.43	0.38
	7.05	6.28	0.55	0.90	3.48	6.73	49.2%	0.52	1.28	0.37
	7.10	5.97	0.53	0.85	3.17	6.40	46.8%	0.50	1.13	0.36
	7.15	5.66	0.51	0.80	2.88	6.08	44.5%	0.47	1.00	0.35
WL	7.20	5.42	0.48	0.75	2.61	5.81	42.5%	0.45	0.87	0.33
	7.25	5.29	0.44	0.70	2.34	5.64	41.3%	0.42	0.74	0.32
	7.30	5.15	0.40	0.65	2.08	5.47	40.0%	0.38	0.62	0.30
	7.35	5.02	0.36	0.60	1.82	5.30	38.8%	0.34	0.51	0.28
	7.40	4.88	0.32	0.55	1.58	5.13	37.6%	0.31	0.41	0.26
	7.45	4.66	0.29	0.50	1.34	4.89	35.8%	0.27	0.32	0.24
	7.50	4.21	0.26	0.45	1.12	4.43	32.4%	0.25	0.25	0.23
	7.55	3.91	0.23	0.40	0.91	4.11	30.1%	0.22	0.19	0.21
	7.60	3.61	0.20	0.35	0.73	3.79	27.8%	0.19	0.14	0.19
	7.65	3.31	0.17	0.30	0.55	3.48	25.4%	0.16	0.09	0.17
	7.70	3.01	0.13	0.25	0.39	3.16	23.1%	0.12	0.06	0.14
	7.75	2.31	0.12	0.20	0.27	2.45	17.9%	0.11	0.04	0.13
	7.80	1.86	0.09	0.15	0.16	1.96	14.3%	0.08	0.02	0.11
	7.85	1.41	0.06	0.10	0.08	1.46	10.7%	0.06	0.01	0.08
	7.90	0.77	0.04	0.05	0.03	0.78	5.7%	0.04	0.00	0.06
	7.95	0.31	0.00	0.00	0.00	0.32	2.3%	0.00	0.00	0.01

STREAM NAME: Lonetree Creek
XS LOCATION: Upper
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.86	cfs
CALCULATED FLOW (Qc)=	0.87	cfs
(Qm-Qc)/Qm * 100 =	-1.2	%
MEASURED WATERLINE (WLm)=	7.17	ft
CALCULATED WATERLINE (WLc)=	7.20	ft
(WLm-WLc)/WLm * 100 =	-0.5	%
MAX MEASURED DEPTH (Dm)=	0.75	ft
MAX CALCULATED DEPTH (Dc)=	0.75	ft
(Dm-Dc)/Dm * 100	-0.2	%
MEAN VELOCITY=	0.33	ft/sec
MANNING'S N=	0.286	
SLOPE=	0.012	ft/ft
.4 * Qm =	0.3	cfs
2.5 * Qm=	2.2	cfs

RECOMMENDED INSTREAM FLOW:
============================

FLOW (CFS)	PERIOD
___________________	__________________
___________________	__________________
___________________	__________________
___________________	__________________

RATIONALE FOR RECOMMENDATION:
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RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………….....…….....…....……....... DATE:......…....…......……………

CWCB REVIEW BY: ..……………………………....………………………………………………….....................................….............. DATE:.................…………….....

STREAM NAME: Lonetree Creek
XS LOCATION: Upper
XS NUMBER: 0

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

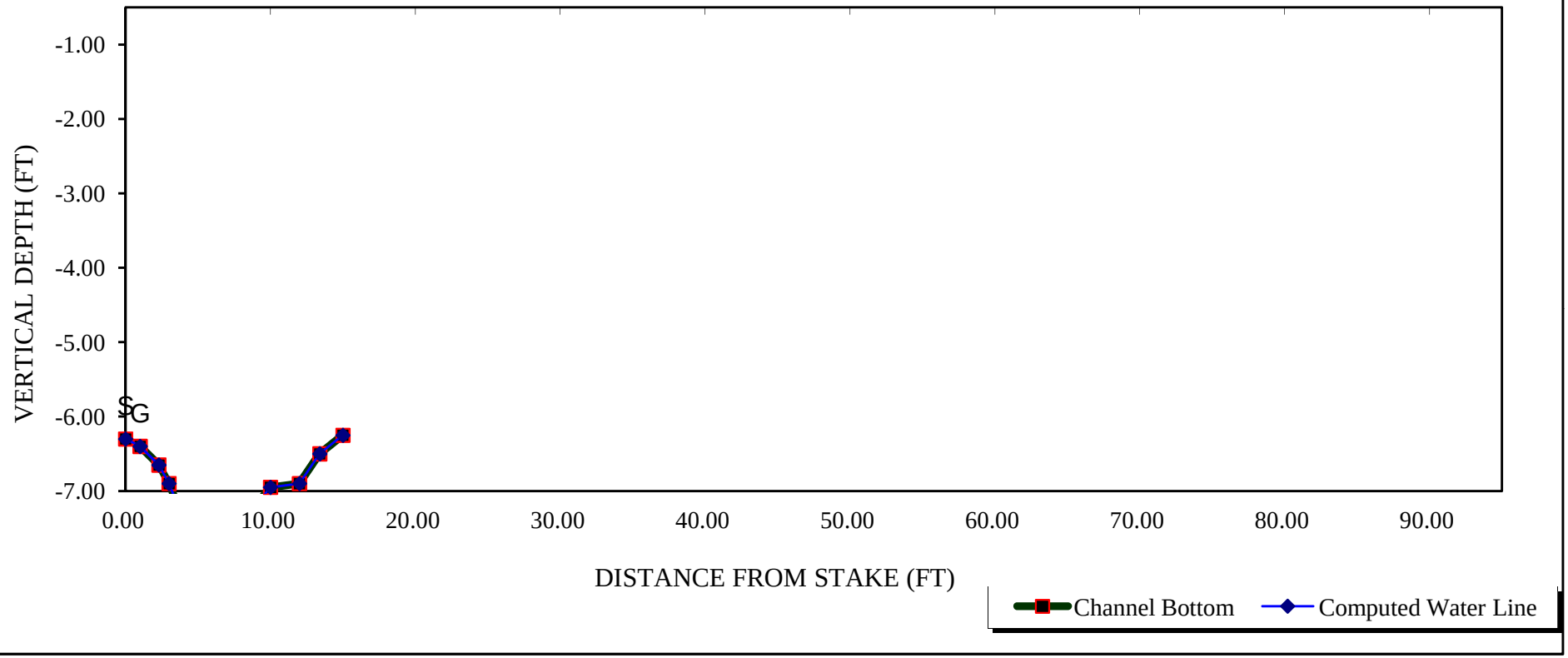
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

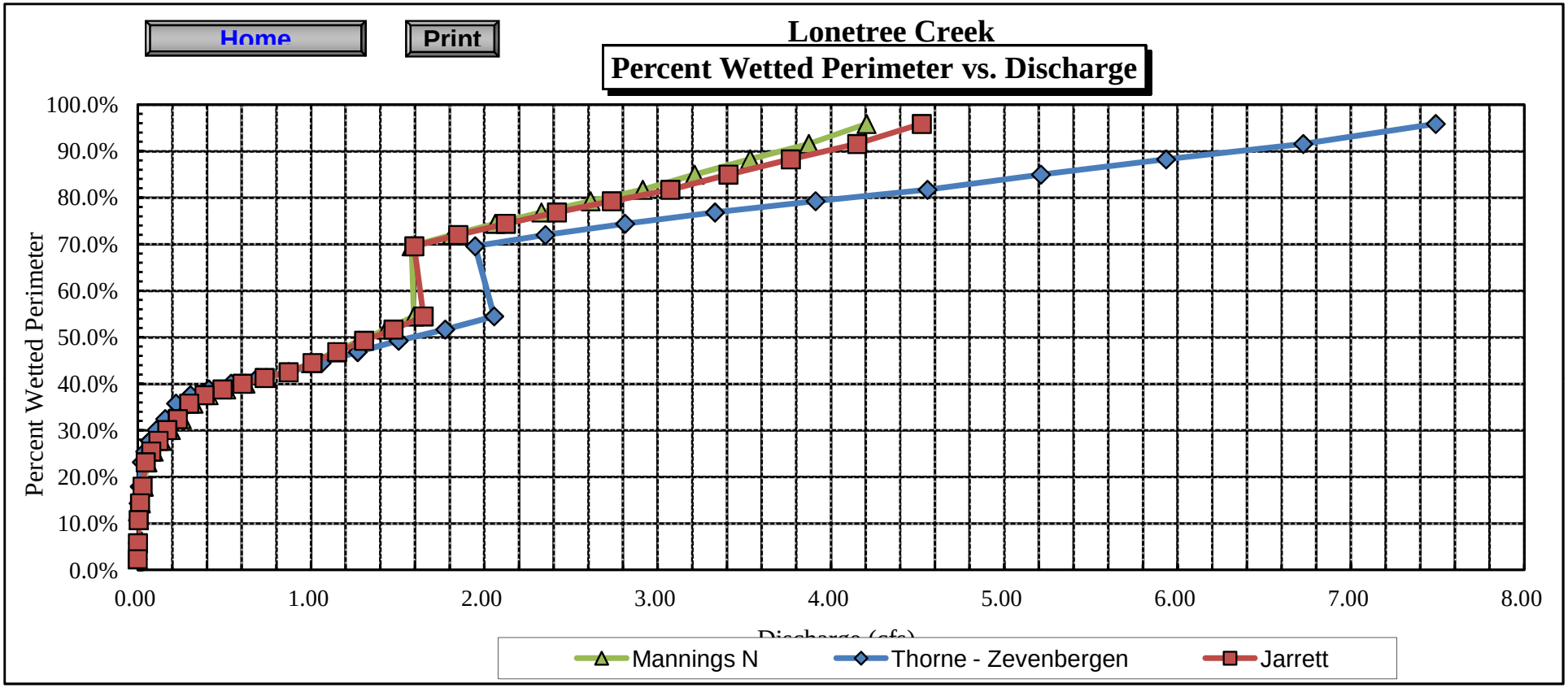
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.40	13.04	0.76	1.55	9.90	13.66	100.0%	0.72	4.91	0.50
	6.45	12.48	0.74	1.50	9.29	13.10	95.8%	0.71	4.52	0.49
	6.50	11.90	0.73	1.45	8.68	12.51	91.5%	0.69	4.15	0.48
	6.55	11.46	0.71	1.40	8.09	12.06	88.2%	0.67	3.77	0.47
	6.60	11.02	0.68	1.35	7.53	11.61	85.0%	0.65	3.41	0.45
	6.65	10.59	0.66	1.30	6.99	11.16	81.7%	0.63	3.07	0.44
	6.70	10.27	0.63	1.25	6.47	10.83	79.2%	0.60	2.74	0.42
	6.75	9.96	0.60	1.20	5.96	10.50	76.8%	0.57	2.42	0.41
	6.80	9.64	0.57	1.15	5.47	10.17	74.4%	0.54	2.12	0.39
	6.85	9.33	0.54	1.10	5.00	9.84	72.0%	0.51	1.85	0.37
	6.90	9.01	0.50	1.05	4.54	9.50	69.6%	0.48	1.60	0.35
	6.95	6.96	0.59	1.00	4.14	7.45	54.5%	0.56	1.65	0.40
	7.00	6.59	0.58	0.95	3.80	7.06	51.7%	0.54	1.48	0.39
	7.05	6.28	0.55	0.90	3.48	6.73	49.2%	0.52	1.31	0.38
	7.10	5.97	0.53	0.85	3.17	6.40	46.8%	0.50	1.15	0.36
	7.15	5.66	0.51	0.80	2.88	6.08	44.5%	0.47	1.01	0.35
WL	7.20	5.42	0.48	0.75	2.61	5.81	42.5%	0.45	0.87	0.33
	7.25	5.29	0.44	0.70	2.34	5.64	41.3%	0.42	0.73	0.31
	7.30	5.15	0.40	0.65	2.08	5.47	40.0%	0.38	0.60	0.29
	7.35	5.02	0.36	0.60	1.82	5.30	38.8%	0.34	0.49	0.27
	7.40	4.88	0.32	0.55	1.58	5.13	37.6%	0.31	0.38	0.24
	7.45	4.66	0.29	0.50	1.34	4.89	35.8%	0.27	0.30	0.22
	7.50	4.21	0.26	0.45	1.12	4.43	32.4%	0.25	0.23	0.21
	7.55	3.91	0.23	0.40	0.91	4.11	30.1%	0.22	0.17	0.19
	7.60	3.61	0.20	0.35	0.73	3.79	27.8%	0.19	0.12	0.16
	7.65	3.31	0.17	0.30	0.55	3.48	25.4%	0.16	0.08	0.14
	7.70	3.01	0.13	0.25	0.39	3.16	23.1%	0.12	0.05	0.12
	7.75	2.31	0.12	0.20	0.27	2.45	17.9%	0.11	0.03	0.10
	7.80	1.86	0.09	0.15	0.16	1.96	14.3%	0.08	0.01	0.08
	7.85	1.41	0.06	0.10	0.08	1.46	10.7%	0.06	0.00	0.06
	7.90	0.77	0.04	0.05	0.03	0.78	5.7%	0.04	0.00	0.04
	7.95	0.31	0.00	0.00	0.00	0.32	2.3%	0.00	0.00	0.00

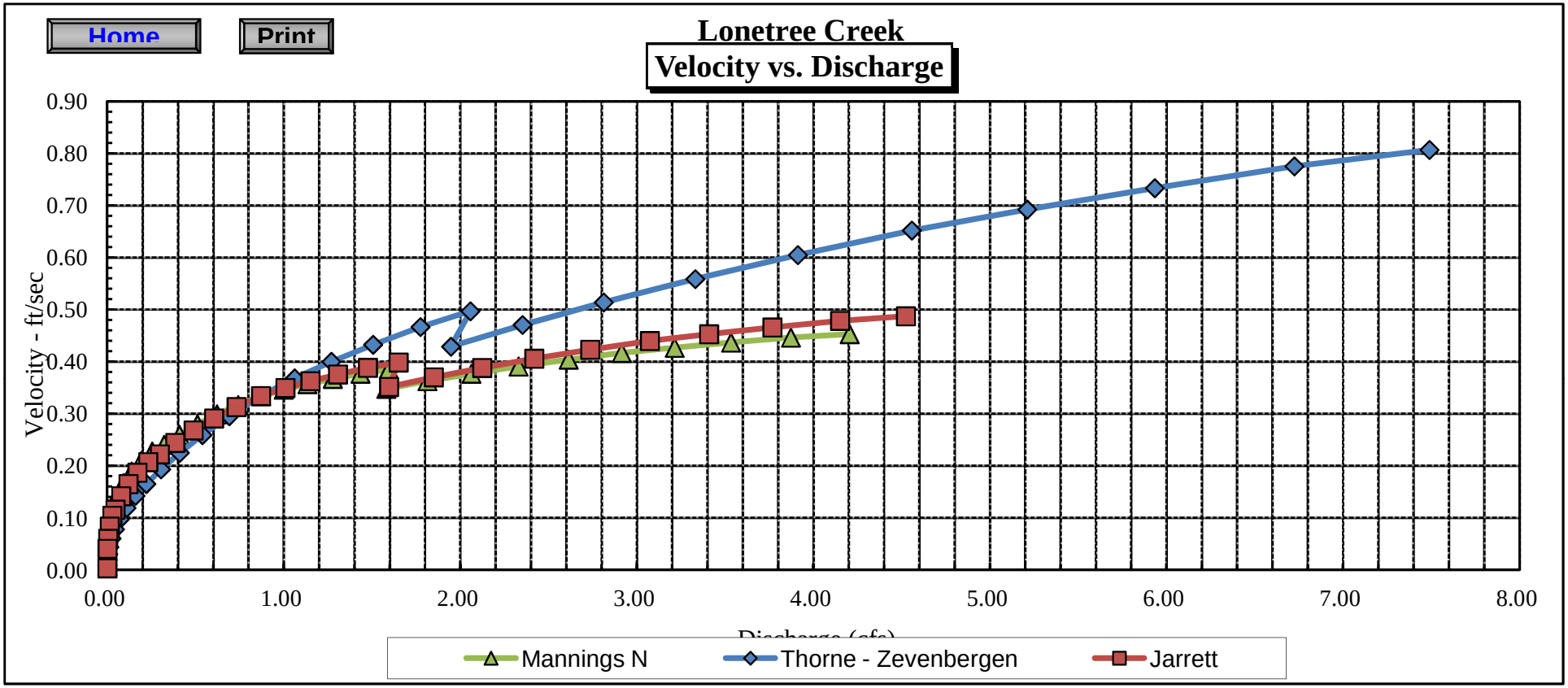
Home Print

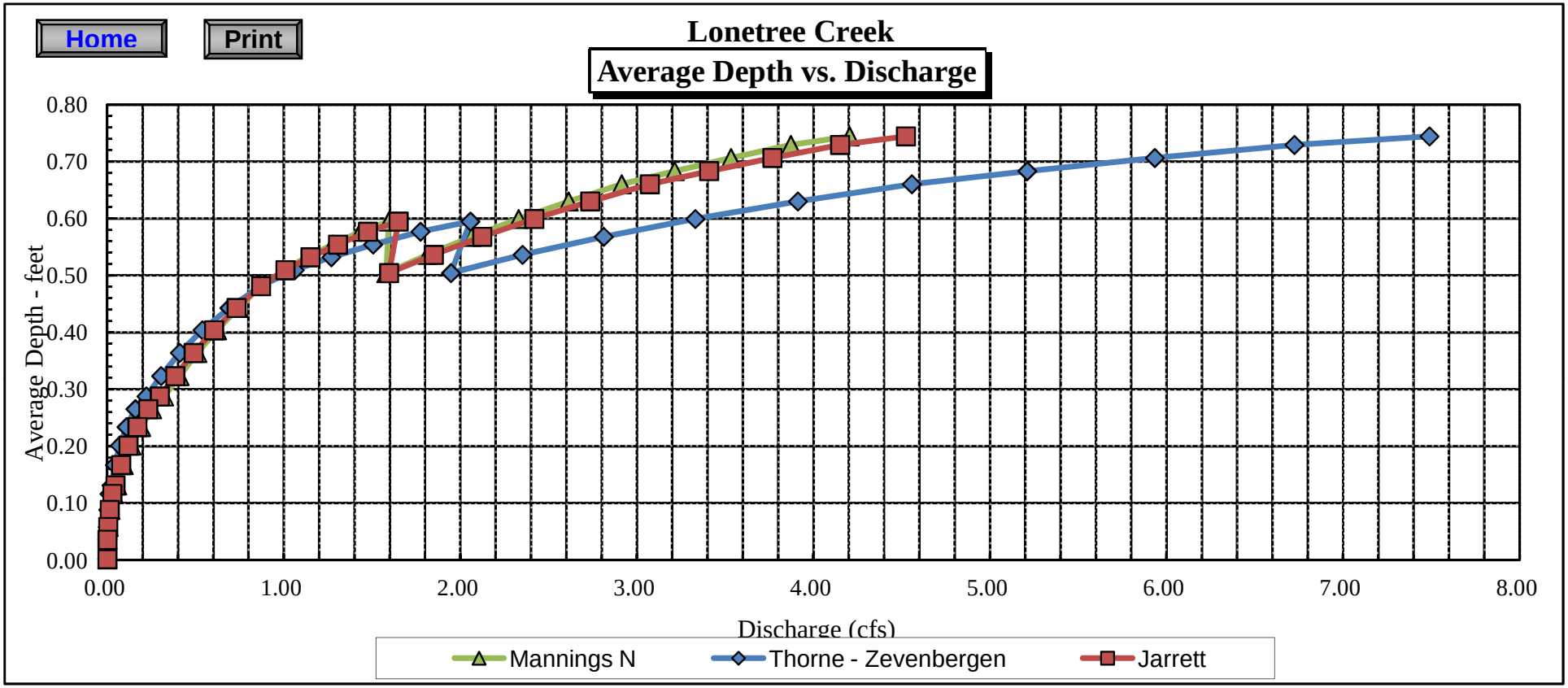
Lonetree Creek

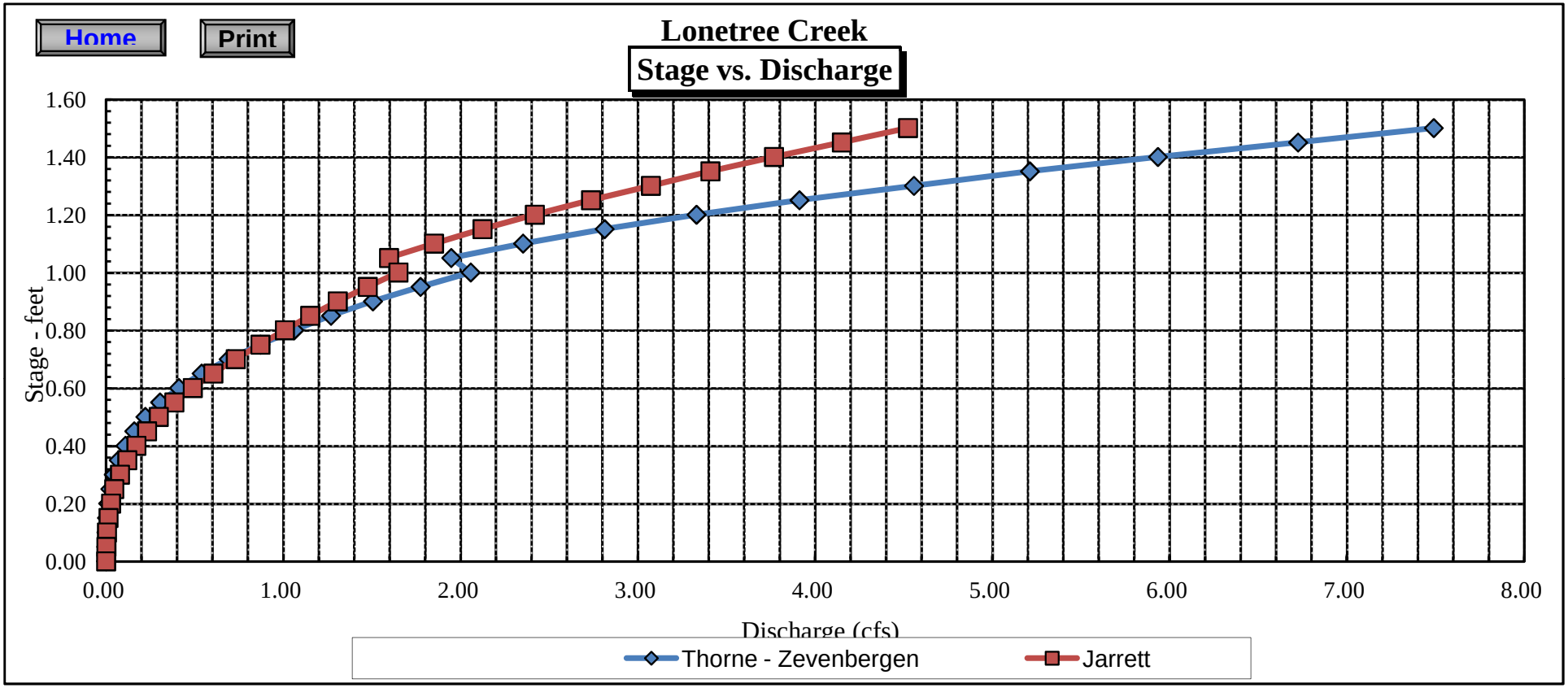
CROSS SECTION DATA ANALYSIS




Home
Print
Lonetree Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Lonetree Creek
Velocity vs. Discharge
Velocity - ft/sec
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Lonetree Creek
Average Depth vs. Discharge
Average Depth - feet
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Lonetree Creek
Stage vs. Discharge
Stage - feet
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information

File Name	LTCABFLM.004.WAD
Start Date and Time	2015/07/23 13:01:03

Site Details

Site Name	LONE TREE CR AT GAGE
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
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	0.2%	1.2%
Velocity	0.4%	1.5%
Width	0.1%	0.1%
Method	1.2%	-
# Stations	1.2%	-
Overall	**2.1%**	**2.2%**

Summary

Averaging Int.	40	# Stations	44
Start Edge	REW	Total Width	9.100
Mean SNR	26.2 dB	Total Area	5.222
Mean Temp	65.98 °F	Mean Depth	0.574
Disch. Equation	Mid-Section	Mean Velocity	0.3820
		Total Discharge	**1.9945**

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information

File Name	LTCABFLM.004.WAD
Start Date and Time	2015/07/23 13:01:03

Site Details

Site Name	LONE TREE CR AT GAGE
Operator(s)	BRIAN EPSTEIN

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:01	5.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:01	5.60	0.6	0.400	0.6	0.160	0.3606	1.00	0.3606	0.100	0.0361	1.8
2	13:02	5.80	0.6	0.600	0.6	0.240	0.3281	1.00	0.3281	0.120	0.0393	2.0
3	13:03	6.00	0.6	0.670	0.6	0.268	0.2992	1.00	0.2992	0.134	0.0401	2.0
4	13:06	6.20	0.6	0.700	0.6	0.280	0.3556	1.00	0.3556	0.140	0.0498	2.5
5	13:07	6.40	0.6	0.720	0.6	0.288	0.2608	1.00	0.2608	0.144	0.0375	1.9
6	13:08	6.60	0.6	0.720	0.6	0.288	0.3550	1.00	0.3550	0.144	0.0511	2.6
7	13:09	6.80	0.6	0.480	0.6	0.192	0.4675	1.00	0.4675	0.096	0.0448	2.2
8	13:10	7.00	0.6	0.450	0.6	0.180	0.4682	1.00	0.4682	0.090	0.0421	2.1
9	13:11	7.20	0.6	0.450	0.6	0.180	0.4531	1.00	0.4531	0.090	0.0407	2.0
10	13:12	7.40	0.6	0.410	0.6	0.164	0.4275	1.00	0.4275	0.082	0.0350	1.8
11	13:13	7.60	0.6	0.410	0.6	0.164	0.4485	1.00	0.4485	0.082	0.0367	1.8
12	13:18	7.80	0.6	0.430	0.6	0.172	0.4715	1.00	0.4715	0.086	0.0405	2.0
13	13:19	8.00	0.6	0.730	0.6	0.292	0.4547	1.00	0.4547	0.146	0.0663	3.3
14	13:20	8.20	0.6	0.720	0.6	0.288	0.4649	1.00	0.4649	0.144	0.0669	3.4
15	13:21	8.40	0.6	0.700	0.6	0.280	0.4780	1.00	0.4780	0.140	0.0669	3.4
16	13:22	8.60	0.6	0.690	0.6	0.276	0.4793	1.00	0.4793	0.138	0.0661	3.3
17	13:24	8.80	0.6	0.760	0.6	0.304	0.4416	1.00	0.4416	0.152	0.0670	3.4
18	13:25	9.00	0.6	0.750	0.6	0.300	0.4295	1.00	0.4295	0.150	0.0644	3.2
19	13:26	9.20	0.6	0.700	0.6	0.280	0.3123	1.00	0.3123	0.140	0.0437	2.2
20	13:27	9.40	0.6	0.730	0.6	0.292	0.3209	1.00	0.3209	0.146	0.0468	2.3
21	13:28	9.60	0.6	0.540	0.6	0.216	0.3940	1.00	0.3940	0.108	0.0425	2.1
22	13:29	9.80	0.6	0.530	0.6	0.212	0.3661	1.00	0.3661	0.106	0.0388	1.9
23	13:30	10.00	0.6	0.750	0.6	0.300	0.2133	1.00	0.2133	0.150	0.0320	1.6
24	13:31	10.20	0.6	0.790	0.6	0.316	0.2700	1.00	0.2700	0.158	0.0426	2.1
25	13:33	10.40	0.6	0.800	0.6	0.320	0.4009	1.00	0.4009	0.160	0.0641	3.2
26	13:34	10.60	0.6	0.750	0.6	0.300	0.4249	1.00	0.4249	0.152	0.0645	3.2
27	13:35	10.80	0.6	0.810	0.6	0.324	0.4252	1.00	0.4252	0.164	0.0697	3.5
28	13:37	11.00	0.6	0.780	0.6	0.312	0.3973	1.00	0.3973	0.156	0.0620	3.1
29	13:38	11.20	0.6	0.750	0.6	0.300	0.3904	1.00	0.3904	0.150	0.0586	2.9
30	13:39	11.40	0.6	0.770	0.6	0.308	0.4075	1.00	0.4075	0.154	0.0628	3.1
31	13:40	11.60	0.6	0.720	0.6	0.288	0.4514	1.00	0.4514	0.144	0.0651	3.3
32	13:41	11.80	0.6	0.700	0.6	0.280	0.4478	1.00	0.4478	0.140	0.0627	3.1
33	13:42	12.00	0.6	0.700	0.6	0.280	0.3927	1.00	0.3927	0.140	0.0550	2.8
34	13:43	12.20	0.6	0.680	0.6	0.272	0.3944	1.00	0.3944	0.136	0.0537	2.7
35	13:44	12.40	0.6	0.600	0.6	0.240	0.4167	1.00	0.4167	0.120	0.0500	2.5
36	13:45	12.60	0.6	0.600	0.6	0.240	0.3930	1.00	0.3930	0.120	0.0472	2.4
37	13:46	12.80	0.6	0.600	0.6	0.240	0.3182	1.00	0.3182	0.120	0.0382	1.9
38	13:47	13.00	0.6	0.510	0.6	0.204	0.2441	1.00	0.2441	0.102	0.0249	1.2
39	*13:48*	*13.20*	*0.6*	*0.430*	*0.6*	*0.172*	*-0.3661*	*-1.00*	*0.3661*	*0.086*	*0.0315*	*1.6*
40	*13:51*	*13.40*	*0.6*	*0.370*	*0.6*	*0.148*	*-0.2746*	*-1.00*	*0.2746*	*0.074*	*0.0203*	*1.0*
41	*13:52*	*13.60*	*0.6*	*0.300*	*0.6*	*0.120*	*-0.2208*	*-1.00*	*0.2208*	*0.060*	*0.0133*	*0.7*
42	13:52	13.80	None	0.150	0.0	0.0	0.0000	1.00	0.2208	0.060	0.0132	0.7
43	13:52	14.40	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.

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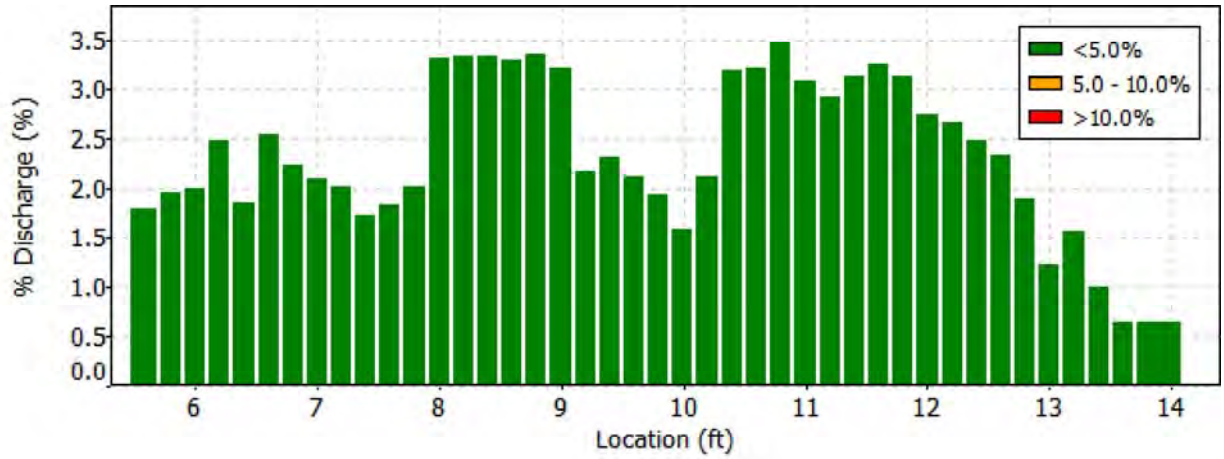
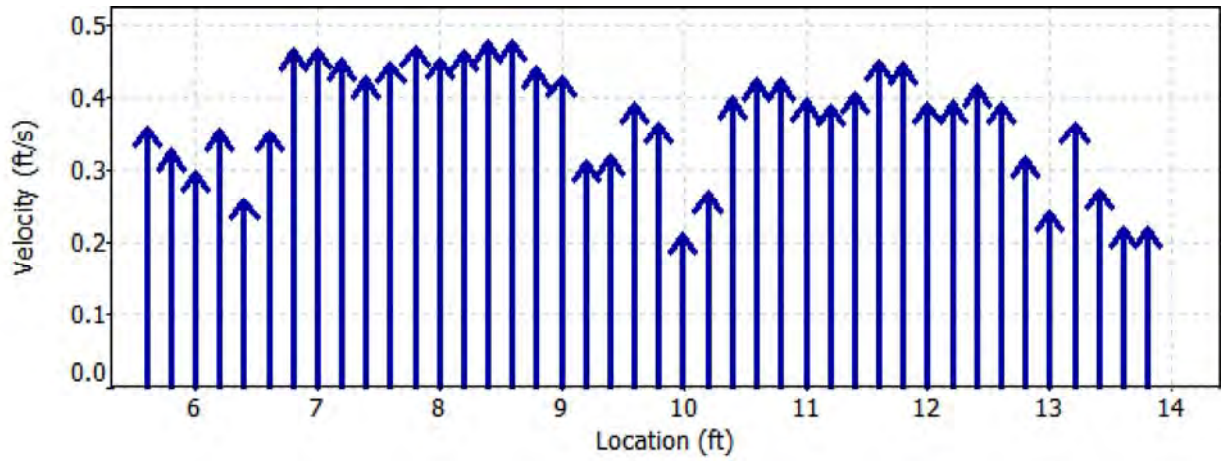
Colorado Water Conservation Board
Department of Natural Resources

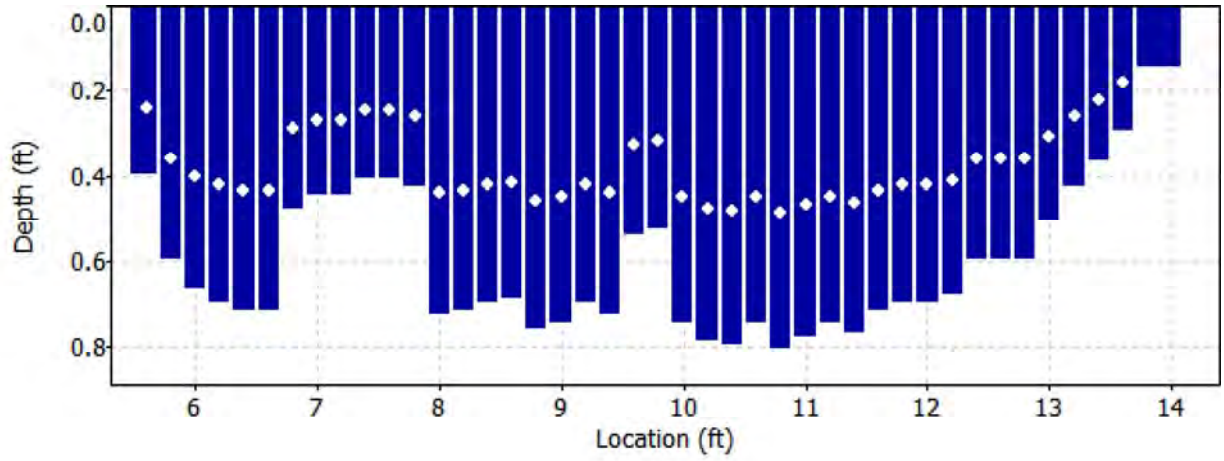
Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information		Site Details	
File Name	LTCABFLM.004.WAD	Site Name	LONE TREE CR AT GAGE
Start Date and Time	2015/07/23 13:01:03	Operator(s)	BRIAN EPSTEIN







COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information

File Name	LTCABFLM.004.WAD
Start Date and Time	2015/07/23 13:01:03

Site Details

Site Name	LONE TREE CR AT GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
39	13.20	0.6	High angle: -177
40	13.40	0.6	High angle: -174
41	13.60	0.6	High angle: -178

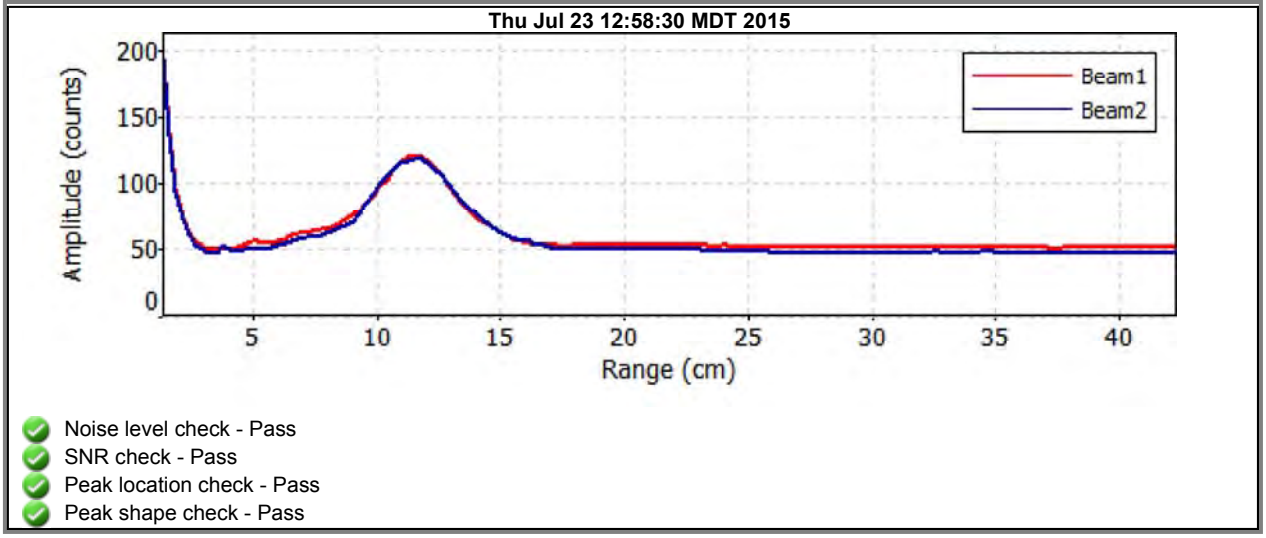
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information		Site Details	
File Name	LTCABFLM.004.WAD	Site Name	LONE TREE CR AT GAGE
Start Date and Time	2015/07/23 13:01:03	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



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

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information

File Name	LTCABFLM.003.WAD
Start Date and Time	2015/07/14 12:41:24

Site Details

Site Name	LONE TREE CR AB FLM
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
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	0.3%	2.5%
Velocity	0.4%	2.0%
Width	0.1%	0.1%
Method	1.4%	-
# Stations	1.7%	-
Overall	**2.5%**	**3.4%**

Summary

Averaging Int.	40	# Stations	31
Start Edge	REW	Total Width	9.200
Mean SNR	24.4 dB	Total Area	5.161
Mean Temp	67.31 °F	Mean Depth	0.561
Disch. Equation	Mid-Section	Mean Velocity	0.6057
		Total Discharge	**3.1265**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:41	5.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:34	5.60	0.6	0.590	0.6	0.236	0.5374	1.00	0.5374	0.147	0.0793	2.5
2	12:41	5.80	0.6	0.690	0.6	0.276	0.5394	1.00	0.5394	0.138	0.0744	2.4
3	13:36	6.00	0.6	0.710	0.6	0.284	0.5295	1.00	0.5295	0.177	0.0940	3.0
4	12:42	6.30	0.6	0.640	0.6	0.256	0.6073	1.00	0.6073	0.160	0.0972	3.1
5	13:39	6.50	0.6	0.630	0.6	0.252	0.6142	1.00	0.6142	0.157	0.0967	3.1
6	12:44	6.80	0.6	0.450	0.6	0.180	0.7280	1.00	0.7280	0.135	0.0983	3.1
7	13:41	7.10	0.6	0.440	0.6	0.176	0.7060	1.00	0.7060	0.110	0.0777	2.5
8	12:48	7.30	0.6	0.560	0.6	0.224	0.6611	1.00	0.6611	0.196	0.1295	4.1
9	12:49	7.80	0.6	0.510	0.6	0.204	0.5981	1.00	0.5981	0.204	0.1220	3.9
10	13:43	8.10	0.6	0.570	0.6	0.228	0.6673	1.00	0.6673	0.142	0.0951	3.0
11	12:50	8.30	0.6	0.810	0.6	0.324	0.6424	1.00	0.6424	0.203	0.1301	4.2
12	12:52	8.60	0.6	0.800	0.6	0.320	0.6273	1.00	0.6273	0.240	0.1506	4.8
13	12:54	8.90	0.6	0.720	0.6	0.288	0.6788	1.00	0.6788	0.216	0.1467	4.7
14	12:55	9.20	0.6	0.600	0.6	0.240	0.6670	1.00	0.6670	0.180	0.1202	3.8
15	12:56	9.50	0.6	0.590	0.6	0.236	0.6850	1.00	0.6850	0.177	0.1213	3.9
16	13:00	9.80	0.6	0.660	0.6	0.264	0.4859	1.00	0.4859	0.198	0.0963	3.1
17	13:01	10.10	0.6	0.730	0.6	0.292	0.5203	1.00	0.5203	0.219	0.1140	3.6
18	13:04	10.40	0.6	0.520	0.6	0.208	0.6480	1.00	0.6480	0.156	0.1012	3.2
19	13:05	10.70	0.6	0.380	0.6	0.152	0.6270	1.00	0.6270	0.114	0.0715	2.3
20	13:07	11.00	0.6	0.340	0.6	0.136	0.6532	1.00	0.6532	0.102	0.0667	2.1
21	13:09	11.30	0.6	0.800	0.6	0.320	0.6148	1.00	0.6148	0.240	0.1476	4.7
22	13:10	11.60	0.6	0.780	0.6	0.312	0.6680	1.00	0.6680	0.234	0.1564	5.0
23	13:12	11.90	0.6	0.660	0.6	0.264	0.6932	1.00	0.6932	0.198	0.1374	4.4
24	13:14	12.20	0.6	0.650	0.6	0.260	0.6631	1.00	0.6631	0.195	0.1294	4.1
25	13:15	12.50	0.6	0.700	0.6	0.280	0.6096	1.00	0.6096	0.210	0.1281	4.1
26	13:17	12.80	0.6	0.670	0.6	0.268	0.6056	1.00	0.6056	0.201	0.1218	3.9
27	13:21	13.10	0.6	0.700	0.6	0.280	0.4619	1.00	0.4619	0.210	0.0971	3.1
28	*13:23*	*13.40*	*0.6*	*0.420*	*0.6*	*0.168*	*-0.6322*	*-1.00*	*0.6322*	*0.167*	*0.1058*	*3.4*
29	13:30	13.90	0.6	0.240	0.6	0.096	0.1535	1.00	0.1535	0.132	0.0202	0.6
30	13:30	14.50	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.

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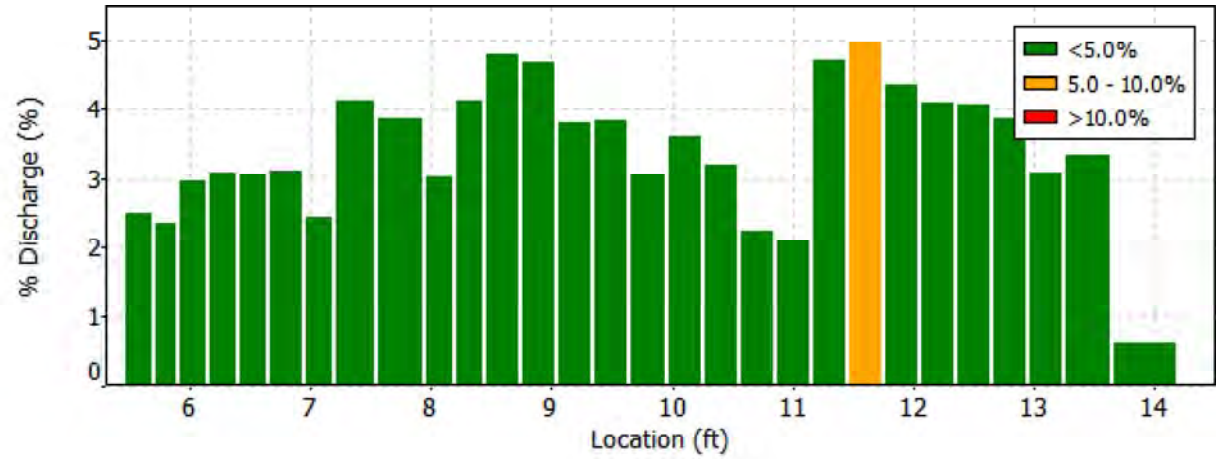
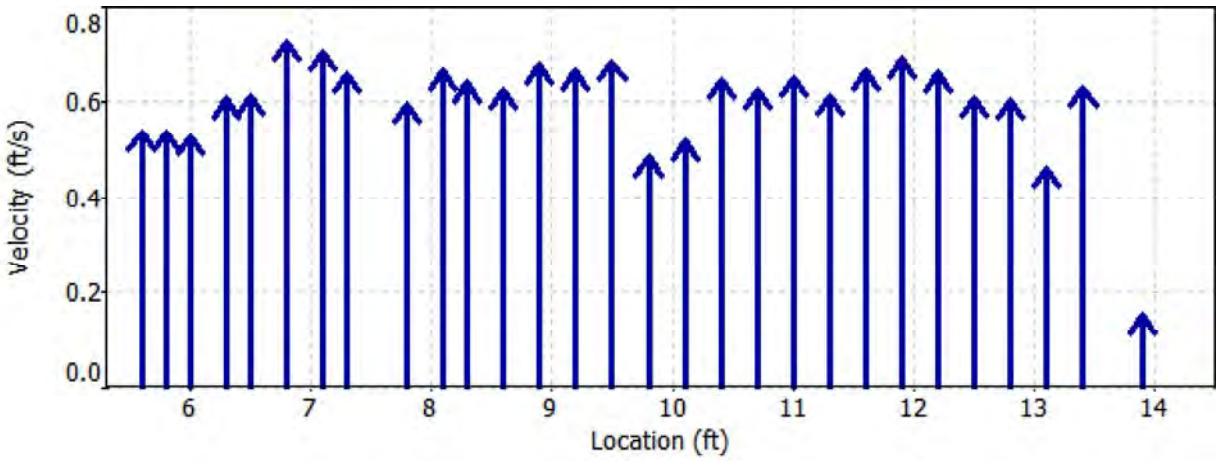
Colorado Water Conservation Board
Department of Natural Resources

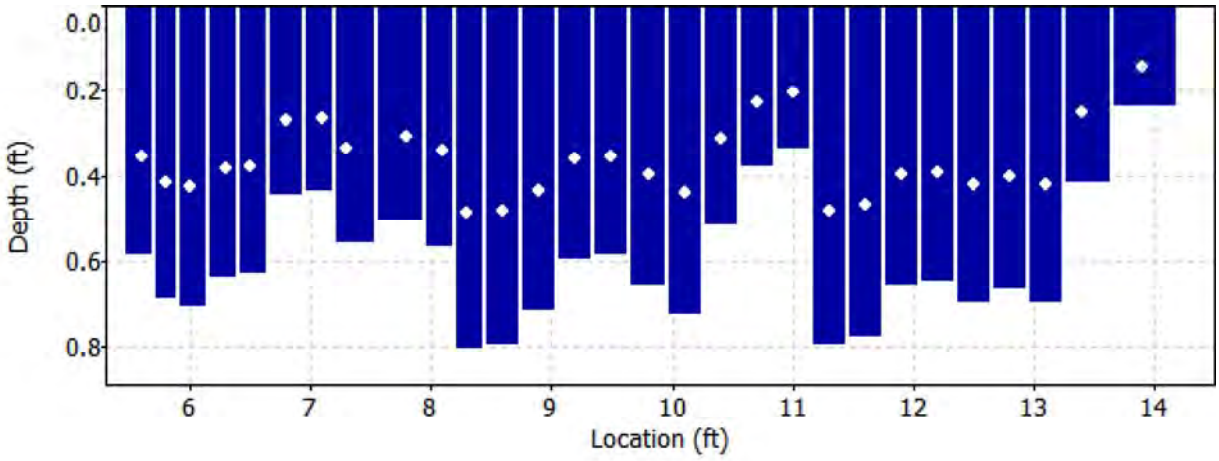
Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCABFLM.003.WAD	Site Name	LONE TREE CR AB FLM
Start Date and Time	2015/07/14 12:41:24	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information

File Name	LTCABFLM.003.WAD
Start Date and Time	2015/07/14 12:41:24

Site Details

Site Name	LONE TREE CR AB FLM
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
28	13.40	0.6	High angle: 179

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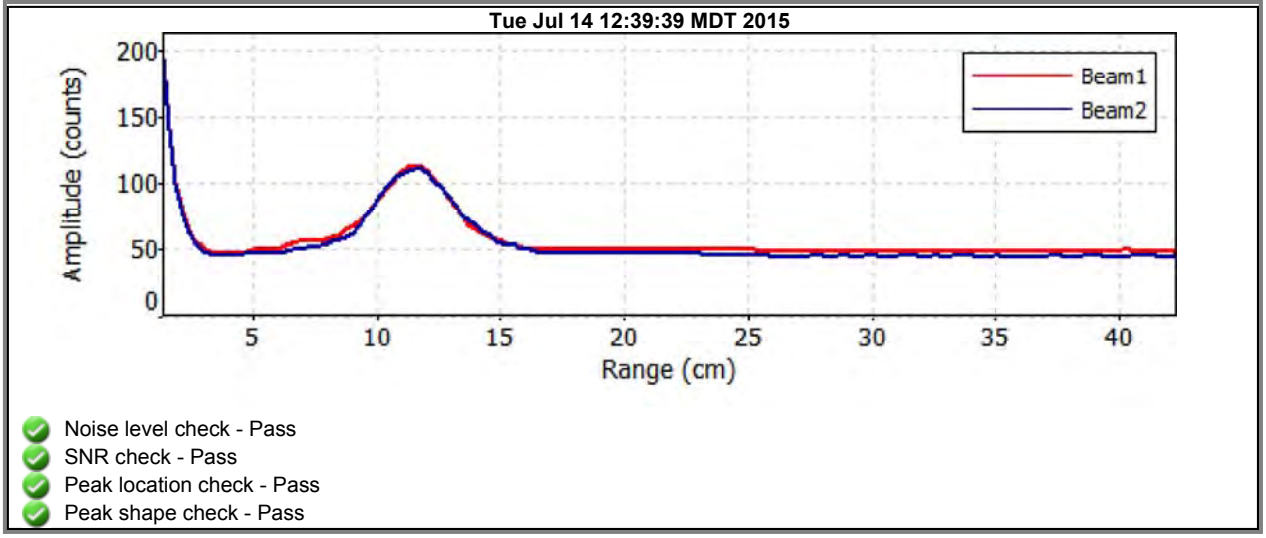
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCABFLM.003.WAD	Site Name	LONE TREE CR AB FLM
Start Date and Time	2015/07/14 12:41:24	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



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

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information

File Name	LTCABFLM.002.WAD
Start Date and Time	2015/06/17 12:58:20

Site Details

Site Name	LONE TREE CR AB FLM
Operator(s)	GRAYS CR BLW OHV DIV

System Information

Sensor Type	FlowTracker
Serial #	P2354
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	0.4%	1.7%
Velocity	0.7%	5.6%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.5%	-
Overall	**3.4%**	**5.9%**

Summary

Averaging Int.	40	# Stations	20
Start Edge	REW	Total Width	11.050
Mean SNR	23.6 dB	Total Area	8.043
Mean Temp	66.49 °F	Mean Depth	0.728
Disch. Equation	Mid-Section	Mean Velocity	1.3153
		Total Discharge	**10.5792**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:58	15.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	12:58	17.00	0.6	0.540	0.6	0.216	1.3323	1.00	1.3323	0.486	0.6475	6.1
2	12:59	17.50	0.6	0.950	0.6	0.380	1.2710	1.00	1.2710	0.475	0.6038	5.7
3	13:01	18.00	0.6	1.000	0.6	0.400	1.2352	1.00	1.2352	0.500	0.6176	5.8
4	13:02	18.50	0.6	1.000	0.6	0.400	1.6585	1.00	1.6585	0.500	0.8292	7.8
5	13:03	19.00	0.6	0.900	0.6	0.360	1.5407	1.00	1.5407	0.450	0.6933	6.6
6	13:04	19.50	0.6	0.850	0.6	0.340	1.5305	1.00	1.5305	0.510	0.7807	7.4
7	13:06	20.20	0.6	0.800	0.6	0.320	1.4042	1.00	1.4042	0.600	0.8424	8.0
8	13:07	21.00	0.6	0.900	0.6	0.360	1.7037	1.00	1.7037	0.585	0.9965	9.4
9	13:08	21.50	0.6	0.900	0.6	0.360	1.7405	1.00	1.7405	0.450	0.7832	7.4
10	*13:09*	*22.00*	*0.6*	*0.950*	*0.6*	*0.380*	*0.9393*	*1.00*	*0.9393*	*0.475*	*0.4462*	*4.2*
11	13:10	22.50	0.6	0.850	0.6	0.340	1.6926	1.00	1.6926	0.425	0.7194	6.8
12	13:12	23.00	0.6	0.900	0.6	0.360	1.5745	1.00	1.5745	0.450	0.7085	6.7
13	13:13	23.50	0.6	0.800	0.6	0.320	1.4557	1.00	1.4557	0.400	0.5822	5.5
14	13:14	24.00	0.6	0.800	0.6	0.320	1.3166	1.00	1.3166	0.400	0.5266	5.0
15	*13:15*	*24.50*	*0.6*	*0.850*	*0.6*	*0.340*	*1.4291*	*1.00*	*1.4291*	*0.425*	*0.6074*	*5.7*
16	13:17	25.00	0.6	0.700	0.6	0.280	0.1447	1.00	0.1447	0.350	0.0506	0.5
17	13:18	25.50	0.6	0.600	0.6	0.240	0.3540	1.00	0.3540	0.300	0.1062	1.0
18	*13:19*	*26.00*	*0.6*	*0.420*	*0.6*	*0.168*	*0.1444*	*1.00*	*0.1444*	*0.262*	*0.0379*	*0.4*
19	13:19	26.75	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

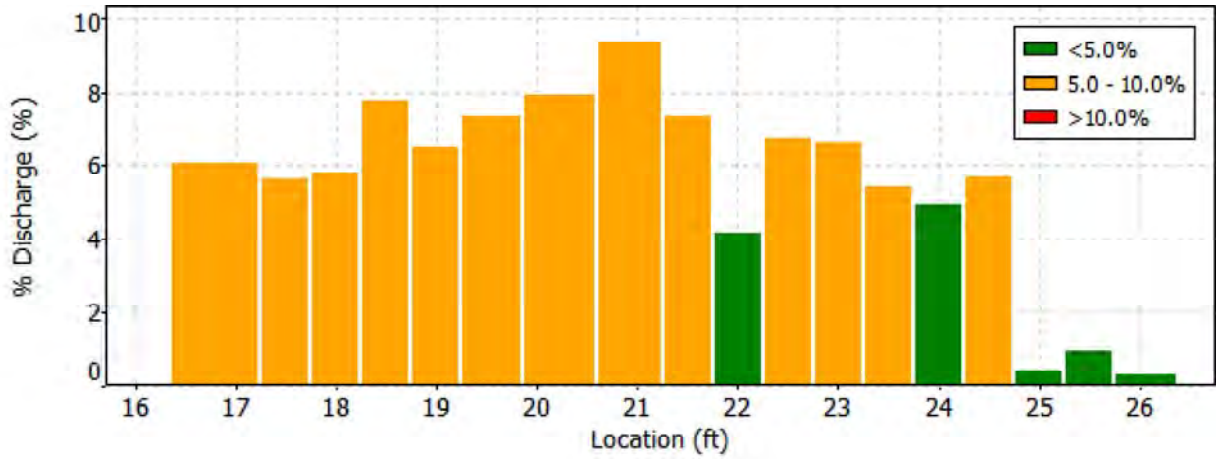
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

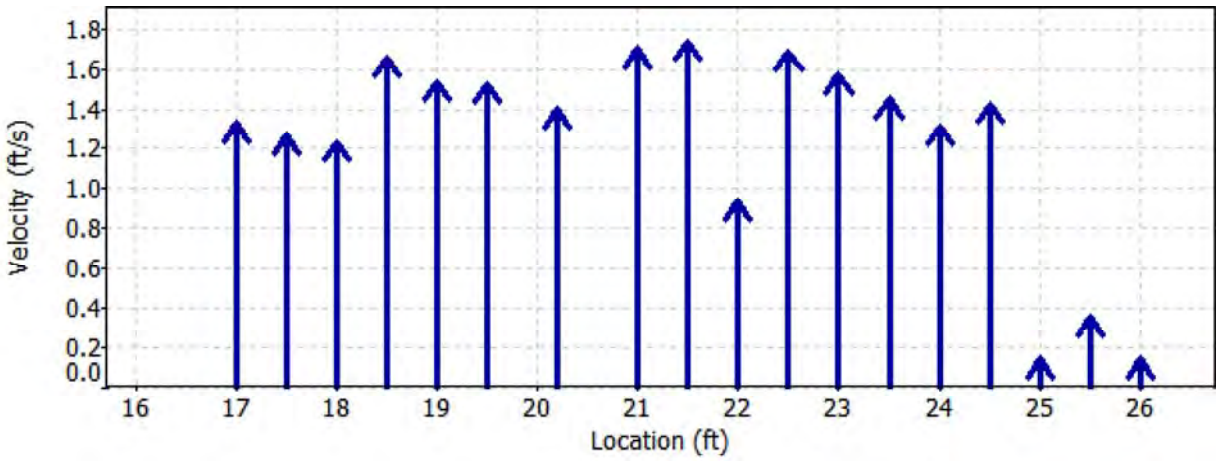
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

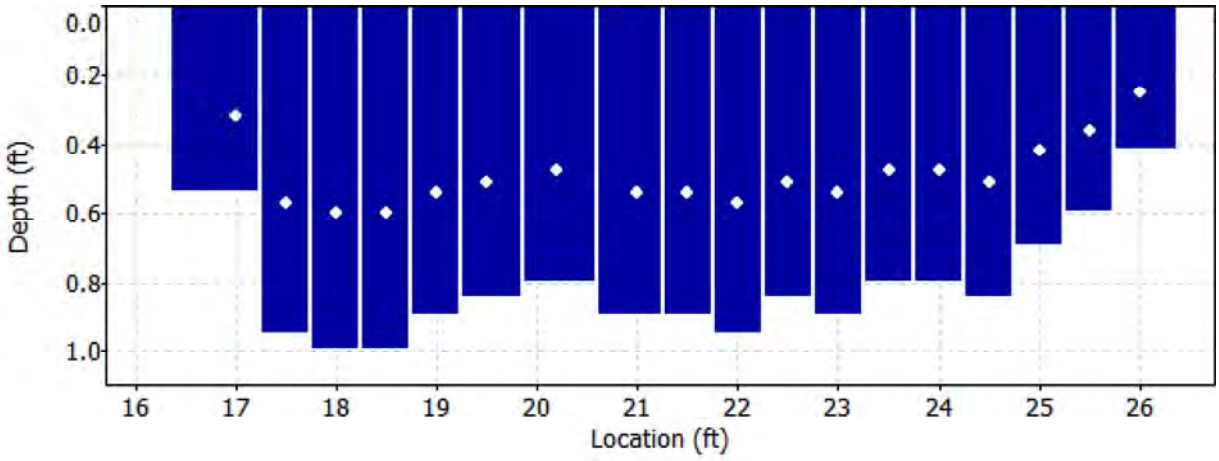
Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCABFLM.002.WAD	Site Name	LONE TREE CR AB FLM
Start Date and Time	2015/06/17 12:58:20	Operator(s)	GRAYS CR BLW OHV DIV







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Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information

File Name	LTCABFLM.002.WAD
Start Date and Time	2015/06/17 12:58:20

Site Details

Site Name	LONE TREE CR AB FLM
Operator(s)	GRAYS CR BLW OHV DIV

Quality Control

St	Loc	%Dep	Message
10	22.00	0.6	High standard error: 0.096
15	24.50	0.6	Boundary QC is Poor; possible boundary interference
18	26.00	0.6	High angle: 31

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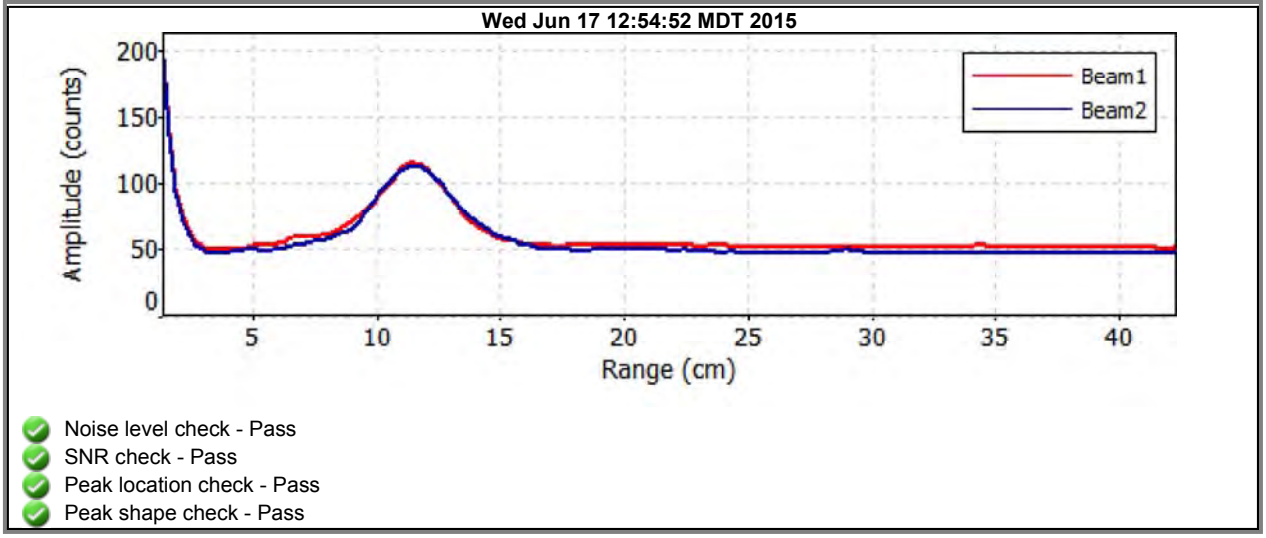
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCABFLM.002.WAD	Site Name	LONE TREE CR AB FLM
Start Date and Time	2015/06/17 12:58:20	Operator(s)	GRAYS CR BLW OHV DIV

Automatic Quality Control Test (BeamCheck)



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

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information

File Name	LTCAPFLM.001.WAD
Start Date and Time	2015/05/12 13:14:04

Site Details

Site Name	LONE TREE ABV FLUME
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
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	0.3%	1.0%
Velocity	0.4%	2.0%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.8%	-
Overall	**3.6%**	**2.4%**

Summary

Averaging Int.	40	# Stations	18
Start Edge	REW	Total Width	9.100
Mean SNR	23.4 dB	Total Area	7.877
Mean Temp	53.00 °F	Mean Depth	0.866
Disch. Equation	Mid-Section	Mean Velocity	1.3298
		Total Discharge	**10.4751**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:14	2.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:14	3.50	0.6	0.730	0.6	0.292	1.0354	1.00	1.0354	0.547	0.5669	5.4
2	13:16	4.00	0.6	0.880	0.6	0.352	0.8684	1.00	0.8684	0.440	0.3821	3.6
3	13:17	4.50	0.6	0.980	0.6	0.392	1.0942	1.00	1.0942	0.490	0.5361	5.1
4	13:19	5.00	0.6	1.050	0.6	0.420	1.5108	1.00	1.5108	0.525	0.7931	7.6
5	13:20	5.50	0.6	0.940	0.6	0.376	1.3816	1.00	1.3816	0.470	0.6493	6.2
6	13:21	6.00	0.6	1.000	0.6	0.400	1.3780	1.00	1.3780	0.500	0.6890	6.6
7	13:22	6.50	0.6	1.020	0.6	0.408	1.5253	1.00	1.5253	0.510	0.7779	7.4
8	13:23	7.00	0.6	0.930	0.6	0.372	1.6903	1.00	1.6903	0.465	0.7861	7.5
9	13:25	7.50	0.6	0.970	0.6	0.388	1.6204	1.00	1.6204	0.485	0.7860	7.5
10	13:26	8.00	0.6	1.000	0.6	0.400	1.6483	1.00	1.6483	0.500	0.8241	7.9
11	13:27	8.50	0.6	1.010	0.6	0.404	1.5141	1.00	1.5141	0.505	0.7645	7.3
12	13:28	9.00	0.6	1.040	0.6	0.416	1.4419	1.00	1.4419	0.520	0.7498	7.2
13	13:29	9.50	0.6	1.100	0.6	0.440	1.1831	1.00	1.1831	0.550	0.6507	6.2
14	13:30	10.00	0.6	0.980	0.6	0.392	1.3058	1.00	1.3058	0.490	0.6398	6.1
15	13:31	10.50	0.6	0.880	0.6	0.352	1.1621	1.00	1.1621	0.440	0.5113	4.9
16	13:32	11.00	0.6	0.800	0.6	0.320	0.8373	1.00	0.8373	0.440	0.3684	3.5
17	13:32	11.60	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.

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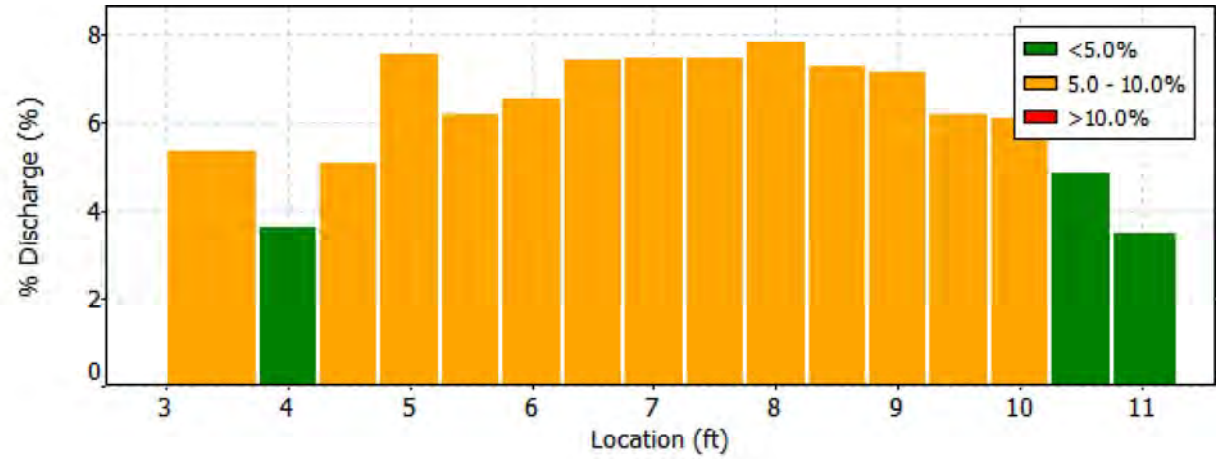
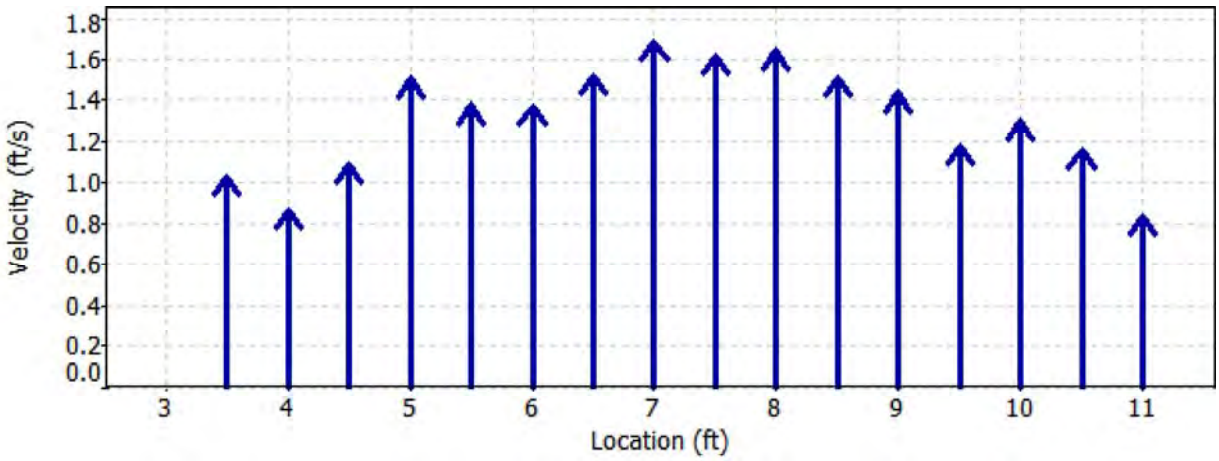
Colorado Water Conservation Board
Department of Natural Resources

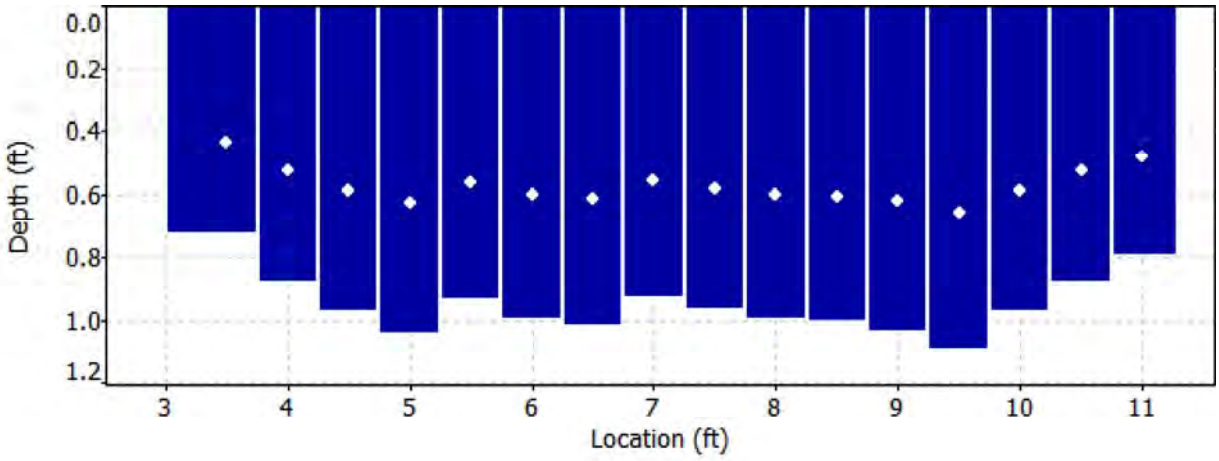
Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCAPFLM.001.WAD	Site Name	LONE TREE ABV FLUME
Start Date and Time	2015/05/12 13:14:04	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCAPFLM.001.WAD	Site Name	LONE TREE ABV FLUME
Start Date and Time	2015/05/12 13:14:04	Operator(s)	BRIAN EPSTEIN

Quality Control

No Quality Control warnings

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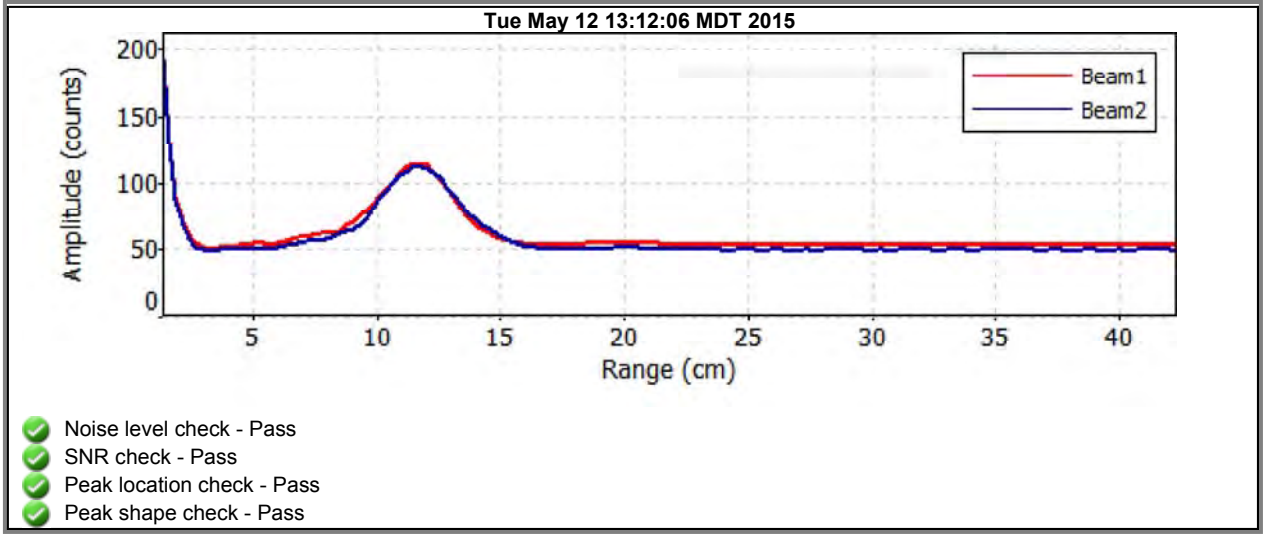
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Jul 16 2015

File Information		Site Details	
File Name	LTCAPFLM.001.WAD	Site Name	LONE TREE ABV FLUME
Start Date and Time	2015/05/12 13:14:04	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



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

Discharge Measurement Summary

Date Generated: Thu Nov 20 2014

File Information

File Name	LTCAOTMS.001.WAD
Start Date and Time	2014/10/10 10:48:58

Site Details

Site Name	LONE TREE A OLD FLM
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
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	1.0%	9.3%
Velocity	2.8%	43.9%
Width	0.3%	0.3%
Method	4.8%	-
# Stations	7.8%	-
Overall	**9.6%**	**44.9%**

Summary

Averaging Int.	40	# Stations	7
Start Edge	REW	Total Width	2.100
Mean SNR	34.8 dB	Total Area	0.531
Mean Temp	50.64 °F	Mean Depth	0.253
Disch. Equation	Mid-Section	Mean Velocity	0.9819
		Total Discharge	**0.5215**

Measurement Results

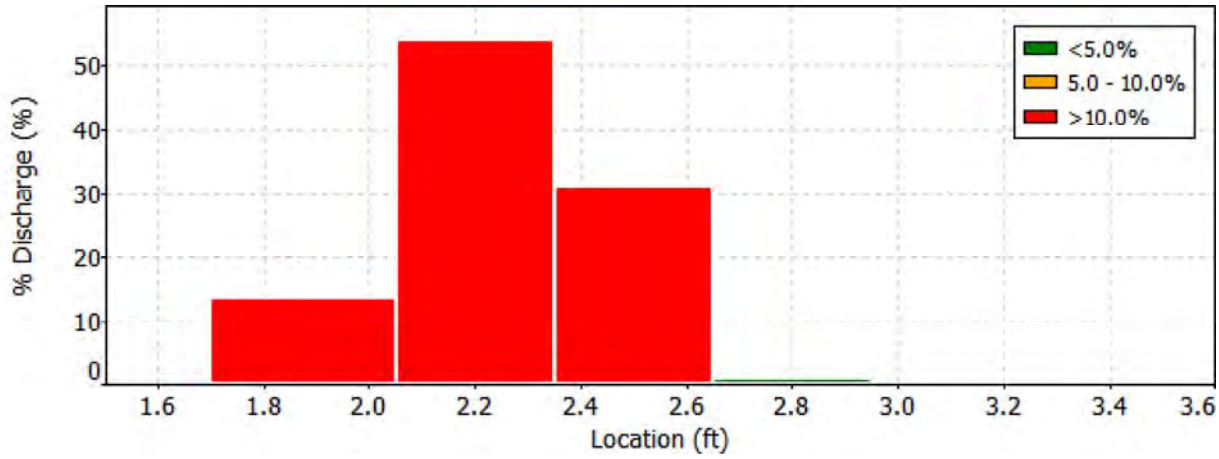
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:48	1.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	10:48	1.90	0.6	0.160	0.6	0.064	1.2635	1.00	1.2635	0.056	0.0708	13.6
2	10:50	2.20	0.6	0.300	0.6	0.120	3.1385	1.00	3.1385	0.090	0.2825	54.2
3	*10:51*	*2.50*	*0.6*	*0.400*	*0.6*	*0.160*	*1.3550*	*1.00*	*1.3550*	*0.120*	*0.1627*	*31.2*
4	*10:53*	*2.80*	*0.6*	*0.350*	*0.6*	*0.140*	*0.0531*	*1.00*	*0.0531*	*0.105*	*0.0056*	*1.1*
5	*10:54*	*3.10*	*0.6*	*0.400*	*0.6*	*0.160*	*-0.0007*	*1.00*	*-0.0007*	*0.160*	*-0.0001*	*0.0*
6	10:54	3.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

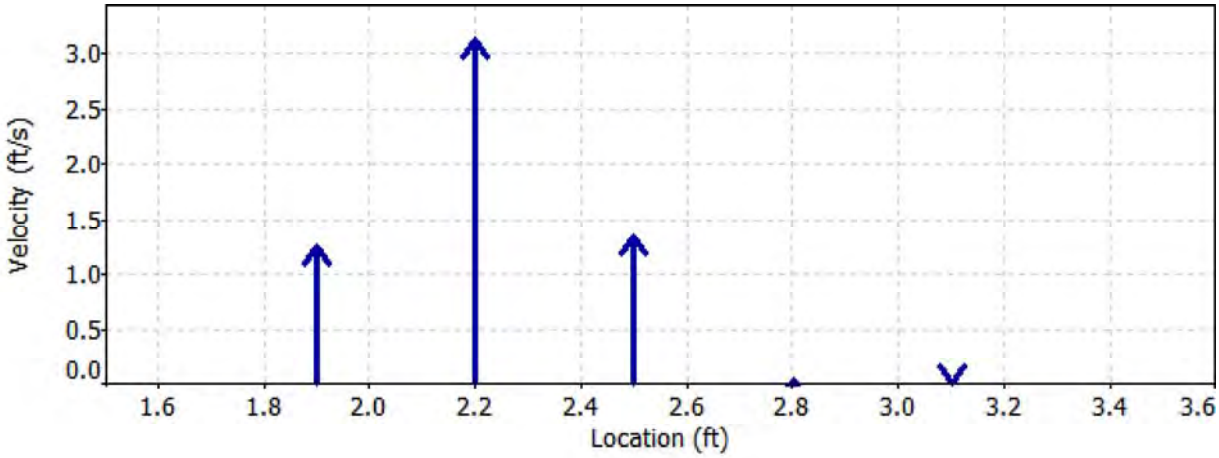
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

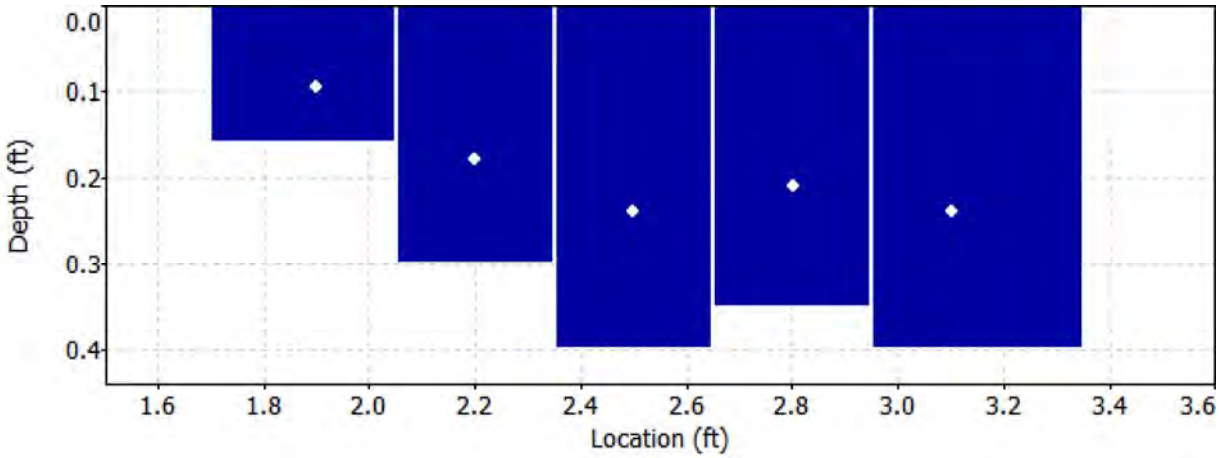
Discharge Measurement Summary

Date Generated: Thu Nov 20 2014

File Information		Site Details	
File Name	LTCAOTMS.001.WAD	Site Name	LONE TREE A OLD FLM
Start Date and Time	2014/10/10 10:48:58	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Thu Nov 20 2014

File Information		Site Details	
File Name	LTCAOTMS.001.WAD	Site Name	LONE TREE A OLD FLM
Start Date and Time	2014/10/10 10:48:58	Operator(s)	BJE

Quality Control

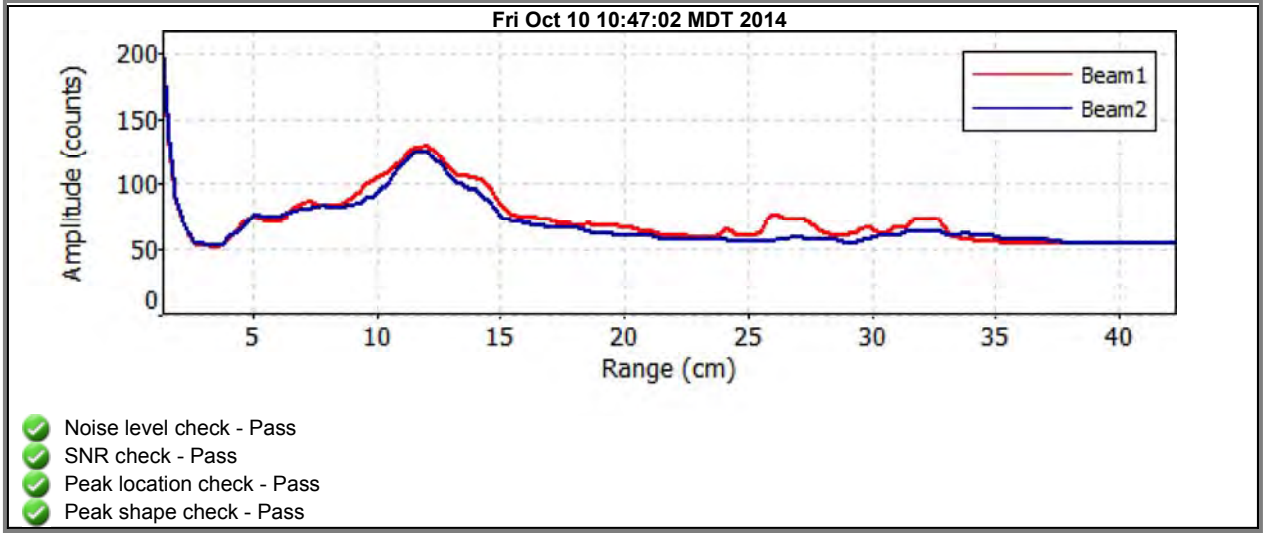
St	Loc	%Dep	Message
3	2.50	0.6	High standard error: 0.104
4	2.80	0.6	High angle: -63
		0.6	SNR (24.0) is different from typical SNR (34.8)
5	3.10	0.6	SNR (61.7) is different from typical SNR (34.8)

Discharge Measurement Summary

Date Generated: Thu Nov 20 2014

File Information		Site Details	
File Name	LTCAOTMS.001.WAD	Site Name	LONE TREE A OLD FLM
Start Date and Time	2014/10/10 10:48:58	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



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

Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information

File Name	LNTCUR2X.001.WAD
Start Date and Time	2014/06/11 11:28:04

Site Details

Site Name	LONE TREE UPPER
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
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	0.5%	2.0%
Velocity	2.8%	9.5%
Width	0.2%	0.2%
Method	2.5%	-
# Stations	3.6%	-
Overall	**5.3%**	**9.8%**

Summary

Averaging Int.	40	# Stations	19
Start Edge	LEW	Total Width	4.750
Mean SNR	16.2 dB	Total Area	2.463
Mean Temp	65.85 °F	Mean Depth	0.519
Disch. Equation	Mid-Section	Mean Velocity	0.3562
		Total Discharge	**0.8773**

Measurement Results

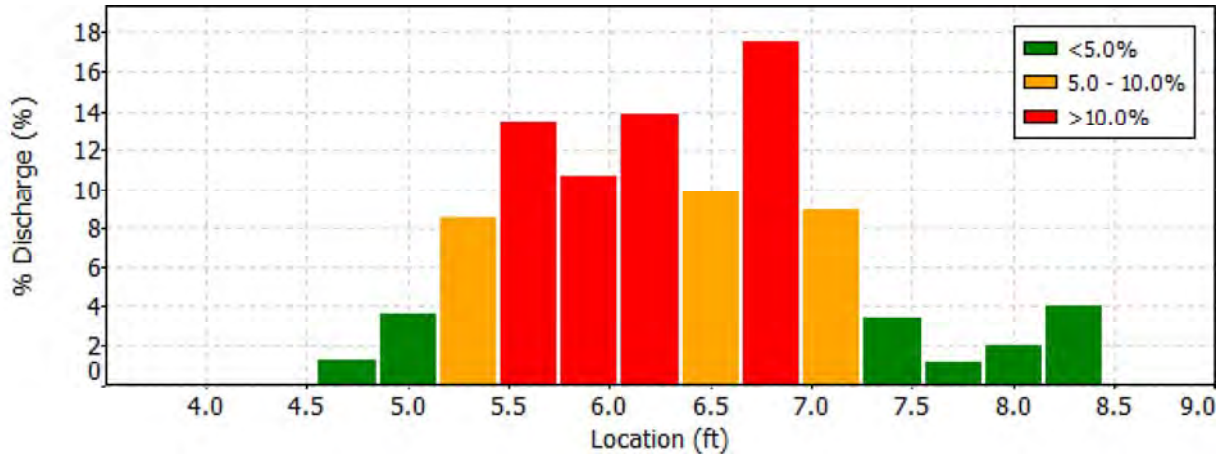
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:28	3.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	11:28	3.80	None	0.300	0.0	0.0	0.0000	1.00	0.0000	0.090	0.0000	0.0
2	11:28	4.10	None	0.390	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
3	11:28	4.40	None	0.460	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
4	11:28	4.70	None	0.460	0.0	0.0	0.0000	1.00	0.1798	0.069	0.0124	1.4
5	11:33	5.00	0.6	0.600	0.6	0.240	0.1798	1.00	0.1798	0.180	0.0324	3.7
6	11:34	5.30	0.6	0.650	0.6	0.260	0.3907	1.00	0.3907	0.195	0.0762	8.7
7	11:35	5.60	0.6	0.600	0.6	0.240	0.6611	1.00	0.6611	0.180	0.1191	13.6
8	*11:37*	*5.90*	*0.6*	*0.620*	*0.6*	*0.248*	*0.5092*	*1.00*	*0.5092*	*0.186*	*0.0948*	*10.8*
9	*11:38*	*6.20*	*0.6*	*0.660*	*0.6*	*0.264*	*0.6191*	*1.00*	*0.6191*	*0.198*	*0.1227*	*14.0*
10	*11:39*	*6.50*	*0.6*	*0.840*	*0.6*	*0.336*	*0.3465*	*1.00*	*0.3465*	*0.252*	*0.0874*	*10.0*
11	11:43	6.80	0.6	0.880	0.6	0.352	0.5866	1.00	0.5866	0.264	0.1550	17.7
12	*11:44*	*7.10*	*0.6*	*0.690*	*0.6*	*0.276*	*0.3845*	*1.00*	*0.3845*	*0.207*	*0.0796*	*9.1*
13	*11:49*	*7.40*	*0.6*	*0.600*	*0.6*	*0.240*	*0.1732*	*1.00*	*0.1732*	*0.180*	*0.0312*	*3.6*
14	*11:51*	*7.70*	*0.6*	*0.530*	*0.6*	*0.212*	*0.0728*	*1.00*	*0.0728*	*0.159*	*0.0116*	*1.3*
15	*11:52*	*8.00*	*0.6*	*0.430*	*0.6*	*0.172*	*0.1430*	*1.00*	*0.1430*	*0.129*	*0.0185*	*2.1*
16	11:54	8.30	0.6	0.320	0.6	0.128	0.3806	1.00	0.3806	0.096	0.0365	4.2
17	*11:57*	*8.60*	*Input V*	*0.220*	*0.0*	*0.000*	*0.0000*	*1.00*	*0.0000*	*0.077*	*0.0000*	*0.0*
18	11:57	9.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

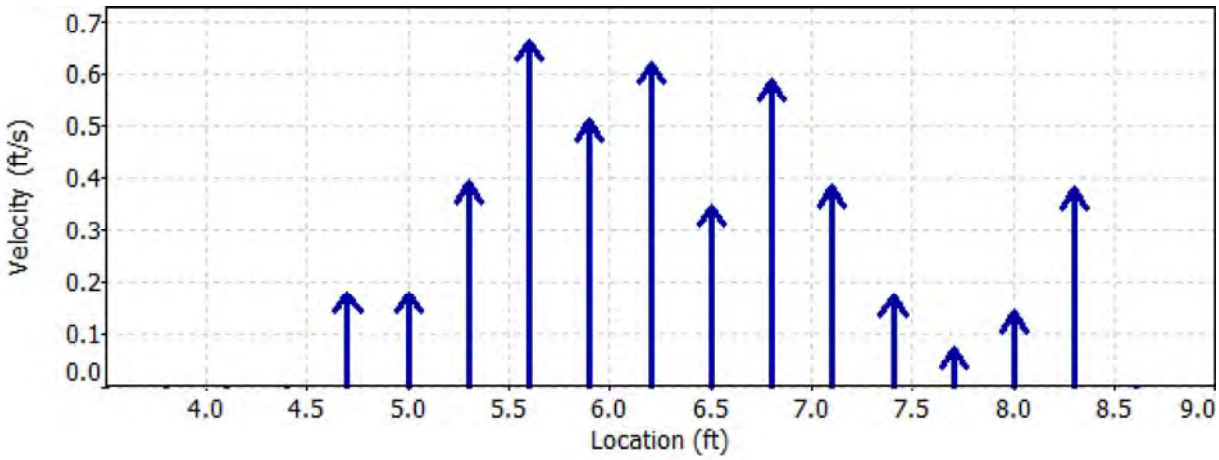
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

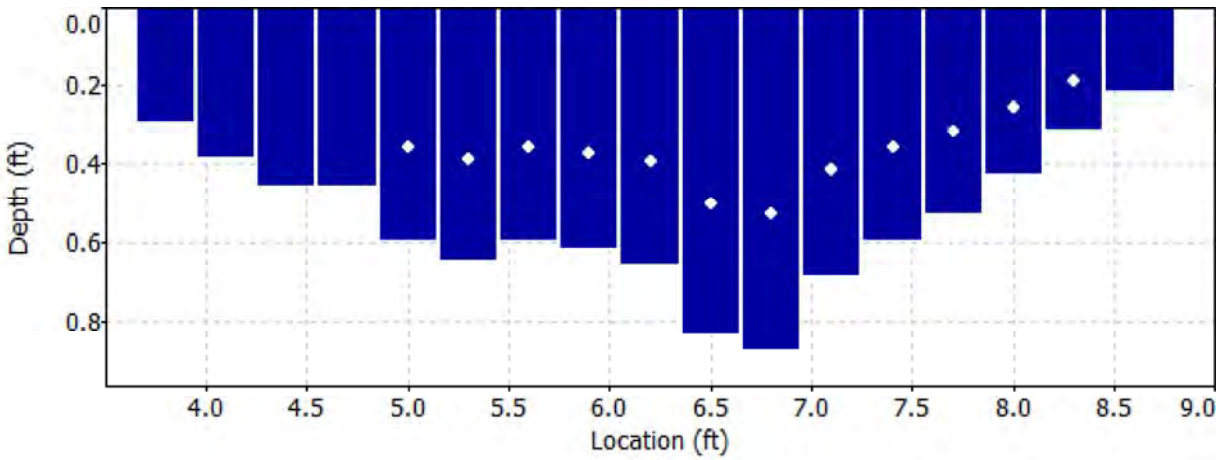
Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	LNTCUR2X.001.WAD	Site Name	LONE TREE UPPER
Start Date and Time	2014/06/11 11:28:04	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	LNTCUR2X.001.WAD	Site Name	LONE TREE UPPER
Start Date and Time	2014/06/11 11:28:04	Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
8	5.90	0.6	High SNR variation during measurement: 4.3,5.2
9	6.20	0.6	High SNR variation during measurement: 5.2,5.2
10	6.50	0.6	High SNR variation during measurement: 5.6,5.6
12	7.10	0.6	High SNR variation during measurement: 5.2,4.7
13	7.40	0.6	High SNR variation during measurement: 5.2,5.2
14	7.70	0.6	High angle: 29
		0.6	High SNR variation during measurement: 6.5,6.5
15	8.00	0.6	High SNR variation during measurement: 6.9,6.5
17	8.60	0.0	Low SNR: 0.0,0.0
		0.0	SNR (0.0) is different from typical SNR (17.5)
		0.0	High standard error: 0.000

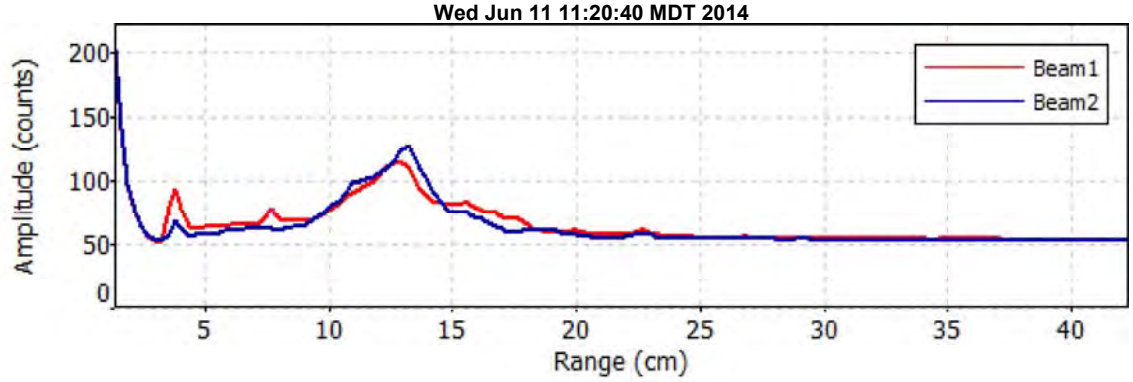
Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	LNTCUR2X.001.WAD	Site Name	LONE TREE UPPER
Start Date and Time	2014/06/11 11:28:04	Operator(s)	BJE

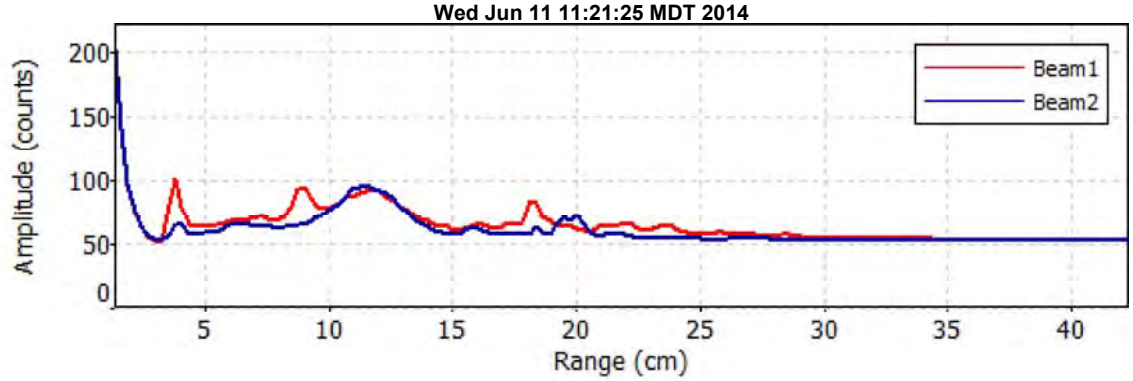
Automatic Quality Control Test (BeamCheck)

Wed Jun 11 11:20:40 MDT 2014



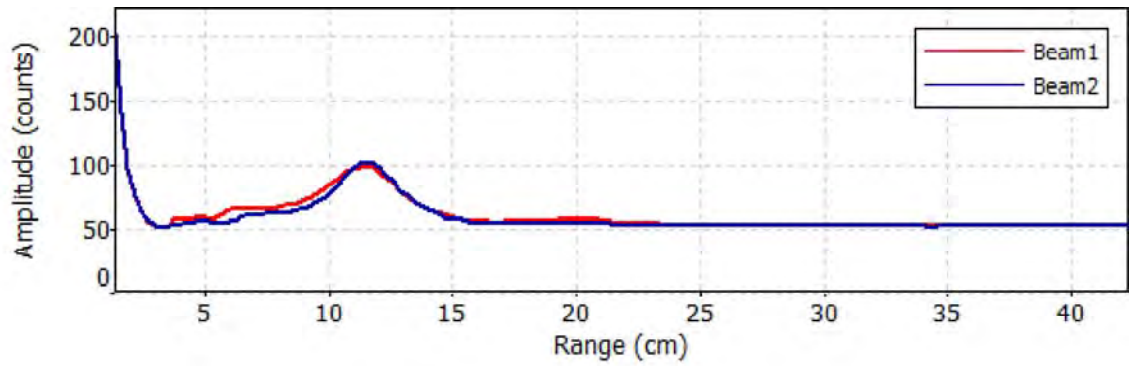
- Noise level check - Pass
- SNR check - Pass
- Peak location check - Fail
- Peak shape check - Pass

Wed Jun 11 11:21:25 MDT 2014



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

Wed Jun 11 11:22:25 MDT 2014



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

STATE OF COLORADO

Epstein - DNR, Brian <brian.epstein@state.co.us>

20151026_LoneTreeCreek_FieldNotes

1 message

Brian Epstein - DNR <brian.epstein@state.co.us> Tue, Nov 10, 2015 at 12:11 PM
To: Brian Epstein <Brian.Epstein@state.co.us>

Lone Tree Creek Field Notes

October 26, 2015

Brian Epstein

11:10 Arrive temporary weir site

- conditions upon arrival: light rain, cloudy, mostly higher elevation clouds in vicinity

11:15 Weir

- weir staff plate = 0.55'

- top of weir leaning slightly downstream

- small amount of seepage around weir, mostly from right bank side

- good stilling above weir, nice drop through weir, and good nap

- two iPhone pictures weir: (1st) from upstream right bank, looking downstream and (2nd) from downstream right bank, looking upstream

11:17 pond below weir

- pond staff plate = 0.59'

- iPhone picture taken of staff plate

11:20 iPhone video

- from downstream left bank of weir

- pans from upstream to downstream

- focuses on right bank seepage

- focuses on nap

11:37 observed weir staff plate = 0.55'

- maximum level before water goes around weir over bank

- rain stopped

11:45 depart weir site

Brian Epstein
Hydrologist, Stream and Lake Protection Section
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Office: 303-866-3441x3253 | Cell: 720-545-6027
1313 Sherman Street, Room 721, Denver, CO 80203
brian.epstein@state.co.us | www.cwcb.state.co.us

State of Colorado

Colorado Water Conservation Board

Field Notes

Lone Tree Creek
Party: Brian Epstein

09:57 arrive temporary gage site
- damage to site from cows, hoof prints and manure
  - weir top tilted downstream
  - water flowing around right and left sides
  - pressure transducer head no longer in place; now 10 feet upstream, slightly submerged on right edge of creek
  - data logger fence post mount bent horizontal so it is parallel to the ground
  - time lapse camera missing
  - @ 10:17 AM staff plate on weir reads 0.42'
    *artificial low because water flow around weir
  - @ 10:20 AM staff plate in pond reads 0.50'
  - time lapse camera discovered submerged in pond 6.0' downstream of weir
  - plants in notch of V
  - before scrubbed off debris line at 0.46' on weir staff
- Pictures & videos of site conditions upon arrival

10:05 Pic 374 site overview from right bank looking downstream
10:05 Pic 375 close up of pressure transducer head "relocated" by cows with weir in background
10:06 Pic 376 data logger mount repositioned by cows
10:06 Pic 377 time lapse camera mount vacant and backside of staff plate

10:07 Pic 378 weir face with sand bags out of place
10:07 Vid 379 Standing on right bank, pan from upstream to weir and then examine water flowing around weir
10:17 Pic 380 staff plate of weir after scrub off debris build up 0.42'
10:21 Pic 381 close up staff plate in pond water level 0.50'
10:22 from left bank looking at control of pond w/ staff plate
10:25 - 10:45 repositioned sandbags and rocks around weir to stop leaks and removed pressure transducer and logger

- pictures and videos after work complete
10:48 Pic 383 front of weir, staff reading 0.46'
10:49 Pic 384 close up of weir staff reading 0.46'
10:49 Video 385 bank of weir leaks around sides reduced to near zero
10:58 Pic 386 site overview to compare with site overview upon arrival

- there is a tiny amount of water seeping under weir, evidenced by slight muddy upwelling after stomping on upstream sand bag, observed on right side of V

11:36 depart weir site

State of Colorado

Colorado Water Conservation Board

Field Notes

Lone Tree Creek
10:16 arrive weir site
10:19:00 synchronize camera time to Verizon time
10:19 Pic 337 upstream of weir cow drinking from Lone Tree, taken from right bank
10:20 weir staff = 0.48'
Pic 338 weir
Pic 339 "
Pic 340 "
• build up of aquas veg in V of weir

10:33 camera staff = 0.59'
10:37:00 Eee PC time synchronized to Verizon time
10:40 downloaded SD card to Eee PC
10:43 Pic 341 camera staff plate
341 " " "
343 " " "
344 " " "
10:47 erased SD card, replaced in Timelapse camera and began recording
11:00 connected to data logger
11:00:45 computer time = 11:01:57 logger time
11:04:30 synchronize logger to computer time
11:04 downloaded logger
11:07 clear logger history
11:08 disconnect from logger
11:17 - 11:19 removed veg from V-notch
11:20 weir staff = 0.49'
11:21 Pic 345 weir
345 "
347 "
11:25 depart weir site

Notes By: Brian Epstein YYYY-MM-DD: 2015-08-27 Page 1 of 1

State of Colorado

Colorado Water Conservation Board

Field Notes

Brian Epstein
Kelly Cunningham

Lone Tree Creek
09:44 arrive at staff plate/camera
09:47 staff reading 0.59 feet
09:53 staff/tinelayer camera
Pic 308 taken from right bank
09:54 Pic 309 area to install weir, taken from downstream
09:56 Pic 310 from slightly above location planning weir install, looking upstream at pool above
10:00 Began installing weir
10:21 Pic 311 Kelly excavating trench for weir
10:21 Pic 312 control downstream for staff/TL camera
11:37 Pic 313 weir installed
11:38 Pic 314 closeup of installed weir
11:39 Pic 315 " " " "
11:40 Pic 316 close up of downstream side of weir, good rope
12:52 staff on weir 0.53 feet (sensor PT 1.09')
staff on downstream pool staff/TL camera 0.60 feet
Survey - arbitrary datum, larger # lower down
sensor head = 7.85 feet
top of staff = 6.27 feet (plate reads 1.09)
water level = 6.83 feet (plate reading 0.53)
difference: sensor head - water level = 1.02 feet
convert sensor output to staff
EU High 3.00 - 0.56 = 2.44
EU Low 0.00 - 0.56 = -0.56
13:11 synchronized Logger time to computer
13:13 Programmed Loggers:
- Read every 15 minutes starting at 13:15
- Weir equation 90° V-notch
- Saved screen shots and program file
13:35 Pic 317 overview of site
13:53 departed site

Notes By: Brian Epstein YYYY-MM-DD: 2015-08-17 Page 1 of 1

State of Colorado

Colorado Water Conservation Board

Field Notes

Lone Tree Creek

11:47 arrive Timelapse gage site, sunny gusty wind
11:57 EEE PC & Lumix Camera synchronized to Verizon Cellular phone time
12:00 Staff plate = 0.90 feet
12:00 Pic 201 staff plate
12:01 Pic 202 Timelapse camera and staff plate
12:04 removed SD card from Timelapse camera
12:07 loaded pictures onto computer
12:11 deleted pictures from SD card
12:14 • replaced SD card in Timelapse Camera
• lowered view angle
12:32 • set up measurement X-section 120 feet upstream from temp Timelapse gage
• replaced FlowTracker Batteries
12:55:00 FlowTracker synchronized to Verizon Phone
13:01 surface waves, very small, blown upstream by gusty wind
13:55 wind continued through out measurement mostly upstream or from rb to lb and upstream on approx 45° angle to tag line
13:14 - 13:17 Vid 203 Pic 204 - 206 fishes in pool above X-section
14:13 Pic 207 from REW Timelapse gage
14:13 Pic 209 " (close up)
14:13 Pic 209 from bank location looking upstream at X-section
14:14 Pic 210 " (close up)
14:14 Pic 211 from rb looking US at X-section
14:14 Pic 212 from rb looking at lb of X-section
14:15 Pic 213 from rb looking downstream at X-sec
15:52 Pic 214 gage control and aquatic vegetation
15:53 Pic 215 staff plate 0.89 feet
15:54 removed sd card

Notes By: Brian Epstein YYYY-MM-DD: 2015-07-23 Page 1 of 3

Lone Tree Creek (cont'd)

15:55 Saved pictures to computer folder 20150723_LoneTreeCr

16:00 staff plate 0.89 feet, retrieved SD card and turned on trailcam camera 88% battery remaining

16:15 departed site

14:15 to 15:50 attempted install of 4 feet wide v-notch weir, water levels still to high, without weir water ~ 3.5' at proposed location, dug weir install water width expanded to 4.5', which is wider than weir, stopped install so as not to erode bank

YYYY: 2015
MM-DD: 07-23

State of Colorado
Colorado Water Conservation Board
ADV Discharge Measurement Notes

Meas. No.: ØØ4
Division: 1
District: 10

Station Name:	LTCABFLM
	Lone Tree — River, (Creek), Canal, Ditch
At, Near, Above, Below	
Latitude:	Longitude:
Party:	Brian Epstein

Conditions

Weather:	Sunny ~80°F, gusty wind mostly upstream
Wind Spd / Dir:	variable/rb to lb — Water Temp:
X-Sec Desc:	sand and cobbles w/ aquatic growth (veg)
Flow Conds:	parallel flow lines
Control Desc.:	natural riffle downstream of staff

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
12:00	0.90'				
13:59	0.89'				

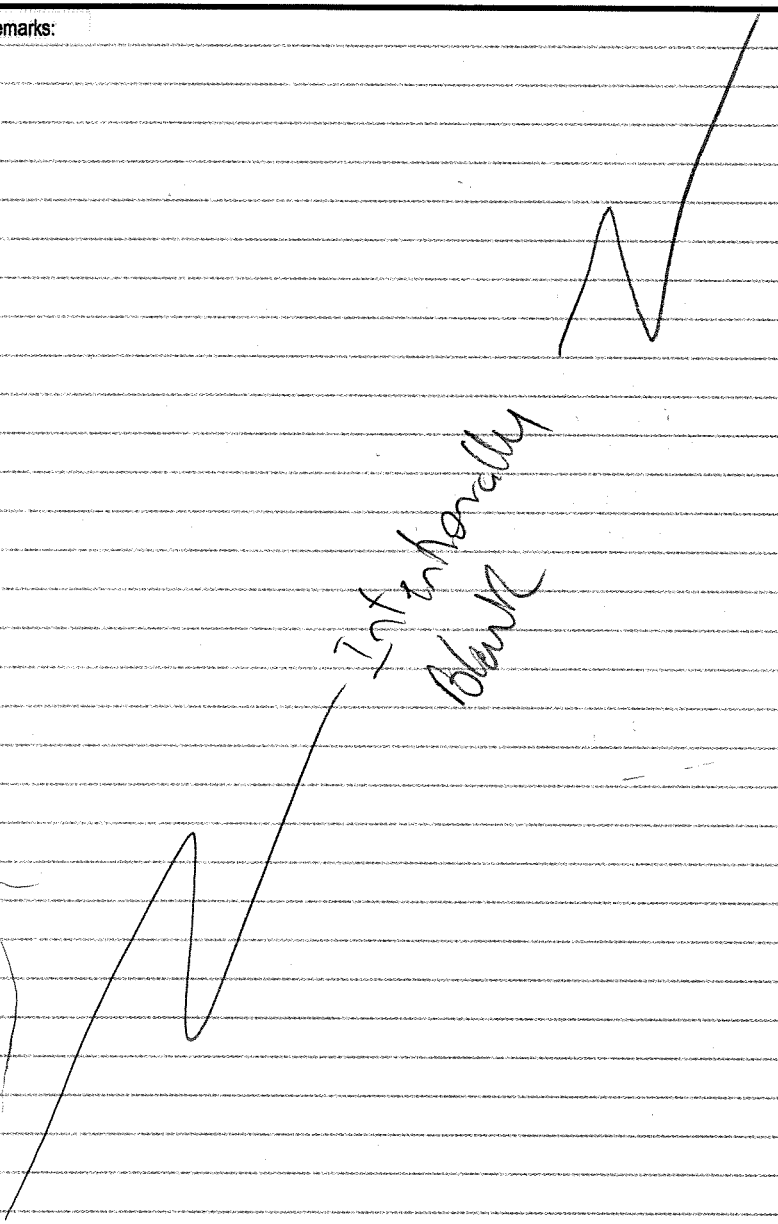
~~Pressure Transducer~~ Download		Weighted MGH	
~~File~~ Folder Name:	Timelapse camera 20150723_lonetreecreek	GH Corr.	
Time:	12:07	Correct MGH	

Discharge Measurement

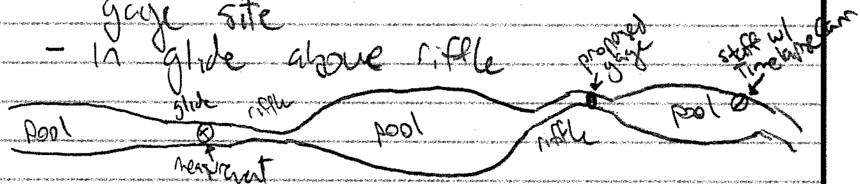
Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	LTCABFLM.ØØ4		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
		120	(ft.) or mi / (upstream) or downstream of gage		
Start Edge: REW	5.3	End Edge: LEW	14.4	Total Width:	9.1
Start Time:	12:59	End Time:	13:55		
Discharge:	1.994	Uncertainty:	2.1	# Stations:	44
Mean v:	0.382	Width	9.099	Mean d:	0.57
Max v:	0.479	Area:	5.222	Max d:	0.81
Mean SNR:	26.2	σV:	0.009	Mean Temp:	66.0

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:



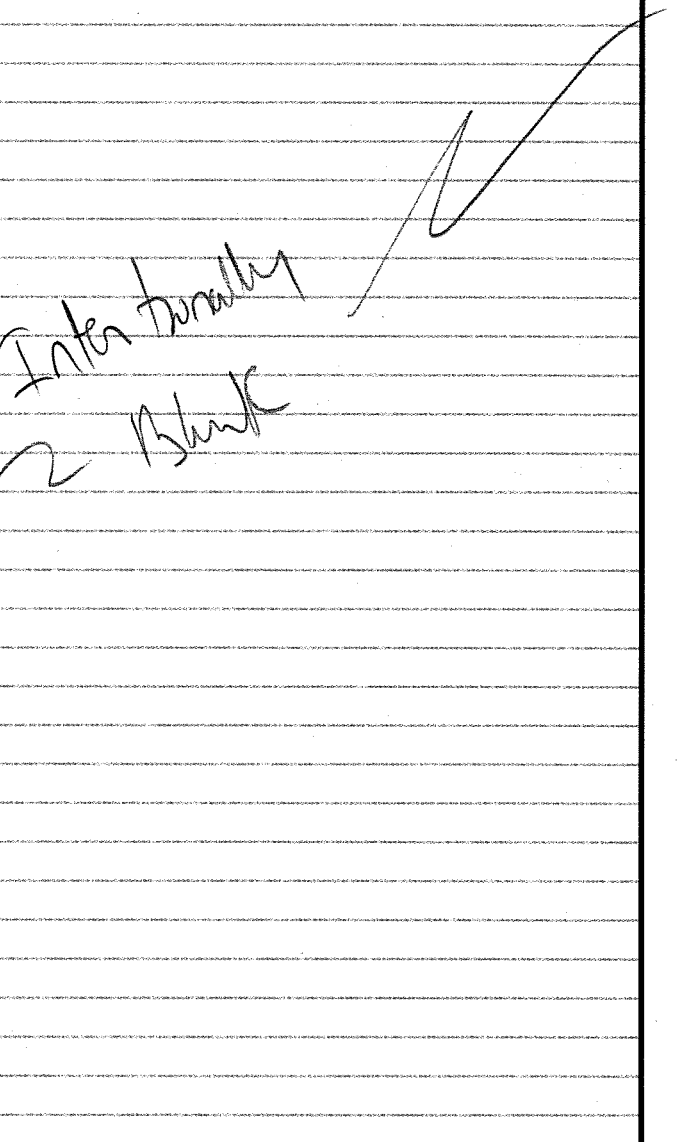
Lone Tree Creek
10:23 Arrive site with previous temp gage
BJE's CWCB Camera
10:35 171 Picture of site upon arrival, from ds
10:35 172 " " " " " , from rb
10:36 173 " " " " " , looking us
from proposed temp gage (and historic)
10:37-10:50 Set up discharge measurement X-section
- above pool that is above proposed weir
gage site
- in glide above riffle



10:52 174 picture of crustacean in ~~glide~~ above measurement
10:52 175 picture of crustacean in glide above measurement
10:53 176 fish above measurement x-section
11:01 177 from rb, measurement x-section
11:01 178 from ds, measurement x-section
11:02 179 from us, measurement x-section
11:15-12:25 Setup Timelapse Cam 8.0
name: ~~LTCM~~ LTCTMSFP
interval: 15 min, photo, 1920 x 1080
Program: wake up 06:00; sleep 20:00,
imprint info
Date: 7/14/2015 11:17 set to inReach time
12:24 staff = 1.04 feet
12:29 180 & 181 Staff plate w/ Timelapse Cam dos
Picture observed staff set up:
- Timelapse Cam 8.0 34" from
staff
- in pool downstream of historic
temp gage

Notation
ds = down stream
us = up stream
rb = right bank
lb = left bank

Notes By: Brian Epstein   YYYY-MM-DD: 2015-07-14



Page 2 of 3	State of Colorado	Meas. No.: 003
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 07-14	ADV Discharge Measurement Notes	District: 10

Station Name: LTCABFLM

Lone Tree — River / Creek, Canal, Ditch

At, Near, Above, Below — Flume (historic temp gage)

Latitude: — Longitude:

Party: Brian Epstein

Conditions

Weather: ~78°F mostly cloudy; storm clouds SW

Wind Spd / Dir: 0 mph to light 16 to rb — Water Temp:

X-Sec Desc: sand & cobbles w/ plant growth (aquatic)

Flow Conds: Laminar

Control Desc.: natural cntl. downstream of staff plate

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage (ft)	Pressure Trans.	Time	Staff Gage	Pressure Trans.
12:24	1.04				
13:54	1.04				

Connect ~~Pressure Transducer~~ Download — Weighted MGH

File Name: not downloaded — GH Corr.

Time: N/A — Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	Yes or No	Raw Data File:	LTCABFLM.003		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
	120	ft or mi / upstream or downstream of gage			
Start Edge:	REW 5.3	End Edge:	LEW 14.5	Total Width:	9.2
Start Time:	12:40	End Time:	13:46		
Discharge:	3.126	Unsertainty:	2.5	# Stations:	31
Mean v:	0.606	Width	9.20	Mean d:	0.56
Max v:	2.729	Area:	5.16	Max d:	0.81
Mean SNR:	24.3	σv:	0.11	Mean Temp:	67.3

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

12:36 Flowtracker time = in/each trip

13:57 Rc 182 control from rb

State of Colorado

Colorado Water Conservation Board

Field Notes

Lone Tree Creek

10:36 Arrive site where historic temp gage had been

10:53 Pic 123 from right bank picked of where flume used to be, at drop pedra right 4' wide and 0.75' deep

10:54 Pic 124 from right bank looking upstream from old flume location

Cross-Section (measured down from tape)

Horizontal	Vertical	Comment
4.00	0.525	high water debris mark Pic 125
6.00	0.750	right bank
8.00	0.975	
10.00	1.350	
12.00	1.600	
13.90	1.925	
14.00	2.200	
15.70	2.525	edge of water in Pic 126 submerged grass
16.50	3.075	to water: 2.525 and end of grass
17.00	3.425	2.525
19.00	3.525	2.525
21.00	3.375	2.525
23.00	3.475	2.525
24.90	3.400	2.525 beginning submerged grass
26.75	2.525	edge of water (left)
27.00	2.275	
28.00	2.150	
30.00	1.850	
32.00	1.850	
34.00	1.950	
36.00	1.800	
38.00	1.750	
40.00	1.925	
42.00	2.150	

horizontal	vertical	comments
44.00	2.700	
46.00	2.375	
48.00	2.425	
50.00	2.400	
52.00	2.300	
54.00	2.100	
56.00	1.550	
58.00	1.325	big wooden debris deposit
60.00	1.075	
62.00	0.950	
66.00	0.525	scarp

*see Page 3 RH ADV Sheet

13:55 Depart Historic Gage driving upstream
14:00 GPS Point: LoneTreeCr 002 - fence line (logged original 2012-05-10 10:58)
13:59 Pic 130 from fenceline on right bank looking downstream onto private
14:00 Pic 131 from fenceline on right bank looking upstream onto private
14:17 LoneTreeCr 009 - right bank above creek
- water flowing
- grass on both banks laying down with heavy in downstream direction
- grass under water in flowing area
- walked upstream ~300 feet, same conditions as GPS location
14:20 Pic 132 from GPS looking cross stream
" " 133 same as above but close up
" " 134 from GPS point looking downstream
14:52 GPS Point: LoneTreeCr 003 (logged original 2012-05-10 10:26)
14:53 Pic 135 50 feet south of gps point LoneTree from right bank
" Vid 136 same location as above, pans from upstream to downstream

Page 3 of 6	State of Colorado	Meas. No.: 002
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 06-17	ADV Discharge Measurement Notes	District: 10

Station Name: LTCABFLM

Lone Tree — River, (Creek), Canal, Ditch

(At), Near, Above, Below — Fenceline

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Sunny w/ cumulous clouds on western skyline

Wind Spd / Dir: upstream light — Water Temp:

X-Sec Desc: Boulder and Cobbles

Flow Conds: laminar steady

Control Desc.: N/A

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.

Pressure Transducer Download

File Name: N/A

Time:

Weighted MGH

GH Corr.

Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	LTCABFLM.002		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	N/A ft. or mi / upstream or downstream of gage				
Start Edge:	REW 15.70	End Edge:	26.75 ~~13.23~~	Total Width:	
Start Time:	12:54	End Time:	13:23		
Discharge:	10.579	Unsertainty:	3.4	# Stations:	20
Mean v:	1.315	Width	11.050	Mean d:	0.73
Max v:	1.740	Area:	8.043	Max d:	1.00
Mean SNR:	23.5	σv:	0.031	Mean Temp:	66.5

Meas. By:	Brian Epstein	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

Pics

13:29 #126 x-section from dd flume location

13:30 #127 same as above close up

13:30 #128 from right bank, x section

13:31 #129 from left bank, looking along x-section at woody high water debris on left bank

- flushed two mallards walking upstream

15:02 GPS Location: LoneTree Cr 01 (historic 2015-05-10 10:15)
- water flows from riffle into deep pool
15:03 Pic 137 Pool, notice dark line of drop off
" " 138 riffle into pool
" Vid 139 riffle flowing
- during last ten minutes clouds moved overhead, front edge of partly cloudy sky moving from west to east, looks like rain clouds to the west, lightening to west, temperature reducing
- walked upstream ~200 feet, very marshy area in the grass

15:27 GPS Point: LoneTree Cr 010
- from right bank hillside over looking I-25 and ~~Spotte~~ LoneTree Creek intersection
- water flowing
- water stage seems above normally occurring level, as observed from submerged woody plants

15:28 Panoramic 140-142 taken from upstream to downstream
15:30 Pic 143 looking at flow under bridge predominantly in picture center

15:45 GPS Point: LoneTree Cr 011
- pond and riffle
- water flowing
15:46 Pic 144 from GPS point looking upstream
" " 145 " " " " downstream
- walked from GPS point to next, flowing whole way

15:53 GPS Point: LoneTree Upper R2X (historic 2014-06-11 11:06)
- water flowing
15:54 Pic 146 from GPS looking upstream

Lone Tree Creek (cont'd)

State of Colorado

Colorado Water Conservation Board

Field Notes

15:54 Pic 147 from gps point looking downstream
16:22 GPS Point: Lone Tree Cr 02
- flowing
- drove creek from last GPS point, all observed areas flowing

16:22 Pic 148 from gps looking upstream
" " 149 from gps looking downstream
" " 150 from gps looking cross stream zoomed in

Notes By: Brian Epstein YYYY-MM-DD: 2015-06-17 Page 6 of 6

Page 2 of 2	State of Colorado	Meas. No.: 001
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 05-12	ADV Discharge Measurement Notes	District: 1

Station Name: LTCAPFLM

Lone Tree River, (Creek), Canal, Ditch

At, Near, (Above), Below by Dne Pond previous flume location

Latitude: N 40° 57' 55.00" Longitude: W 104° 55' 30.95" NAD83

Party: Brian Epstein

Conditions

Weather: 56°F Partly Cloudy

Wind Spd / Dir: light Breeze / Variable Water Temp:

X-Sec Desc: boulder, cobble, sand bed

Flow Conds: laminar

Control Desc.: N/A

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download		Weighted MGH		
File Name:	N/A	GH Corr.		
Time:		Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	LTCAPFLM.001		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	N/A	ft. or mi / upstream or downstream of gage			
Start Edge:	REW 2.5	End Edge:	LEW 11.6	Total Width:	9.1
Start Time:	13:12	End Time:	13:34		
Discharge:	10.475	Unsertainty:	3.6	# Stations:	18
Mean v:	1.330	Width	9.100	Mean d:	0.87
Max v:	1.690	Area:	7.877	Max d:	1.10
Mean SNR:	23.4	σv:	0.022	Mean Temp:	53.0

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks: Lone Tree Creek May 12, 2015

12:03 Arrive Site
- Water flowing high in response to recent precipitation

12:12 Pic989 from REW looking downstream, pond above former flume location

12:13 Pic990 from REW looking cross stream, former flume location

12:13 Pic991 from REW, pond downstream of former flume location

13:09 Pic992 from REW looking cross stream at X-section

13:10 Pic993 from downstream center of creek, looking upstream at X-section

13:39 0.99' from current water level to recent high water mark, debris deposition

13:52 Depart Site

#

Observed on the way from Denver
- Cache la Poudre out of bank @ Fort Collins
- Saint Vrain out of bank @ I-25

Page 1 of 2	State of Colorado	Meas. No.: 001
YYYY: 2014	**Colorado Water Conservation Board**	Division:
MM-DD: 10-10	ADV Discharge Measurement Notes	District:

Station Name:

Lone Tree River, (Creek) Canal, Ditch

At, Near, Above, Below Old Temporary Measurement Site (old flume)

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Fog, Light Rain ~45°F

Wind Spd / Dir: Water Temp:

X-Sec Desc: historic gps: LoneTrFlume

Flow Conds: mostly laminar

Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / (Poor (>8%)) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download

File Name: N/A

Time:

Weighted MGH		
GH Corr.		
Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / (P2355)
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	LTCA0TMS.001		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	N/A	ft. or mi / upstream or downstream of gage			
Start Edge:	REW 1.5	End Edge:	LEW 3.6	Total Width:	2.1
Start Time:	10:48	End Time:	10:57		
Discharge:	0.52	Unsertainty:	9.7	# Stations:	7
Mean v:	0.98	Width	2.1	Mean d:	0.25
Max v:	3.14	Area:	0.53	Max d:	0.40
Mean SNR:	34.8	σv:	0.049	Mean Temp:	50.6

Meas. By:	BE	Notes By:	BE
Processed By:		Reviewed By:	

Remarks:

Pictures

10:42 617 X-section from downstream

11:01 618 Video Pan from right bank upstream of x-section, thru x-section to downstream

- Walked downstream of measurement section along LoneTree Creek
  - creek wet, observed all the way to fence line
  - creek beat up by cattle
  - Wide deep slow moving areas and shallow narrow fast moving areas exist, just like observed in measurement area
  - a diversion structure, no longer connected w/ creek exists

Pictures

11:27 619 from GPS point LoneTreeCrPic009, creek area at fence line, wet

11:27 620 from GPS point LoneTreeCrPic008, creek looking downstream of fence

11:41 621 from left bank on hill above measurement point (by truck), looking at creek

11:41 622 from fence line above measurement location looking down to measurement location (near truck)

Remarks: Lower Lone Tree Field Notes

by: Brian Epstein
date: June 11, 2014
Party: Jay Skinner
Eric Rubenstahl

Waypoint: LoneTreeLowerFlume

- Temporary Flume Install, complete 10:11 AM
- 10:20 $h_a = 0.32'$ $h_b = 0.11'$ $w = 3''$ $q_a = 0.188 q_b = \cancel{0.35}\ 0.035$ $Q = 0.11$ cfs
- 10:09 Pic 0236 Flume from above
- 10:11 Pic 0237 Staff $h_a = 0.32$
- 10:12 Pic 0238 from US flume
- 10:12 Pic 0239 from US flume close up
- 10:13 Pic 0240 from DS looking up to flume
- 10:35 $h_a = 0.32$
- small amount of water flowing through joints

Page 1 of 2	State of Colorado	Meas. No.: 001
YYYY: 2014	**Colorado Water Conservation Board**	Division: 1
MM-DD: 06-11	ADV Discharge Measurement Notes	District: 3

Station Name: Lone Tree Creek Upper R2X

Lone Tree River, (Creek) Canal, Ditch

At, Near, Above, Below Waypoint Name: LoneTreeUpper R2X

Latitude: N 40° 59' 08.70" Longitude: W 104° 54' 57.97" NAD 83

Party: Jay Skinner, Eric Rubenstahl & Brian Elston

Conditions

Weather: Sunny ~78°F

Wind Spd / Dir: ~~10~~ SE ~2 mph Water Temp:

X-Sec Desc: boulder bed silty banks

Flow Conds: mostly laminar, steady

Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download

File Name: N/A

Time:

Weighted MGH

GH Corr.

Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / P2385
Firmware:	3.7	Software:	2.20		
Diag Test File:	Yes or No	Raw Data File:	LNTCVR2X.001		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
		N/A	ft. or mi / upstream or downstream of gage		
Start Edge:	3.5	End Edge:	9.0	Total Width:	5.5
Start Time:	11:20	End Time:	12:00		
Discharge:	0.077	Unsertainty:	5.3%	# Stations:	19
Mean v:	0.356	Width	4.749	Mean d:	0.52
Max v:	0.661	Area:	2.463	Max d:	0.88
Mean SNR:	17.5	σv:	0.033	Mean Temp:	65.9

Meas. By: BJE Notes By: BJE

Processed By: Reviewed By:

Remarks:

11:16 Pic 02H1 R2x upper bank Tree from Right bank, Eric on rod

11:16 Pic 02H2 R2x upper bank Tree from downstream Eric on rod Jay on Right

State of Colorado

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Field Notes

Lone Tree Creek

Party: BJE, Jay Skinner & Eric R

Observed Creek
- @ former flume location
- GPS Point: LoneTreeCrPic0001
- drove north from gps point along creek
- all locations flowing heavier than previous observation
  - → patches of snow in shaded areas
  - → Eric mentioned storms that likely contributed

Pictures at GPS Point: LoneTreeCrPic0001
103-0034 Lone Tree Creek looking downstream from ~~treasure hunt~~ obs point
0035 Video "
0036 looking upstream

Notes By: Brian Eastern YYYY-MM-DD: 2014-04-16 Page 1 of 1

State of Colorado

Colorado Water Conservation Board

Field Notes

Lone Tree Creek
June 19, 2013
Brian Epstein, Rob Viehl, Brandy Logan

→ looks consistent from when flume was installed last season

time	pic #	comment
12:41	802	lone tree stream channel
12:41	803	lone tree stream channel looking upstream

State of Colorado

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Field Notes

August 2, 2012
Lone Tree Creek
@ Flume Site

13:09 Arrive at site
13:11 825-829 Flume site conditions upon arrival
13:22 830 Data logger housing condition → full of muddy water
13:30 831-832 Flume after sand scraped out → "bath tub" ring at 0.17' on the staff

13:31-13:59 Removed equipment stacked up supplies used to get equipment

14:00 833 Picture of stacked supplies
14:00 834 site where flume was ripped out
14:01 835 "
14:01 836 Video "
14:02 837 Overview of how site was left
14:09 Departed site

State of Colorado

Colorado Water Conservation Board

Field Notes

June 18, 2012 Lone Tree Creek Flume Site

12:35 arrive at site
12:36 Pic 654-656 Site condition upon arrival, log where flume used to be, flume on its side, pressure transducer out of water
12:47 Pic 657-659 current water level on temp staff, placed at point of zero flow being set to zero, rear upstream fence post; water level = 0.44',
12:50-14:15 set up and leveled cross-section for channel geometry, upstream of former flume location; also removed tree limb that was at old flume location, (cross-section taken on Page 2 and 3)
14:15- Pic/Vid 660 cross-section
14:15-15:47 reinstalled flume
15:28 Pic 661-663 flume during leveling process
15:39 Vid 664 staff gage in flume and flow
15:42 Pic 665 flume after leveling complete
15:42 Vid 666 flow through flume after set
15:45 Pic 667-668 flume staff = 0.18'
15:47 Pic 669 Site over view post reconstruct
15:47 Vid 670 Site over view post reconstruct

Set up laser level & cross-section tape
→ leveled both
→ laser leveled at 2.48' above ground surface

Tape Measure	measure staff	tape height	water height
0.20	2.39	2.20	NA
0.40		2.28	NA
0.60		2.49	NA
0.80		2.52	NA
1.00		2.55	NA
1.10		2.62	edge water
1.40		2.84	0.29
1.60		2.59	0.04
1.80		2.59	0.04
2.00		2.84	0.30
2.20		2.84	0.34
2.40		2.82	0.26
2.60		2.80	0.32
2.80		2.69	0.20
3.00		2.74	0.20
3.20		2.89	0.34
3.40		2.79	0.25
3.60		2.75	0.20
3.80		2.72	0.16
4.00		2.70	0.16
4.20		2.69	0.16
4.30		2.59	0.00 new
4.40		2.59	N/A
4.60		2.46	NA
4.80		2.40	NA
5.00		2.36	
* 5.00	high water mark = 1.26		
5.20		2.32	
5.40		2.29	
5.60		2.26	
5.80		2.21	
6.00		2.18	

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Colorado Water Conservation Board

Field Notes

June 18, 2017
Long Tree Creek
(cont'd)

tape reading	tape height	comment
6.20	2.17	
6.40	2.10	
6.60	2.10	
6.80	2.09	
7.00	2.09	
7.20	2.09	
7.40	2.04	
7.60	2.02	
7.80	2.04	
8.00	1.98	
8.20	1.96	
8.40	1.95	
8.60	1.91	
8.80	1.90	
9.00	1.89	
9.20	1.86	
9.40	1.88	
9.60	1.85	
9.80	1.80	high water mark 0.66'
10.00	1.80	
11.00	1.70	
12.00	1.58	
13.00	1.49	
14.00	1.40	
14.50	1.34	
14.80	1.20	

15:45 Flume staff 0.18'
15:47 temp staff gage 0.40'
15:50 Depart Site

State of Colorado

Colorado Water Conservation Board May 30, 2012

Field Notes

Lone Tree Creek

Flume Install w/ Water Level Logger

GPS Location

Name	Lat	Long
LoneTr Flume	N40° 57' 54.33"	W104° 55' 31.11" NAD83

Picture/Video

#	time	content
579	13:04	overview of flume install taken from right bank
580	13:04	overview from downstream
581	13:04	close from downstream
582	13:05	" " "
583	13:05	close up from right bank
584	13:05	overview from upstream
585	13:13	Staff gage
586		overview video flume

Levels

Time	PT	Staff
13:45	0.39	0.22

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Field Notes

May 24, 2012

Spottlewood Creek Lower Segret
Met Station Setup

10:00 Select Site

Instrument above ground
72 inch temp humidity = 1.83m
77 inch wind = 1.96m
58 inch radiation = 1.47m
39 inch rim of tipping bucket = 0.99m

14:03 GPS location name: MetStation (WMS80)
Program Launched Lat/Long: 30.43"
Modem reconnected N 40°5'30.43"
Program tested W 105°5'57.36"

Verizon Cellular signal weak

Picture	Content
557 - 563	data logger wiring
564 - 566	met station overview
567	tipping bucket
568	radiation sensor
569	multisensor
570	heat flux plate location
571	burried PT cable
572	pressure transducer
573	met station over view

May 24, 2012

Lone Tree Creek

15:15 Arrive Site
574 - 575 selected install (GPS LoneTreeFlume)
Worked on getting cut flume installed. Not enough sandbags, leaking under flume

16:35 Gave up on install

Supply Needs for next install:
→ sand bags
→ sand
→ newspaper bags to stuff
→ Crosslinked polyacrylamide

576 - 578 Install site as left

State of Colorado

Colorado Water Conservation Board

Field Notes

May 10, 2012 Field Visit

Lone Tree Creek

GPS	Pic/Vid	Content
	516	Truck Side Orientation
	517	Walking down to creek
LoneTreeCr001	518	Ponded Water
	519	Walking along dry creek to ponded water
LoneTreeCr002	520	Old diversion structure → can divert to creek left
	521	"
LoneTreeCr003	522	other end of ponded area
LoneTreeCr004	523	2nd Ponded Area, talk about
	524	"
LoneTreeCr005	525	Walk along fence line and creek (video)
LoneTreeCr006	526	Lone Tree creek on City Property taken from pasture fence, another ponded area
LoneTreeCr007	527	Ponded area beginning of little reach, minnow spotted
	528	Video
	529	downstream of 007, flow
	530	Attempted video of fish

Spottlewood Lower

GPS	Pic	Content
SpottlewoodCr	531	Spottlewood Surfaces picture of upper GPS point
	532	Snake in ponded area 25' downstream GPS
	533	Scenic view of Spottlewood between FISH points
SpottlewoodCr007	534	video of fish

May 10, 2012

Spottlewood Lower (cont'd)

GPS	Pic Vid	content
Spottlewood Cr003	535	Vid of Spottlewood system
	536	Spottlewood as clouds buried

Spottlewood Creek upper

GPS	Pic Vid	content
Spottlewood Cr004	537	Ponded area
	538	" Video
Spottlewood Cr005	539	Ponded area drop pool
"	540	Spottlewood above drop pool

Graves Creek

GPS	Pic Vid	Content
GravesCr	541	Flume, ramp flume good fall
	542	"
	543	Video • Fort Collins hourly reading of Flume w/ Sutherden
GravesCr002	544	Picture Graves Creek at Meadow Springs and Soapstone Ranch
	545	"


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