Montana Bureau of Mines and Geology Report of Investigation 22

STREAM CHARACTERIZATION OF BLACKTAIL AND SILVER BOW CREEKS:

A CONTINUOUS TRACER INJECTION INVESTIGATION CONDUCTED DURING BASEFLOW CONDITIONS IN AN URBAN AREA IMPACTED BY MINING: BUTTE, MONTANA

Nicholas J. Tucci

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MBMG
Montana Bureau of Mines and Geology

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LIST OF ACRONYMS

As—Arsenic
AR—British Petroleum Atlantic Richfield Company
BTC—Blacktail Creek
Br—Bromide
BMFOU—Butte Mine Flooding Operable Unit
BPSOU—Butte Priority Soil Operable Unit
°C—Degree centigrade
Cd—Cadmium
COCs—Contaminants of Concern
cfs—cubic feet per second
Cu—Copper
EPA—Environmental Protection Agency
Hg—Mercury
ICP-MS—Inductively coupled plasma–mass spectrometry
Kg—Kilogram
L—Liter
NaBr—Sodium bromide
µg/L—Microgram per liter
mg/L—Milligram per liter
MBMG—Montana Bureau of Mines and Geology
MDEQ—Montana Department of Environmental Quality
MSD—Metro Storm Drain
MSD-Subdrain—Metro Storm Drain-Subdrain
NRD—Natural Resource Damages Program
Pb—Lead
SBC—Silver Bow Creek
SBC/MSD—Upper Silver Bow Creek/Metro Storm Drain
TR—Total recoverable
Zn—Zinc

EXECUTIVE SUMMARY

In September 2011, scientists from the Montana Bureau of Mines and Geology conducted a continuous bromide tracer injection in the Blacktail Creek/Upper Silver Bow Creek confluence area in Butte, Montana. This work was funded by the Natural Resource Damage Program and performed during baseflow conditions, when groundwater contributions to surface-water flow were dominant. Blacktail Creek is the headwater stream for Upper Silver Bow Creek, which receives the majority of its baseflow contributions from Summit Valley groundwater in Butte, Montana. The stream is of interest because it intersects both the Butte Area One injured area restoration site and the Butte Priority Soils Operable Unit of the Silver Bow Creek/Butte Area National Priority List site, and is a focal point for past and current remediation/restoration activities.

The work evaluated streamflow, chemistry, metals loading, and groundwater/surface-water interactions in a reach of stream impacted by more than a century of mining- and milling-related activities, land development, land-use change, and streambed manipulation. A continuous tracer injection test was performed using a sodium bromide solution with a bromide concentration of 22.5 percent wt/wt to obtain creek bromide concentrations of roughly 3 mg/L. Manual measurements of discharge were obtained at 15 sites over a total stream length of 10,500 ft using a SonTek FlowTracker. Steady-state conditions with respect to bromide were reached after 11 h of injection. The tracer results were combined with synoptic sampling of mainstem, tributary, and drivepoint piezometer data. Samples from 30 groundwater wells, 17 mainstem locations, 8 tributary locations, and 5 drivepoint piezometer locations in the Blacktail streambed and two wetland sites were analyzed for bromide, common cations and anions, and 36 minor and trace analytes.

Results from the tracer injection and manual FlowTracker measurements were consistent, and suggest that discharge in Blacktail Creek between Oregon Avenue and George Street increased by 2.2 cfs (22 percent). Wetlands located adjacent to Blacktail Creek received the majority (99%) of recharge from local groundwater sources, and contributed 39 percent of the flow increase observed in the studied reach of Blacktail Creek (Oregon Avenue to George Street). The remaining baseflow contributions (61%) in Blacktail Creek were groundwater inputs into the stream. Results of the tracer study also indicate that two reaches of Blacktail Creek are non-gaining reaches, and may be net-losing reaches. Gains in streamflow were not observed in the upper reach of Silver Bow Creek, from the confluence to site SS-06. Gains in flow were not observed in Upper Silver Bow Creek.

Results from metals loading assessments indicate that while there appears to be source areas for copper and zinc loading to the stream, contaminants of concern (As, Cd, Cu, Pb, and Zn) concentrations remained below DEQ-7 acute and chronic life standards for dissolved concentrations throughout the study area. Total recoverable Cu and Zn concentrations were elevated in the Kaw Avenue reach of Blacktail Creek. One mainstem, one wetland, and two tributary samples exceeded DEQ-7 acute and chronic life standards for total recoverable Cu, while two tributary samples exceeded DEQ-7 acute and chronic life standards for total recoverable zinc. The sources of total recoverable Cu and Zn to this area of Blacktail Creek are thought to be either bed sediment loads or nearby streambank sediment (i.e., BTC Berm) loading from historic Grove Gulch discharges. The two wetlands, located north of Blacktail Creek and adjacent to Kaw Avenue, exhibited water quality with elevated concentrations of copper and zinc. Both of the wetlands contributed measurable flow into Blacktail Creek and are potential point sources; however, metals concentrations of the groundwater that recharged the wetlands near Kaw Avenue were not assessed during this investigation. Therefore, groundwater entering the wetlands could not be ruled out as a potential source.

1.0 INTRODUCTION

The floodplains of lower Blacktail (BTC) and upper Silver Bow (SBC) Creeks in Butte traverse the southern flank of the Butte Priority Soils Operable Unit (BPSOU; fig. 1; EPA, 2006). Both floodplains have been heavily impacted by a century of mining operations that resulted in the deposition of metal-laden tailings deposits [arsenic (As), cadmium (Cd), copper (Cu), mercury (Hg), lead (Pb), and zinc (Zn)] that serve as point sources of contamination to groundwater and surface water. To qualify and quantify known sources of Cu and Zn to surface water, synoptic sampling of groundwater and surface water was conducted during a tracer injection test under baseflow conditions (September 2011).

1.1 Site Background

Due to a varying array of water-management practices and water-demand issues (mining processes, milling processes, smelting processes, urbanization, and post-mining remediation efforts), the Silver Bow Creek and Blacktail Creek stream channel geographic setting, morphology, and hydrologic integrity have been heavily modified.

1.1.1 Blacktail Creek

Blacktail Creek is a north–northwest-flowing intermontane stream that drains the southern Summit Valley, and currently serves as the headwater stream for the Silver Bow Creek drainage basin. In Butte, tributaries to Blacktail Creek include Basin Creek, Sand Creek, Grove Gulch, and a series of wetlands located adjacent to the creek. The wetlands (fig. 1), both natural and constructed, are fed by groundwater from the north and south Summit Valley. Today, the perennial reach of Silver Bow Creek is formed just upstream of Montana Street (fig. 1) at the confluence of Blacktail Creek and the Upper Silver Bow Creek/Butte Metro Storm Drain (SBC/MSD), a dry streambed that historically drained the northern Summit Valley (fig. 1) and currently serves as a storm-water management channel.

1.1.2 Silver Bow Creek

In its upper reaches, Silver Bow Creek historically flowed southward from the confluence of two headwater streams, Yankee Doodle Gulch and Dixie Gulch. As the creek continued south along the base of the Butte Hill, its valley widened as tributaries out of gulches from the East Ridge (Park Canyon and Horse Canyon, fig. 2A) joined the mainstem. Silver Bow Creek's channel then turned westward around the base of the ridge on the east end of the Butte Hill. As the creek flowed along the base of the Butte Hill, it entered the middle reaches of the Summit Valley, a marshy environment where it joined Blacktail Creek, in an area colloquially referred to as the 'confluence area.' Excavation and dewatering of the Berkeley Pit (1955), construction of the Weed Concentrator, and formation of the Yankee Doodle Tailings Impoundment Dam (May 1963) physically isolated the northernmost part of the Summit Valley, and these historic hydrologic conditions no longer exist. The historic headwaters of Silver Bow Creek have been filled by material excavated from the Berkeley Pit, and a local groundwater divide north of Harrison Avenue forms the northeastern boundary of the current Silver Bow Creek Drainage Basin (Tucci, 2010; EPA, 2011).

The former course of upper Silver Bow Creek that drained the north part of the valley (the Butte Hill, south of the Berkeley Pit between Montana Street and the Continental Drive) was extensively altered by a public works project in the 1930s. This action channelized the streambed for use as an industrial sewer and to collect storm-water runoff (Quivik, 1998). Today, this area is the primary focus for ongoing remediation efforts for BPSOU (EPA, 2006; EPA, 2011b), and is now referred to as the Metro Storm Drain (MSD) (fig. 1). A French-drain collection system, known as the Metro Storm Drain Subdrain (MSD Subdrain), buried directly under the current MSD channel, extends from the Civic Center to a pumping vault west of Kaw Avenue (fig. 1). The MSD Subdrain was designed to capture shallow contaminated groundwater and prevent it from discharging to surface water; dewatering and construction began in 2003 and the drain became operational in 2005 (EPA, 2006). The MSD Subdrain has had profound impacts on the hydrogeologic and hydrologic setting in the BTC/SBC confluence area (Tucci and Icopini, 2010, 2012).

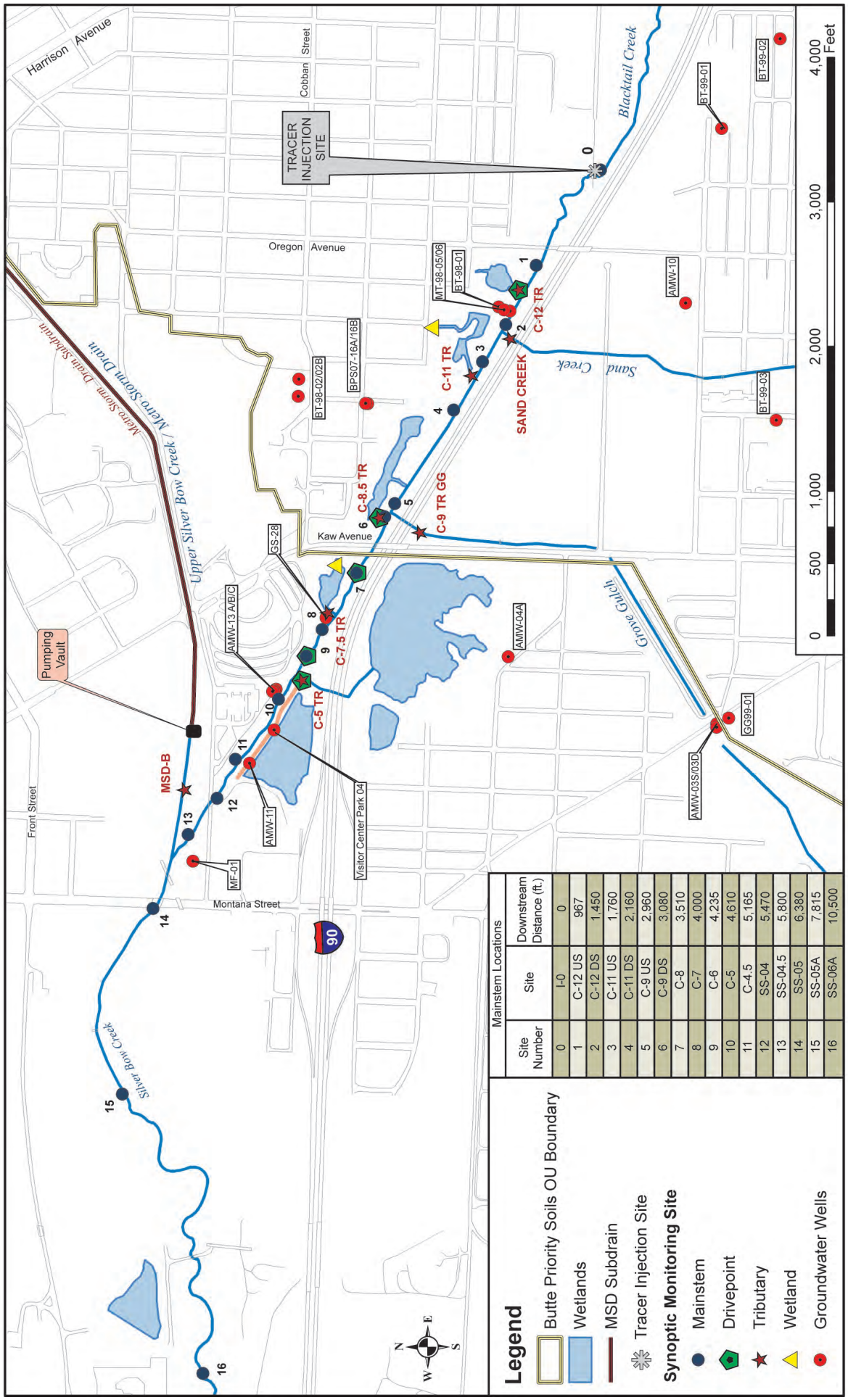


Figure 1. Location map showing tracer injection site, synoptic sampling locations, and groundwater monitoring wells. Mainstem site numbers labeled with black text. Tributary synoptic sampling sites labeled with dark red text. Survey source data: MBMG Navigational Grade GPS. Imagery: 2009 NAIP, Silver Bow County. Projection: NAD 83 Decimal Degrees.

1.1.3 Blacktail Creek/Silver Bow Creek Confluence Area

The pre-mining setting of the Blacktail/Silver Bow Creek confluence was described as a low-flow, low-gradient wetland environment with "luxuriant growth of grass and vegetation" (Meinzer, 1914). Many of Butte's earliest settlers reported that the valley was "swampy and peaty" before mining occurred (Meinzer, 1914). At present, an organic-rich silt layer remains throughout the BTC/SBC confluence area, although it is buried under varying quantities of fill and waste material. When identified in borehole logs, the organic silt is used by geoscientists to determine the valley's pre-mining original soil horizon (Tucci, 2012).

In 1879, the first large-scale mineral processing smelter (Colorado Smelter) was built on Silver Bow Creek, at the west end of the valley (fig. 2B; Ray and Leonard, 1890). Between 1879 and 1888, at least three more smelters of consequence (Butte Reduction Works, Parrot Smelter, and Montana Ore Purchasing; fig. 2A; Weed, 1904) were constructed, significantly altering the morphology and hydrology of both creeks. Water demands during this time increased dramatically, and at least six dams were constructed for water impoundment and tailings retention purposes (fig. 2B). Blacktail Creek, as far upstream as Harrison Avenue, was converted from a meandering stream to a linear channel in an effort to deliver more water to downstream smelters (Simons, 1915). By 1912, most smelting operations had been moved to Anaconda, and the industrial water demands in Butte declined (Quivik, 1998).

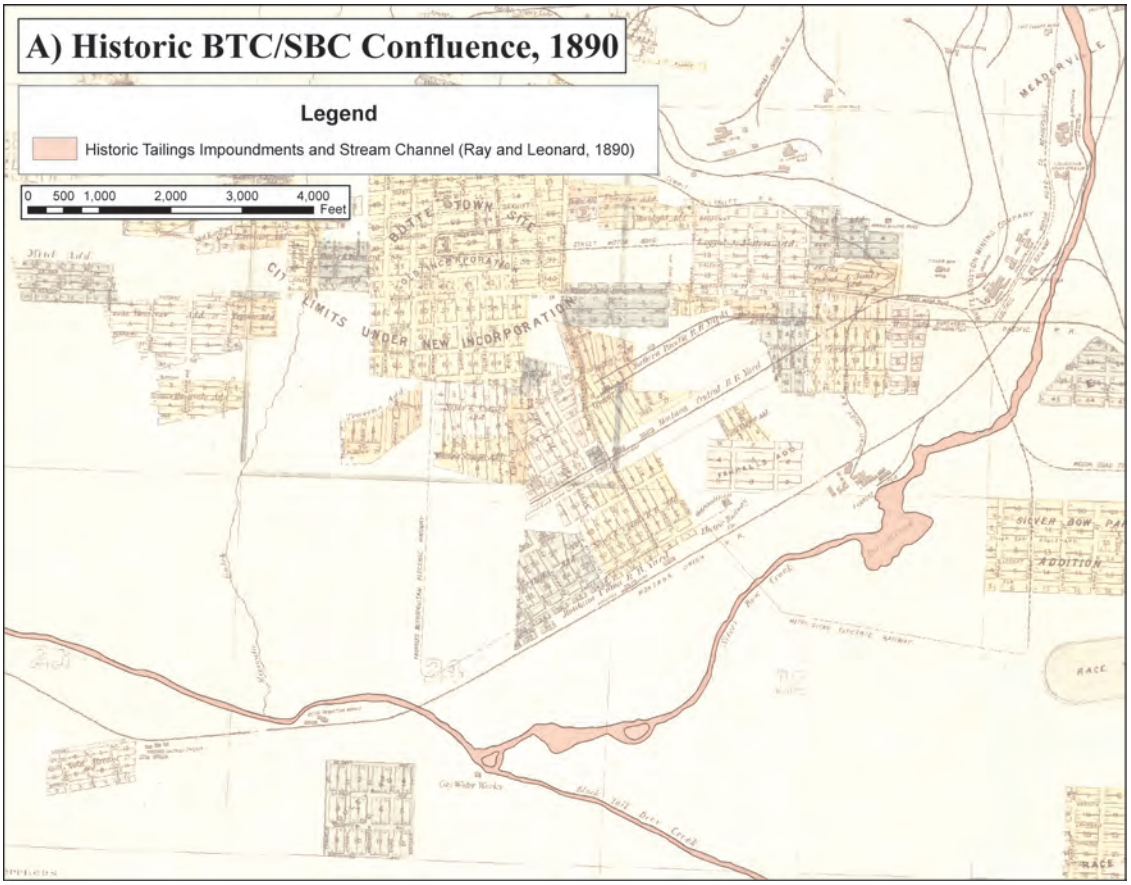
The consequences of aggradation in the confluence area caused by the construction of retention dams on Blacktail and Silver Bow Creeks were significant and are apparent today. Retained water soon became a flooding issue (Meinzer, 1914). Flood control berms adjacent to the streambeds were constructed from readily available mine-waste material. One berm, referred to as the 'BTC berm' (fig. 1), presents a potential point source of contamination to Blacktail Creek. Aggradation from the dam near Montana Street (fig. 2B; Weed, 1895), constructed sometime between 1890 and 1895, caused the BTC/SBC confluence to shift several hundred feet to the northwest (fig. 2C). By the late 1930s, all retention dams on Silver Bow and Blacktail Creeks were removed, and both streambeds were channelized to the extent to which they are geographically represented today. Current conditions bear no resemblance to the pre-mining morphology of the streambeds or the historic hydrologic environment (fig. 2C).

1.1.4 Grove Gulch

Grove Gulch (fig. 1, which joins Blacktail Creek east of Lexington Avenue) begins in mostly rolling open range land approximately 4 mi southwest of the city of Butte. Water from Grove Gulch currently enters Blacktail Creek approximately 75 ft upstream of the Lexington Avenue overpass (fig. 1). The creek has been heavily altered; the earliest recorded anthropogenic manipulation dates back to January 1879, when the five-stamp Grove Gulch Mill, located between Mount Moriah Cemetery and Timber Butte, began processing eight tons of ore per day (Wilcox, 1954).

Currently the stream is an intermittent tributary to Blacktail Creek, contributing negligible volumes during baseflow and low-to-moderate volumes during runoff events (unpublished BPSOU surface-water monitoring data, Trek Environmental written commun., March 25, 2011). However, the current hydrologic conditions of Grove Gulch were not always the case. Historically, Grove Gulch discharged to Silver Bow Creek (fig. 2B; near the Butte Reduction Works) roughly 4,000 ft west of the confluence area. Operations at Clark's Timber Butte zinc mill began in 1914, and as a result, flow from Grove Gulch was routed underneath the Clark tailings impoundment by a combination of vitrified tile and wood stave pipes (Hydrometrics, 1983). At this time, during construction of the mill, the stream was redirected from its confluence with Silver Bow Creek upstream to its current confluence with Blacktail Creek (Simons, 1915).

Clark's zinc mill at Timber Butte operated between 1914 and 1949, generating roughly a million cubic yards of tailings that were poorly impounded within the Grove Gulch floodplain at the base of Timber Butte (Quivik, 1993). After closure of the mill, most ephemeral tributaries draining the north face of Timber Butte were allowed to discharge directly through the Clark Tailings. As a result, substantial erosion of the tailings into Grove Creek occurred



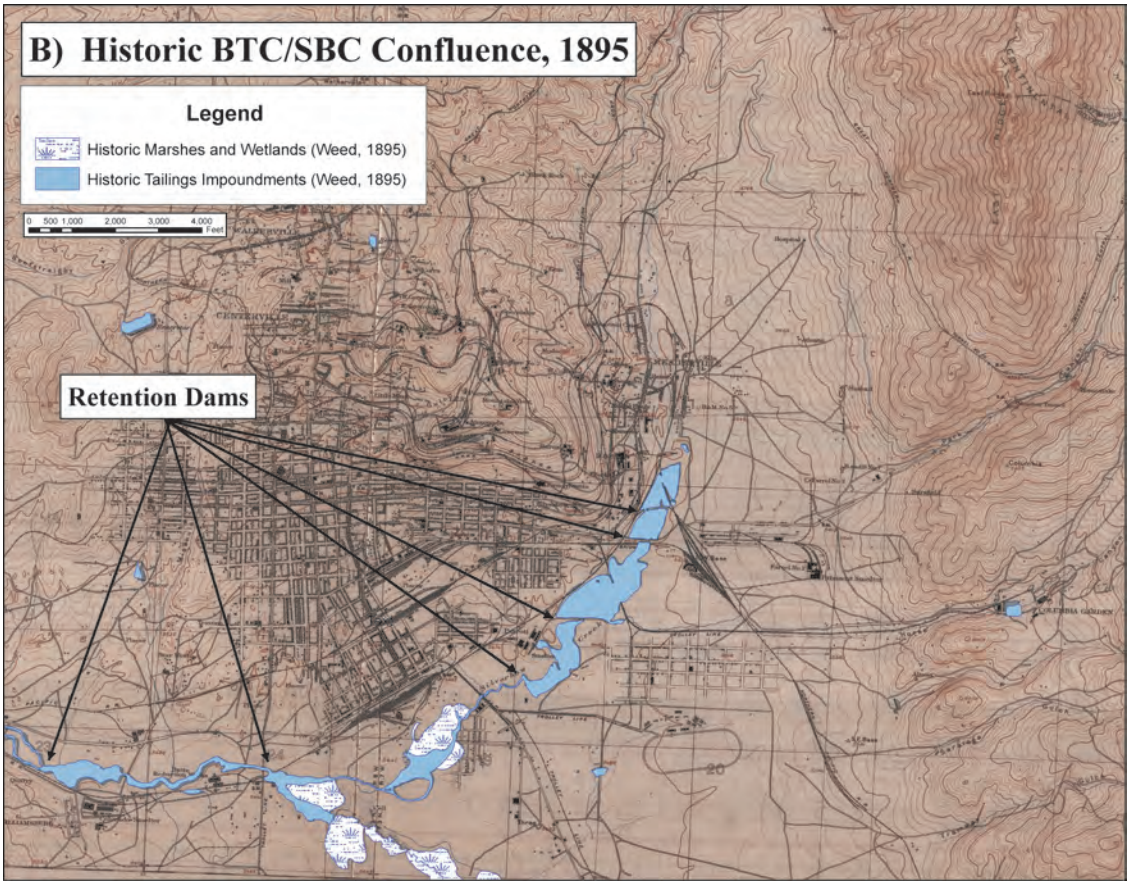


Figure 2. Time-series maps of the BTC/SBC confluence area demonstrating the significance of anthropogenic manipulation of the stream channels between 1890 (A), 1895 (B), and present day (C). The 1890 (pink) and 1895 (light blue) stream channels are overlain on present-day SBC/BTC creeks (dark blue) for comparison (C).

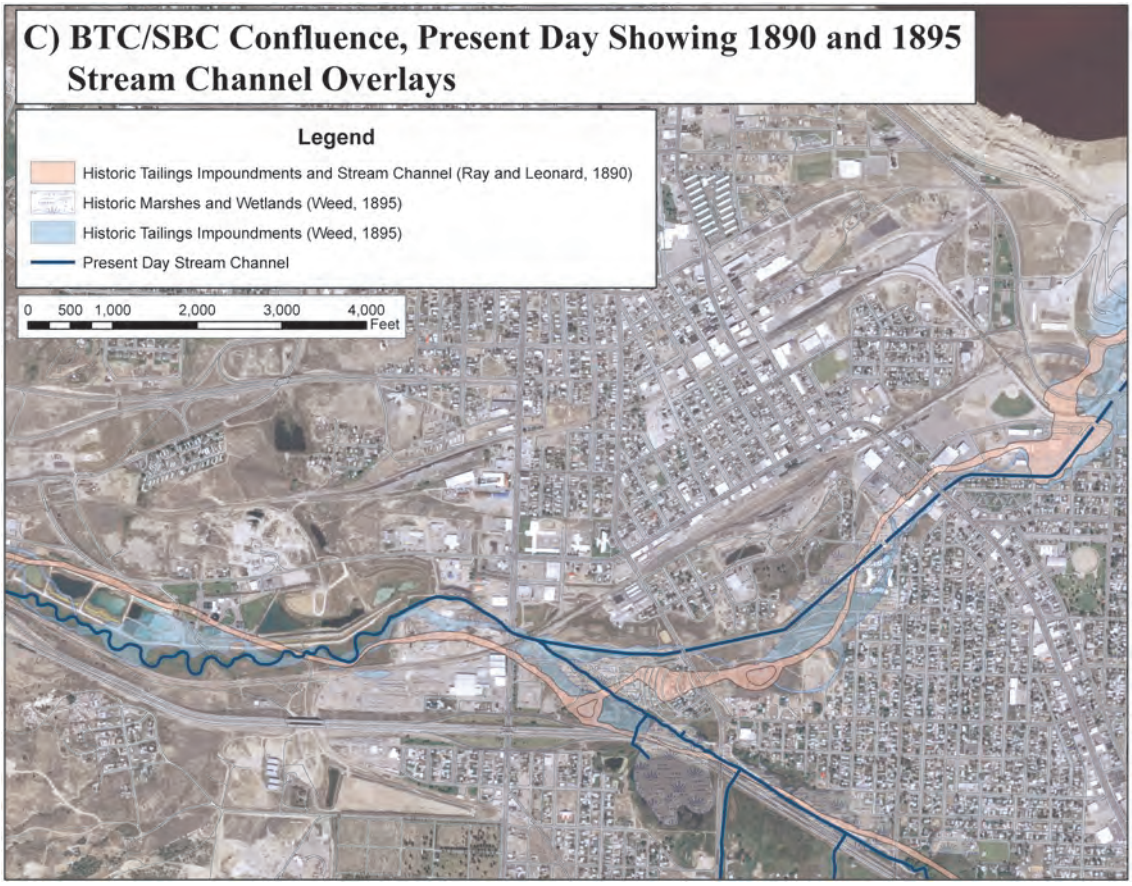


Figure 2, continued.

(Hydrometrics, 1983). Although Grove Creek is an ephemeral stream, large to moderate runoff events (fig. 3) that occurred prior to reclamation activities transported large volumes of tailings downstream, causing degradation in Blacktail Creek. Today the Clark Tailings are reclaimed and are part of a capped repository; however, the historic metal-laden tailings deposits to lower Grove Gulch and Blacktail Creek in streambank and streambed sediments may still be a point source of contamination to surface water.

Figure 3. Grove Gulch streamflow at Rowe Road during a large run-off event in 1995. Picture taken at the gauging station on the south side of Rowe Road shows streamflows overtopping the weir. Historically (pre-1982), large sediment loads were transported into Blacktail Creek during similar events.

Two large-scale remedial actions were implemented in upper Grove Gulch. The Grove Creek Flood Prevention Project was constructed in 1982 to correct flooding and sediment deposition problems caused by the historic placement of the Clark Tailings in the stream's floodplain. Prior to this construction, materials that eroded from the Clark Tailings site were transported and deposited downstream to lower Grove Creek and Blacktail Creek (Hydrometrics,

1983). A 1-million cubic yard stabilized mine waste impoundment and a low-permeability cap were constructed to permanently contain the Clark Tailings in 1998 (Archibald and others, 2003). The tailings that deposited in lower Grove Gulch (from the tailings impoundment to the confluence) and within Blacktail Creek have been left in place, and have not been characterized.

1.1.5 Non-mining stream channel management of Blacktail and Silver Bow Creeks

Historic mining practices were not the only anthropogenic activities that altered the hydrology of the area. Interstate 90 (fig. 1) was constructed through the low-lying wetland area in 1962 (Montana Department of Transportation Aerial Photograph, 1962). Most likely both streambeds were manipulated to accommodate for the infrastructure improvement. The weight of the fill and infrastructure, and subsequent compaction of the alluvial material, most likely altered flow paths and mounded groundwater on both sides of the interstate.

Other than the aforementioned construction of the MSD Subdrain, which altered groundwater flow paths and most likely altered stream hydrology, wetlands have been reconstructed in the lower reach of Blacktail Creek. A large restoration project conducted in the late 1990s by the Montana Economic Revitalization and Development Institute enhanced a series of natural wetlands on the north side of Blacktail Creek between Harrison Avenue and George Street (fig. 1). Many of these wetlands receive groundwater originating from the northeastern portion of the Summit Valley and, prior to this investigation, the water quality of these wetlands were unknown.

1.2 Recent Investigations

Comprehensive monitoring programs were established for Blacktail and Silver Bow Creeks as part of ongoing Superfund-related activities. Surface water has been sampled for water quality on a frequent and consistent basis as part of the Consent Decree monitoring plan for the Butte Mine Flooding Operable Unit (BMFOU; EPA, 2002), and as an interim groundwater monitoring plan for BPSOU (EPA, 2012). Surface-water monitoring activities performed under BMFOU have been conducted since 1983; analytical data are available on the USGS website (http://waterdata.usgs.gov/nwis). Monitoring for BPSOU commenced on a more frequent and consistent basis in 2007; the most recent synopsis of these data was published in 2008 [Environmental Protection Agency (EPA), 2008]. Large datasets have been generated from these comprehensive monitoring programs. In addition, data from several narrowly scoped and focused synoptic sampling events conducted by the Montana Bureau of Mines and Geology (MBMG) has been released through informal reports to the Natural Resources Damages Program (NRD; Tucci, 2006, 2007, 2008) Basic data used in these reports also are available at the MBMG's online database (http://mbmggwic.mtech.edu).

Tucci and Icopini (2012) demonstrated that a source of Cu and Zn loading is present in Blacktail Creek between Oregon Avenue and Montana Street (fig. 1). Three unpublished synoptic sampling events conducted between 2006 and 2010 by the MBMG demonstrate similar results. Subsequent synoptic sampling conducted by the USGS (August 2010, unpublished MBMG split sampling data) showed results consistent with those found by Tucci and Icopini (2012). A review of data for BPSOU, a more comprehensive and extensive dataset for surface water, reveals that the impacts to water quality from this source is intermittent (unpublished BPSOU data, Trek Environmental, oral commun., March 25, 2011).

1.3 Objectives

In September 2011, scientists from the MBMG, with assistance from faculty of Montana Tech of the University of Montana, employees of the Montana Department of Environmental Quality (MDEQ), Trek Environmental [consultants for ARCO (AR)], and CDM-Smith (consultants for the EPA) conducted a series of surface-water/groundwater interaction investigations in Lower Blacktail and Upper Silver Bow Creeks in Butte, Montana. These investigations included synoptic groundwater sampling, streambed drivepoint sampling, and surface-water sampling of mainstem, tributaries, and wetlands samples. These activities were conducted during a continuous-injection sodium bromide (NaBr) tracer investigation in Lower Blacktail and Upper Silver Bow Creeks. The

main objectives of the work were to:

(1) Characterize gaining reaches of Blacktail Creek and Silver Bow Creek,

(2) Determine the quantity and quality of groundwater entering the stream within this reach,

(3) Characterize the water quality of tributaries entering the stream in this reach,

(4) Isolate the reach of Blacktail Creek receiving Cu and Zn loading, and attempt to determine source areas, and

(5) Quantify and qualify sources of metals loading to Blacktail and Silver Bow Creeks, if possible.

2.0 METHODS

2.1 Field Procedures

To quantify and qualify any sources of metals loading to Blacktail and Silver Bow Creeks, synoptic sampling was conducted during tracer injection under baseflow conditions (September 2011). The continuous tracer injection method (Kilpatrick and Cobb, 1985; Kimball, 1997; Wright and Moore, 2003) produces accurate flow calculations for the quantification of spatial, physical, and chemical profiles in stream environments.

Previous monitoring activity shows that the current study area along Blacktail Creek is a gaining reach. During baseflow conditions, significant increases in flow (20–40%) have been observed within the reach between Harrison Avenue and George Street (Unpublished BPSOU data, Trek Environmental, written commun., March 25, 2011). Both groundwater and surface water (Sand Creek, Grove Gulch, and numerous wetlands to the north and south of Blacktail Creek) inputs exist, all of which present themselves as possible sources of metal loading to Blacktail Creek. The current study was designed to quantify flow in this reach, identify the contribution of various inputs to the creek, and identify possible sources for metal loading.

Field methods and analytical procedures were published (appendix A) prior to the onset of this investigation and submitted for review by the federal (EPA) and State (MDEQ, NRD) agencies. A copy of the sampling and analysis plan (SAP) was also submitted to AR. The published SAP (appendix A), which outlines all field and analytical procedures, is included as appendix A of this report.

2.1.1 Tracer Injection Test

A concentrated bromide stock solution [Br = 312,000 mg/L] was prepared by mixing 220 kilograms (Kg) of sodium bromide with 750 liters (L) of upgradient Blacktail Creek water (fig. 4A). The injection site (fig. 1) was chosen to ensure an adequate mixing zone prior to the first downstream monitoring site. Constant injection rates (0.2 L/min) were maintained using a Cole Palmer L/S variable speed peristaltic pump (fig. 4B); the Br tracer solution was injected via flexible silicone tubing into Blacktail Creek at two points along the same stream transect (fig. 4C). During injection, an ISCO automated sampler was used to collect hourly surface-water samples at a downstream site (Montana Street, fig. 1) on Silver Bow Creek, and a bromide ion-selective probe was used to measure in-stream Br concentrations to ensure Br saturation prior to synoptic sampling.

Tracer injection began on September 20, 2012 at 07:45 h and continued at a constant rate until September 21, 2012 at 16:45 h. The injection rates were measured via bucket-and-stopwatch method at hourly intervals. Synoptic sampling of surface water began on September 21, 2012 at 08:15 h and continued until September 21, 2012 at 13:32 h.

2.1.2 Stream Discharge

Stream discharge was measured at mainstem sites and some tributaries using a SonTek Handheld-ADV FlowTracker. Discharge from small tributary sites (fig. 1; C-5TR, C-8.5 TR) was measured with Parshall flumes. Field crews from MBMG and Trek Environmental were responsible for measuring discharge.

2.1.3 Synoptic Sample Collection

Synoptic water-quality samples of mainstem, tributary, and wetland sites in Blacktail and Silver Bow Creeks were collected by MBMG personnel 24.5 h after tracer injection commenced, and all sampling activities were completed within 5 h. In all, 17 mainstem, 8 tributary, and 2 wetland samples

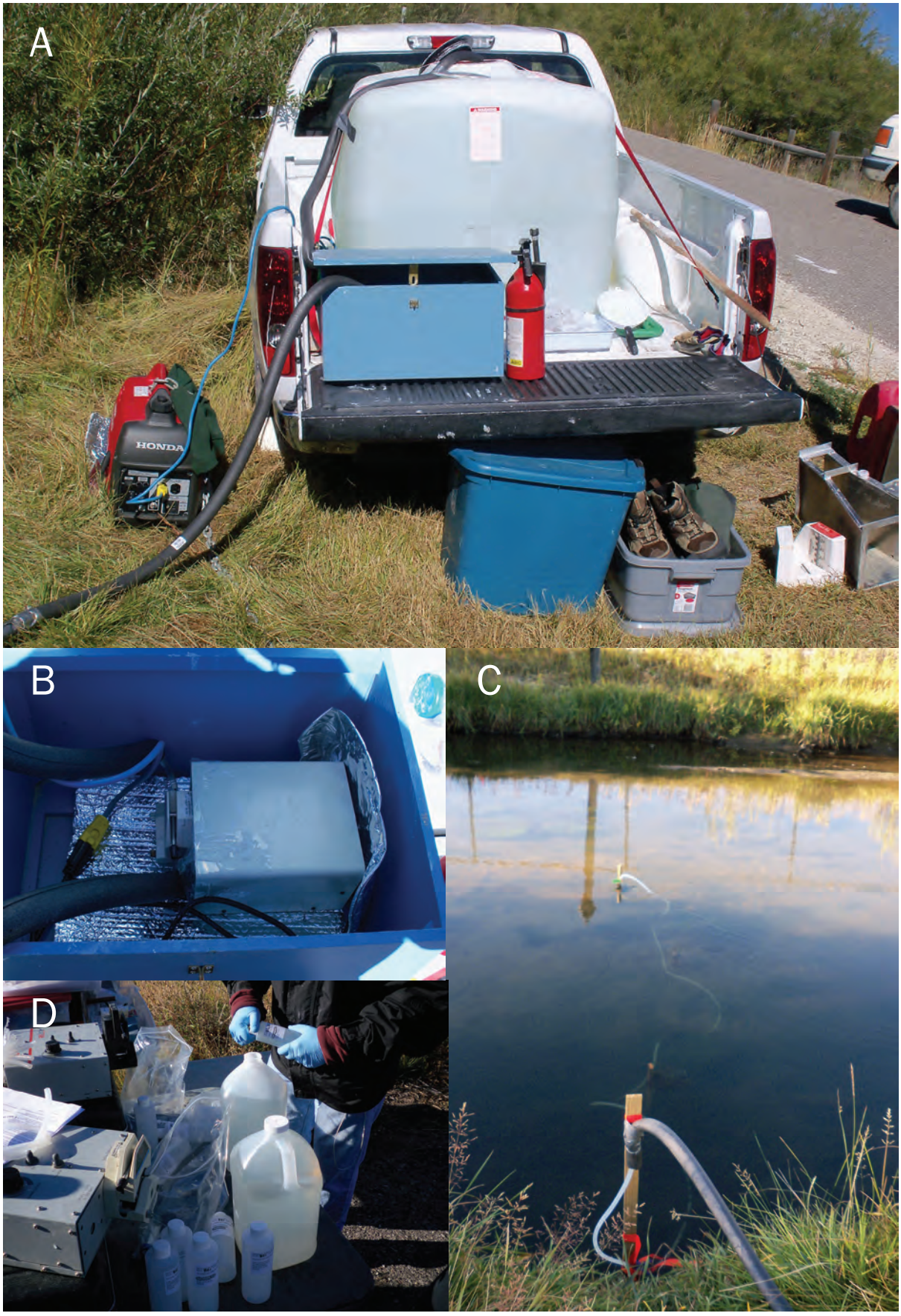


Figure 4. Bromide-tracer injection site on Blacktail Creek: (A) bulk injection tank containing 22.5% Br tracer solution. (B) A constant injection rate (0.2 L/min) was maintained via variable-speed peristaltic pump. (C) Tracer was injected into a stream transect via plastic tube containing two discharge points. (D) Bulk, 1-gal synoptic samples collected by MBMG sampling team were transported to the MBMG sample processing team located at the injection site for processing and preservation.

Table 1. List of synoptic monitoring sites sampled during tracer injection.

GWIC No.	Downstream Distance (ft)	Site	Type	GWIC No.	Downstream Distance (ft)	Site	Type
262809	0	I-0	Mainstem	217884	10,500	SS-06A	Mainstem
262796	967	C-12 US	Mainstem	262795	1,201	C-12 TR	Tributary
262793	1,450	C-12 DS	Mainstem	262812	1,527	SAND CREEK	Tributary
262791	1,760	C-11 US	Mainstem	262790	1,910	C-11 TR	Tributary
262789	2,160	C-11 DS	Mainstem	262808	3,035	C-9 TR GG	Tributary
262807	2,960	C-9 US	Mainstem	262805	3,130	C-8.5 TR	Tributary
262806	3,080	C-9 DS	Mainstem	262803	3,717	C-7.5 TR	Tributary
262804	3,510	C-8	Mainstem	262799	4,770	C-5 TR	Tributary
262801	4,000	C-7	Mainstem	262811	5,343	MSD-B	Tributary
262800	4,235	C-8	Mainstem	262802	3,700	C-7.5 POND	Wetland
262798	4,610	C-9	Mainstem	262795	1,190	C-12 TR	Wetland
262797	5,165	C-10	Mainstem	262795	1,201	C-12 TR	Drivepoint
127593	5,470	C-11	Mainstem	262805	3,130	C-8.5 TR	Drivepoint
262810	5,800	C-12	Mainstem	262804	3,510	C-8	Drivepoint
127536	6,380	C-13	Mainstem	262803	3,717	C-7.5 TR	Drivepoint
249187	7,815	C-14	Mainstem	262800	4,235	C-6	Drivepoint

(fig. 1; table 1) were collected using techniques outlined in appendix A. Mainstem samples are defined as composite water samples collected from in-stream sampling locations, in either Blacktail or Silver Bow Creeks. Known tributary locations were bracketed by mainstem sites (fig. 1) in an attempt to differentiate between surface-water and groundwater contributions of discharge to the stream. Bulk 1-gal water-quality samples collected from each site were transported by an MDEQ representative to the MBMG sampling team located at the injection site (fig. 4D). Samples were collected in a downstream-to-upstream order.

Baseline groundwater sampling of monitoring wells (fig. 1) located adjacent to Blacktail and Silver Bow Creeks occurred in February 2011, 6 months prior to the tracer injection. The time lapse between the groundwater sampling and the injection test occurred because inclement weather conditions and abnormally high baseflows in the creek prevented tracer injection until September, when true baseflow conditions were observed. During injection, a field crew from CDM-Smith performed synoptic drivepoint groundwater sampling of streambanks (fig. 5). Streambank groundwater samples were collected using a custom-built stainless steel drivepoint sampling apparatus and a peristaltic pump (fig. 5). Bulk drivepoint samples were transported to the injection site, where aliquots were processed.

2.2 Quantification of Stream Gain

Quantification of metal loads in surface water requires accurate stream discharge measurements that are often difficult to obtain. Flow in gaining intermontane streams can be measured precisely by adding a dye or salt tracer to a stream, measuring the dilution of the tracer as it moves downstream, and calculating the change in flow discharge by the amount of dilution.

Stream discharge is calculated from a tracer injection by the conservation of mass; the mass injected by the pump equals the mass in the stream after accounting for the background concentration. A sodium bromide tracer of 311,860,000 mg/L (22.5% wt/wt) was injected at a constant rate into Blacktail Creek, starting at 7:45 on September 20, 2011. The mass of a tracer or a metal (in mg/s) is the product of the discharge (in L/s) and concentration (in mg/L).

Figure 5. Synoptic drive-point samples of streambank groundwater were collected at five locations during the tracer test. (A) CDM-Smith representative pushing sampler into streambed sediment. (B) CDM-Smith representative attaching tubing to sampler head. Samples were purged via peristaltic pump into bulk 1-gal containers.

Rearranging the equation for the conservation of mass, the flow in the stream downstream from the injection site is:

$$Q_S = \left(\frac{QiCi}{C_B - C_A}\right),$$

where Qs is the discharge of the stream, in L/s; Qi is the discharge of the injection solution, in L/s; Ci is the tracer concentration in the injectate solution, in mg/L; C_B is the tracer concentration in the stream downstream from the injection, in mg/L; and C_A is the background concentration of the tracer in the stream upstream from the injection point in mg/L (Kimball and others, 2001).

Background Br concentrations were determined by reviewing historic water-quality reports at sites within the study area (Blacktail Creek @ Oregon, SS-04, and SS-05; GWIC, 2012), an analysis of pre-synoptic surface-water samples with a Br ion-selective probe, and the Br concentration at a site upgradient of the tracer injection site. A review of background Br concentrations in Blacktail Creek revealed that concentrations between Oregon Avenue and Montana Street are below 0.10 mg/L. Using these three techniques, a background concentration of 0.087 mg/L Br was calculated.

3.0 RESULTS

All field and laboratory data collected in this study are available in appendix B (groundwater), appendix C (synoptic sampling data during tracer injection), and appendix D (FlowTracker discharge reports). All chemical analysis of groundwater and surface-water data gathered during this investigation can be found on the MBMG Ground Water Information Center's projects page, Superfund group data, under the name BPSOU2011BTS (http://mbmggwic.mtech.edu). Results of the tracer injection and chemical analysis are presented graphically in figure 6.

Tracer injection began on September 20, 2012

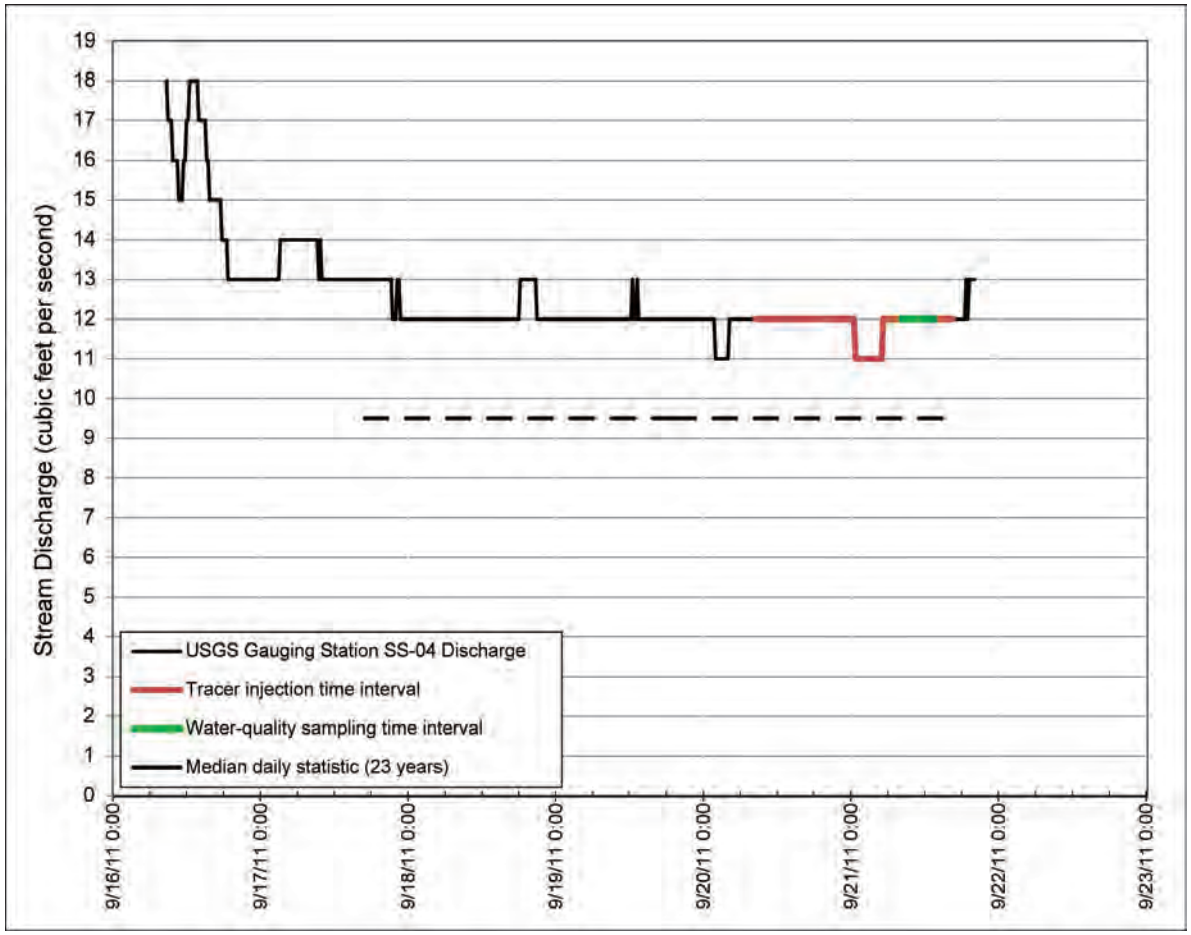


Figure 6. Stream discharge (cubic feet per second) hydrograph for Blacktail Creek at USGS Gauging Station SS-04. Baseflow conditions were observed in Blacktail Creek between September 17, 2012 and September 21, 2012 during tracer injection (shown in red) and synoptic surface-water sampling (shown in green). Streamflow data available at USGS online database (http://waterwatch.usgs.gov/new/index.php).

at 07:45 h and continued at a constant rate until September 21, 2012 at 16:45 h. Synoptic sampling of surface water began on September 21, 2012 at 08:15 h and continued until September 21, 2012 at 13:32 h. Typically, baseflow conditions in Blacktail Creek range between 8 and 12 cfs, and the 23-y daily mean value is 9.5 cfs; baseflow during this test was on the upper end (12 cfs). Baseflow conditions were observed in Blacktail Creek for 4 days prior to the initiation of the tracer injection, and Blacktail Creek remained at baseflow until after sampling was completed; small amplitude diel fluctuations in flow were observed throughout the duration of the experiment (fig. 6).

3.1 Tracer Injection

Tracer injection rates were measured in triplicate with a graduated cylinder throughout the duration of the experiment. Data demonstrated low percent error (2.6%) between triplicate measurements and indicate that constant injection rates (~0.2 L/min) were maintained (fig. 7). Analysis of hourly ISCO samples collected at Montana Street (SS-05) indicate that travel time in Blacktail and Silver Bow Creeks between the injection site (upgradient of Oregon Avenue) and Montana Street was roughly 5.0 h (fig. 7). The bromide tracer concentration reached steady-state conditions at Montana Street approximately 11 h after the injection began (fig. 7).

Bromide concentrations in mainstem, tributary, wetland, and drivepoint samples are shown in figure 8B. The precision of analysis for the Br tracer was used to determine significant changes downstream. A difference in Br concentrations had to exceed 8% (represented by error bars) to be considered a real increase in flow, whereas minor differences (<8.4%) in concentrations were considered experimental error. Some sampling sites exhibited Br concentrations that were greater than upgradient Br concentrations (i.e., SS-04.5–SS-04; SS-05–SS-05A); however, the differences between sites were less than 3 percent, and considered to be within the margin of error.

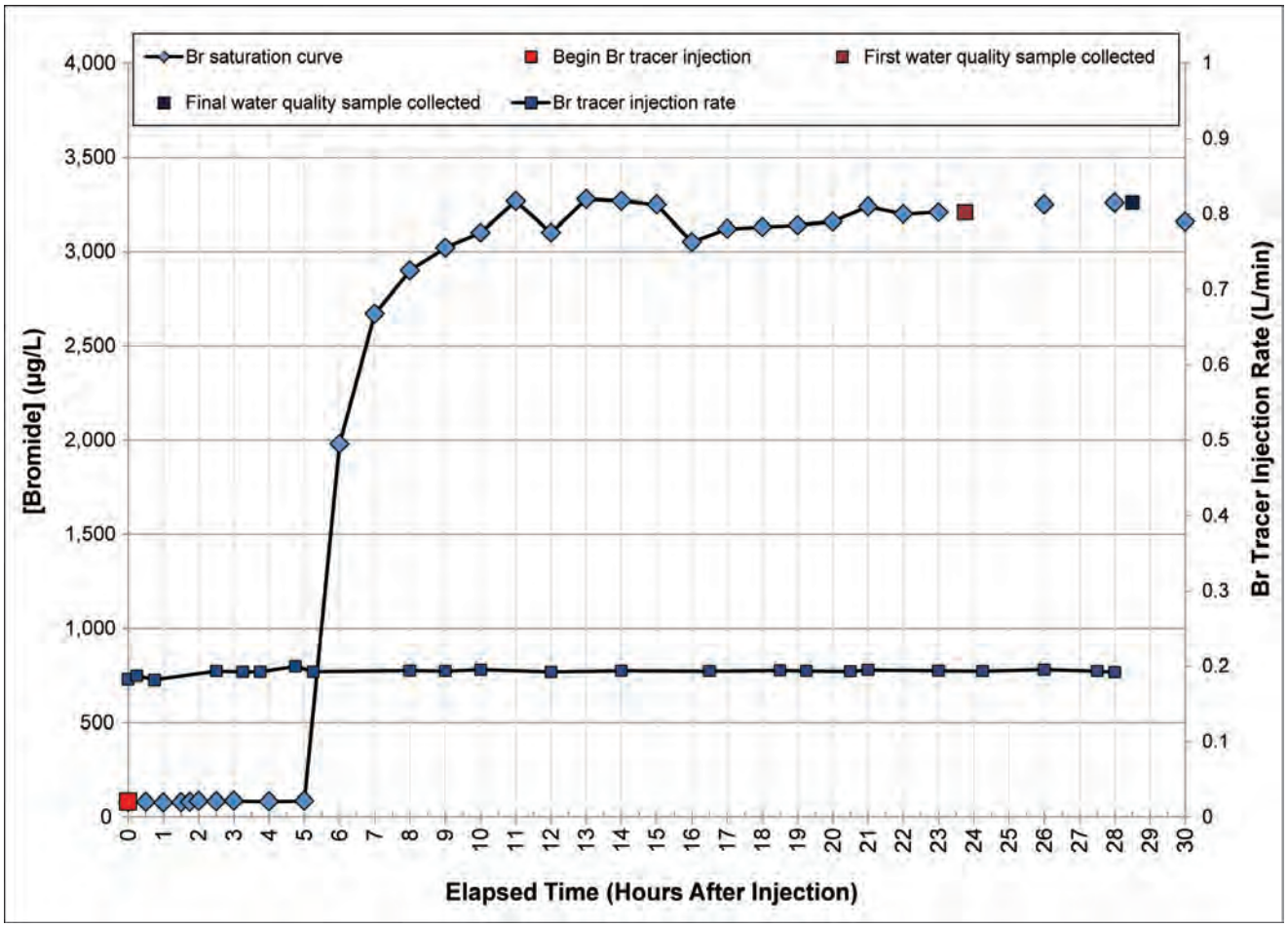


Figure 7. Tracer injection rates (L/min) and changes in concentrations of dissolved Br versus time in ISCO samples collected in SBC at Montana Street.

The dissolved Br concentrations decreased by 20 percent (between Oregon Avenue and 5,165 ft downstream of the tracer injection, site C-4.5). Downstream of sampling station C-4.5 (5,165 ft), dissolved Br concentrations in mainstem samples remain stable, indicating that Blacktail and Silver Bow Creeks were either non-gaining or net-losing reach beyond this station. Concentrations of Br in wetland and drivepoint samples were consistent with background concentrations. Three tributary sites (C-12 TR, Sand Creek, and C-9 TR GG) exhibited elevated Br concentrations (fig. 8B). Elevated Br concentrations may be an indication that Blacktail Creek is losing to tributaries C-12TR (wetland), Sand Creek, and C-9 TR (Grove Gulch).

3.2 Stream Discharge

Measured discharge (green) and calculated discharge (red) at mainstem sites are plotted against downstream distance (from right to left, consistent with flow in map) in figure 8C. Discharge values calculated from tracer-concentration data give a continuous accounting of stream gain, but cannot account for stream loss. The increase in discharge between two stream sites represents the total inflow from surface and subsurface sources to the stream. Stream loss was determined through a review of the FlowTracker data and statistical error. Discharge data are provided in tabular form in figure 8A for comparative purposes.

Error bars associated with each manual discharge measurement (5%) were determined from the FlowTracker data reports (appendix D). Two types of error, observational (Br-injection rates) and instrumental (ICP-MS), were used to estimate the uncertainty associated with calculated discharge value. The error associated with the calculated discharge values (8.4%) were determined using an arithmetic calculation of error propagation (Bevington and Robinson, 1992), assuming a calculated error of 2.6% for the injection rate and an estimated error of 8% for the bromide concentration.

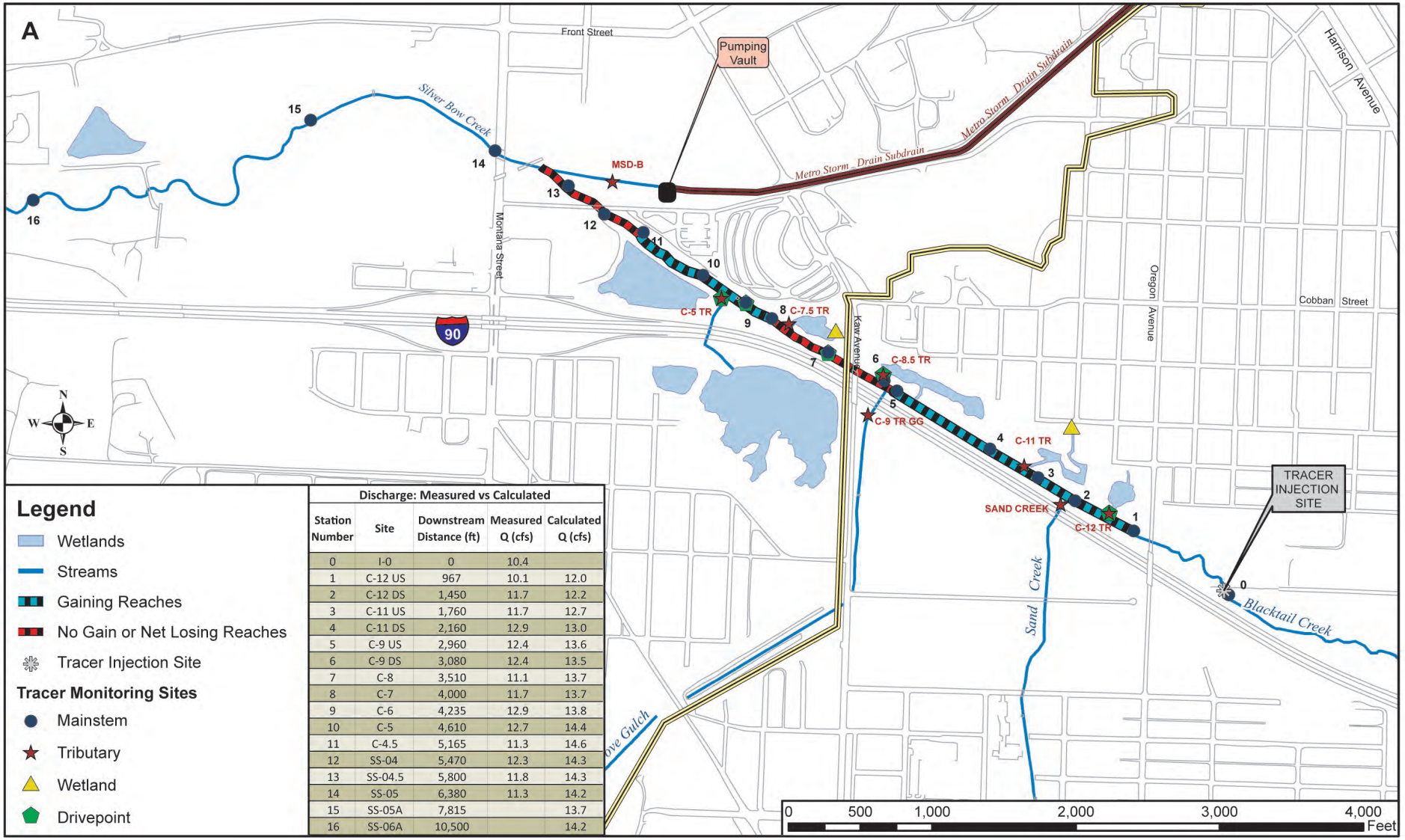
Flow measurements from tributary inputs (i.e., wetlands and streams) are presented in table 2. Overall, manual measurements of flow in tributaries were difficult to perform. In order to obtain more accurate and precise measurements, Parshall flumes were installed in selected tributaries (C-8.5 TR and C-7.5 TR). Discharge measurements on remaining tributaries were performed using a SonTek Flow Tracker. Errors associated with FlowTracker measurements in tributaries varied considerably (appendix D), and sometimes resulted in statistically invalid data. The quality of each discharge measurement was evaluated (table 2); data associated with high percent errors (C-12TR and C-9.5TR GG, >100% errors) were flagged as poor quality. Discharge was not measured in Sand Creek or the Metro Storm Drain (site MSD-B), due in large part to poor gauging conditions and interferences from low-flow conditions.

In total, surface-water contributions from tributaries with detectable flow (table 2, C-11 TR, C-8.5 TR, C-7.5 TR, and C-5TR) accounted for 0.84 cfs, or 39 percent of the total gains observed over the study area. It is assumed that the remainder of gain (61%) observed throughout the Blacktail Creek study area were direct inputs to the stream from groundwater sources. It is important to note that all tributaries that had detectable flow were wetlands that are, by definition, surface-water expressions of groundwater (received the majority of recharge from local groundwater sources).

The uncertainty in gauging flow in four tributaries [C-12TR, Sand Creek, Grove Gulch (C-9TRGG), and MSD-B] was too large to ascertain flow conditions from discharge data. However, flow conditions in these tributaries could be inferred using other data. Significantly elevated Br concentrations observed in samples from these tributaries (fig. 8B,

Table 2. Measured discharge at tributary sites.

Site	Downstream Distance (ft)	Q (cfs)	Method	Quality
C-12 TR	1,201	-2.97E-02	FT*	Poor
SAND CREEK	1,527	—	ND**	
C-11 TR	1,910	1.81E-01	FT*	Ok
C-9 TR GG	3,035	-5.40E-03	FT*	Poor
C-8.5 TR	3,130	2.59E-01	Flume	Good
C-7.5 TR	3,717	4.32E-02	Flume	Good
C-5 TR	4,398	3.57E-01	FT	Ok
MSD-B	5,343	—	ND**	



Legend

- Wetlands
- Streams
- Gaining Reaches
- No Gain or Net Losing Reaches
- Tracer Injection Site

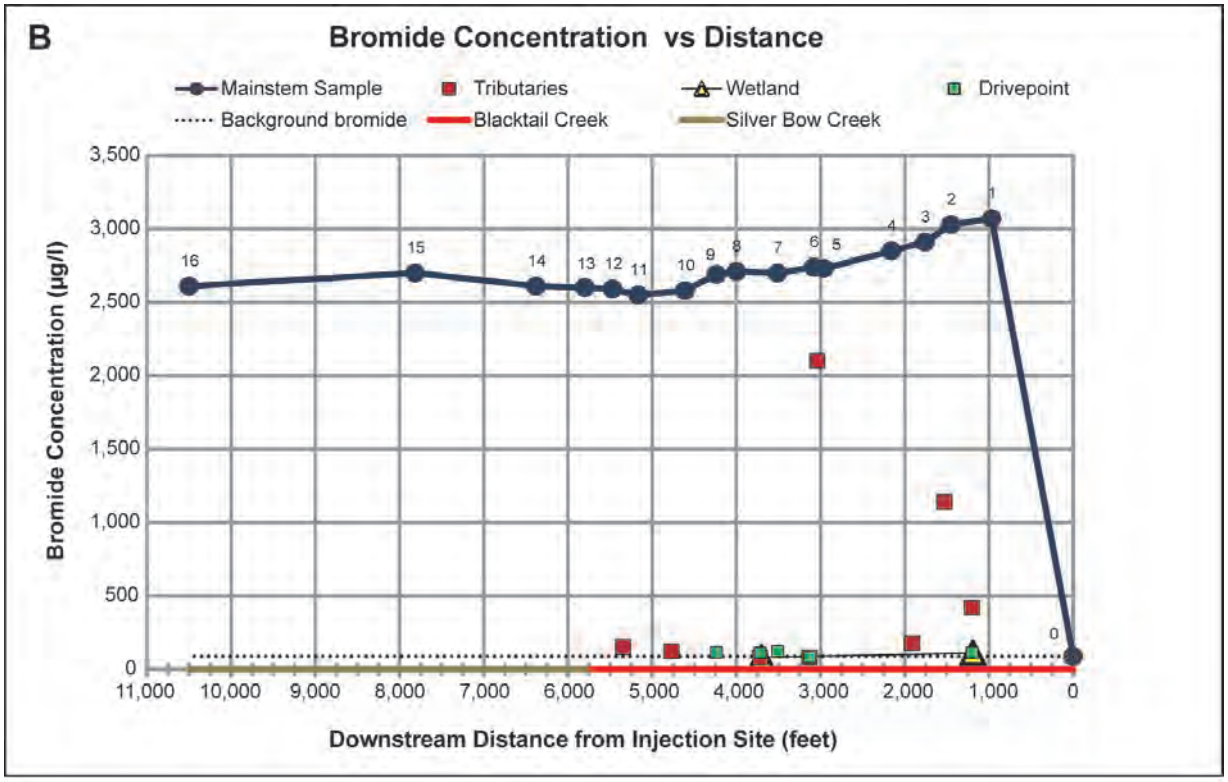
Tracer Monitoring Sites

- Mainstem
- Tributary
- Wetland
- Drivepoint

Discharge: Measured vs Calculated

Station Number	Site	Downstream Distance (ft)	Measured Q (cfs)	Calculated Q (cfs)
0	I-0	0	10.4	
1	C-12 US	967	10.1	12.0
2	C-12 DS	1,450	11.7	12.2
3	C-11 US	1,760	11.7	12.7
4	C-11 DS	2,160	12.9	13.0
5	C-9 US	2,960	12.4	13.6
6	C-9 DS	3,080	12.4	13.5
7	C-8	3,510	11.1	13.7
8	C-7	4,000	11.7	13.7
9	C-6	4,235	12.9	13.8
10	C-5	4,610	12.7	14.4
11	C-4.5	5,165	11.3	14.6
12	SS-04	5,470	12.3	14.3
13	SS-04.5	5,800	11.8	14.3
14	SS-05	6,380	11.3	14.2
15	SS-05A	7,815		13.7
16	SS-06A	10,500		14.2

Figure 8. Map of study area (A), with bromide concentrations in primary, tributary, drivepoint, and wetland synoptic samples (B), and calculated vs. measured discharge (C) during tracer injection. Distance from tracer injection (B and C) are plotted in reverse order, consistent with the direction of streamflow. BTC ID numbers are provided on A, B, and C for comparison. Calculated charges (C) obtained via tracer dilution method using known tracer injection rates and in-stream concentrations of bromide. Gaining reaches are depicted in A. Measured discharges (C) obtained via SonTek FlowTracker flowmeter.



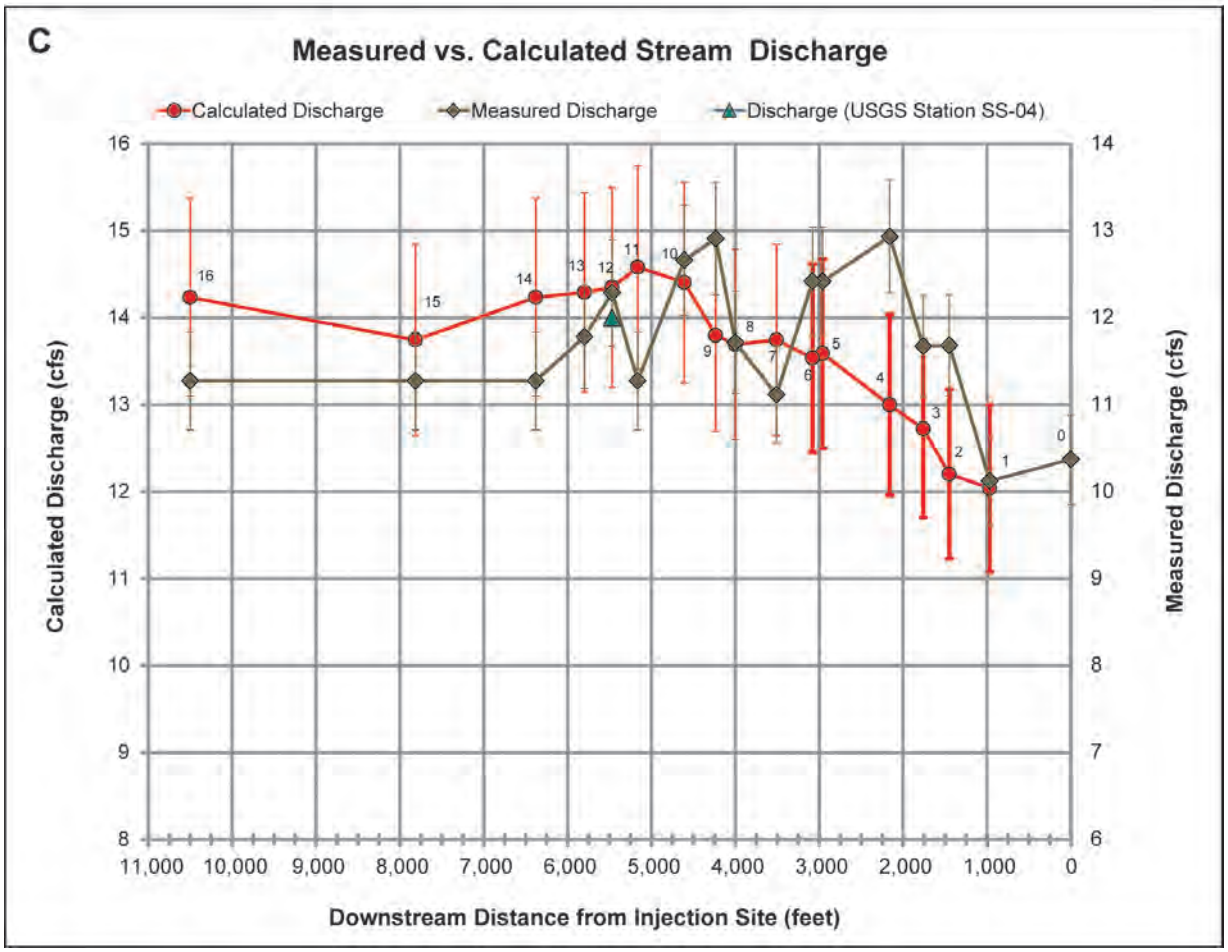


Figure 8, continued.

orders of magnitude above all other Br concentrations) may be an indication that Blacktail Creek is losing flow to three tributaries: C-12 TR, Sand Creek, and Grove Gulch (C-9 TR GG). Elevated Br concentrations were not detected in the MSD sample (MSD-B), which indicates that Blacktail Creek is not losing to the MSD channel.

Combined, all methods of discharge measurement indicate that:

- Discharge in Blacktail Creek increased 2.2 cfs (22%) across the BTC study area.
- The majority (61%) of gains observed in Blacktail Creek were from direct groundwater inputs into the stream. The remainder of inputs were from adjacent wetlands under the influence of groundwater.
- Blacktail Creek in the reach between sampling stations 1 and 5 (fig. 8A, C-12US to C-9 US) is a gaining stream (as denoted by blue/black dashed line in fig. 8A), receiving inputs almost exclusively from groundwater with minor surface-water contribution (<10%, C-11 TR).
- Blacktail Creek in the reach between sampling stations 5 and 8 (fig. 8A, C-9 US to C-7) was either a non-gaining or net-losing reach (as denoted by red/black dashed line in fig. 8A), and was potentially losing a significant amount of flow to Grove Gulch (based upon elevated Br concentrations in Grove Gulch sample).
- Blacktail Creek in the reach between field stations 8 and 11 (fig. 8A, C-7 to C-4.5) was a gaining reach (as denoted by blue/black dashed line in fig. 8A), receiving inputs from groundwater and surface-water sources.
- Blacktail Creek is either a non-gaining or net-losing reach downstream of field station 11 (fig. 8A, site C-4.5, as denoted by the red/black dashed line).
- Flow increases were not observed in the studied reach of Silver Bow Creek.

3.3 General Trends in Synoptic Data

Mainstem sampling operations took roughly 6 h to complete, began at the farthest downstream site (at 08:15 h), and finished at the tracer injection site (at 13:03 h). Other than water temperature, diel fluctuations in physical parameters were not observed over the sampling duration. In general, pH (range: 7.18–7.69), specific conductivity (SC) (range: 300–324 µs/cm), and Eh (range: 359–406 mV) remained stable in mainstem samples collected during the synoptic event (fig. 9A). Subsequently, concentrations of hardness remained consistent with one another over the study site, while water temperatures increased 6°C (consistent with increasing air temperature) over the sampling duration (fig. 9B).

Downward trends in dissolved oxygen (DO) concentrations are shown with stable trends in dissolved organic carbon (fig. 10A). As expected, diel fluctuations in DO are consistent with temperature fluctuations (fig. 9B). Generally, stable trends were observed for concentrations of most major cations and anions except Na and Cl (fig. 10B).

3.4 Downstream Trends of Copper and Zinc Concentrations

Downstream trends for Cu (fig. 11B, total recoverable and dissolved) and Cu loading (fig. 11C) are presented. Upgradient (upstream of injection site) Cu concentrations in mainstem samples during synoptic sampling were 1.4 µg/L (dissolved) and 2.5 µg/L (total recoverable). Overall, concentrations of Cu in mainstem samples increased through the study area (dissolved = 1.4–3.6 µg/L; total recoverable = 2.5–7.9 µg/L); however, all dissolved Cu concentrations and most total recoverable (TR) Cu concentrations remained below MDEQ-7 acute and chronic aquatic-life hardness-based standards for copper (MDEQ, 2010). Increased TR Cu concentrations were observed in samples collected near Kaw Avenue, between C-11 US and C-7. The Kaw Avenue reach was the only area in either stream where mainstem samples exceeded acute and chronic DEQ-7 aquatic-life standards for TR copper (C-9 US, station 5; fig. 11A). Samples from two tributary (C-5 TR and MSD-B; fig. 10) and one wetland (near Kaw Avenue; fig. 10) had concentrations of TR Cu

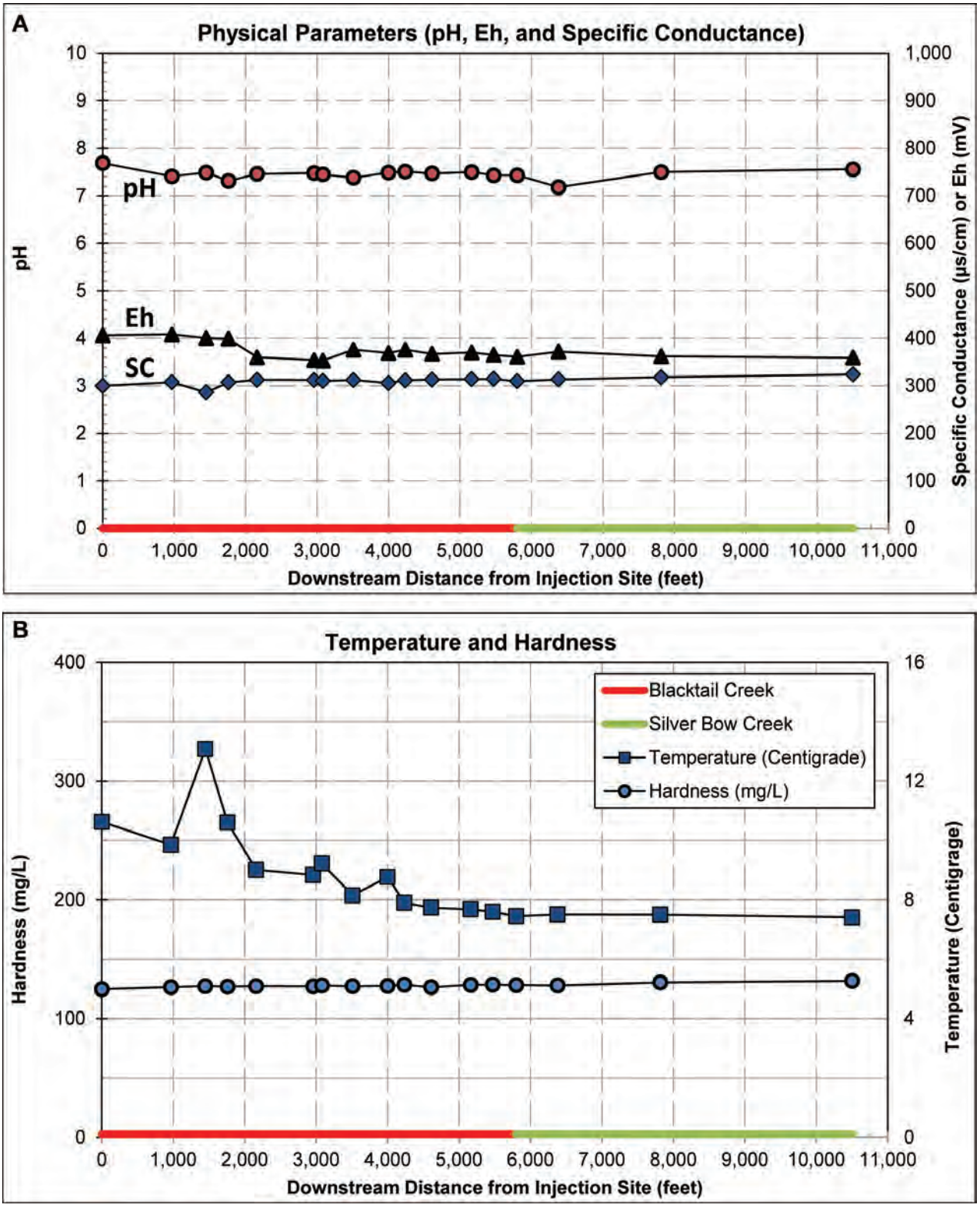


Figure 9. Distance from injection site versus: (A) pH, SC, and Eh; and (B) hardness and water temperature measured in synoptic samples collected on September 21, 2012.

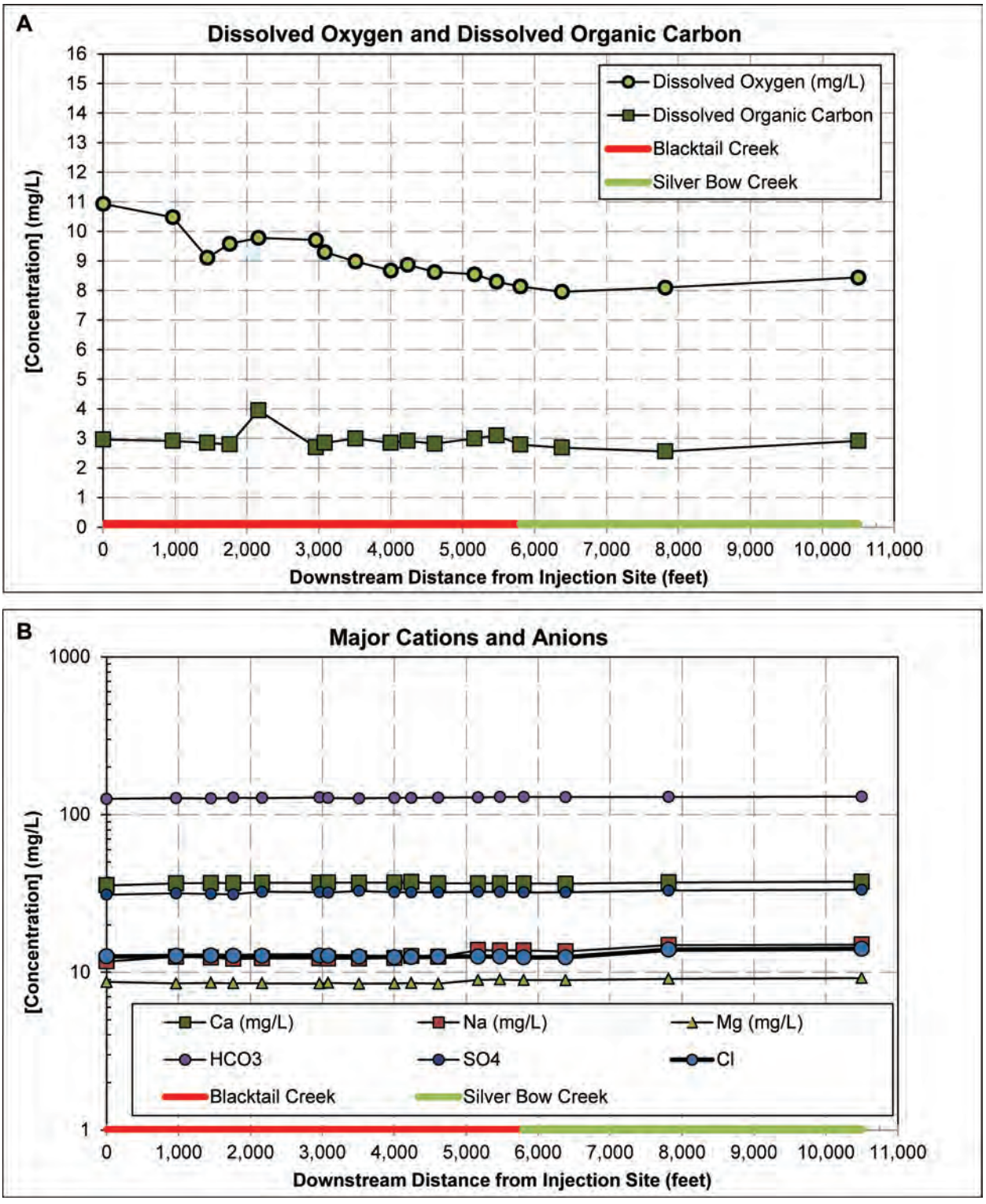


Figure 10. Distance from injection site versus: (A) DO and dissolved organic carbon, and (B) major cations (Ca, Na, Mg) and anions (Cl, HCO3, and SO4) in synoptic samples collected on September 21, 2012.

that exceeded acute and chronic aquatic-life standards (MDEQ, 2010). Samples from two tributaries (TR-8.5TR and MSD-B; fig. 12A) exhibited concentrations of TR Cu that exceeded acute and chronic aquatic-life standards (MDEQ, 2010). Elevated concentrations of Cu in streambed and bank sediments are a likely explanation for increased TR concentration of Cu observed in mainstem water samples, but not for Cu and Zn concentration in the tributaries. Groundwater quality entering the two wetlands to the north of Blacktail Creek (near Kaw Avenue, fig. 1) was not assessed in the current investigation, and could also be potential sources for contamination.

Downstream trends in copper loading in mainstem samples are shown in figure 11B. Upgradient (upstream of injection site) Cu loads were calculated to be 0.1 lb per day (dissolved) and 0.15 lb per day (TR). Cu load doubled within Blacktail Creek reaches below the injection site (0.1 to 0.28 lb/day), and increased by a factor of four in total recoverable samples (0.15 to 0.61 lb/day). Large increases in TR Cu load consistent with observations noted for Cu concentrations are observed in the Kaw Avenue reach of Blacktail Creek.

Trends observed in mainstem samples for dissolved and TR Zn concentration (fig. 12A) were consistent with those observed for copper. Upgradient (upstream of tracer injection) Zn concentrations in mainstem samples were 1.5 µg/L (dissolved) and 2.3 µg/L (TR). Concentrations of Zn in mainstem samples increased through the study area (dissolved, 1.5–12.8 µg/L; TR, 2.3–18.8 µg/L); all concentrations remained below MDEQ-7 acute and chronic aquatic-life hardness-based standards (MDEQ, 2010). Increases in TR Zn were observed in samples collected near Kaw Avenue, between C-11DS and C-7, consistent with the trends observed in copper. Unlike Cu, dissolved and total Zn concentrations in most tributary samples (C-12 TR, C-11TR, C-8.5TR, C-7.5, C-5TR, and MSD-B; fig. 11A) were elevated above those from mainstem samples. Two tributary samples (C-8.5 TR and MSD-B) had TR Zn concentrations that exceeded acute and chronic aquatic-life standards for Zn (MDEQ, 2010). Concentrations of dissolved Zn in two drivepoint samples were elevated above that from surface-water samples, but below DEQ-7 standards (C-8.5 and C-7.5).

Zinc loading in mainstem samples is shown in figure 11B. Background Zn loads were observed at 0.1 lb per day (dissolved) and 0.15 lb per day (TR). Dissolved (0.1–1.0 lb/day) and TR (0.15–1.44 lb/day) Zn load increased by an order of magnitude across the study area. Large increases in TR Zn load, consistent with observations noted for Zn concentrations, were observed in the Kaw Avenue reach of Blacktail Creek.

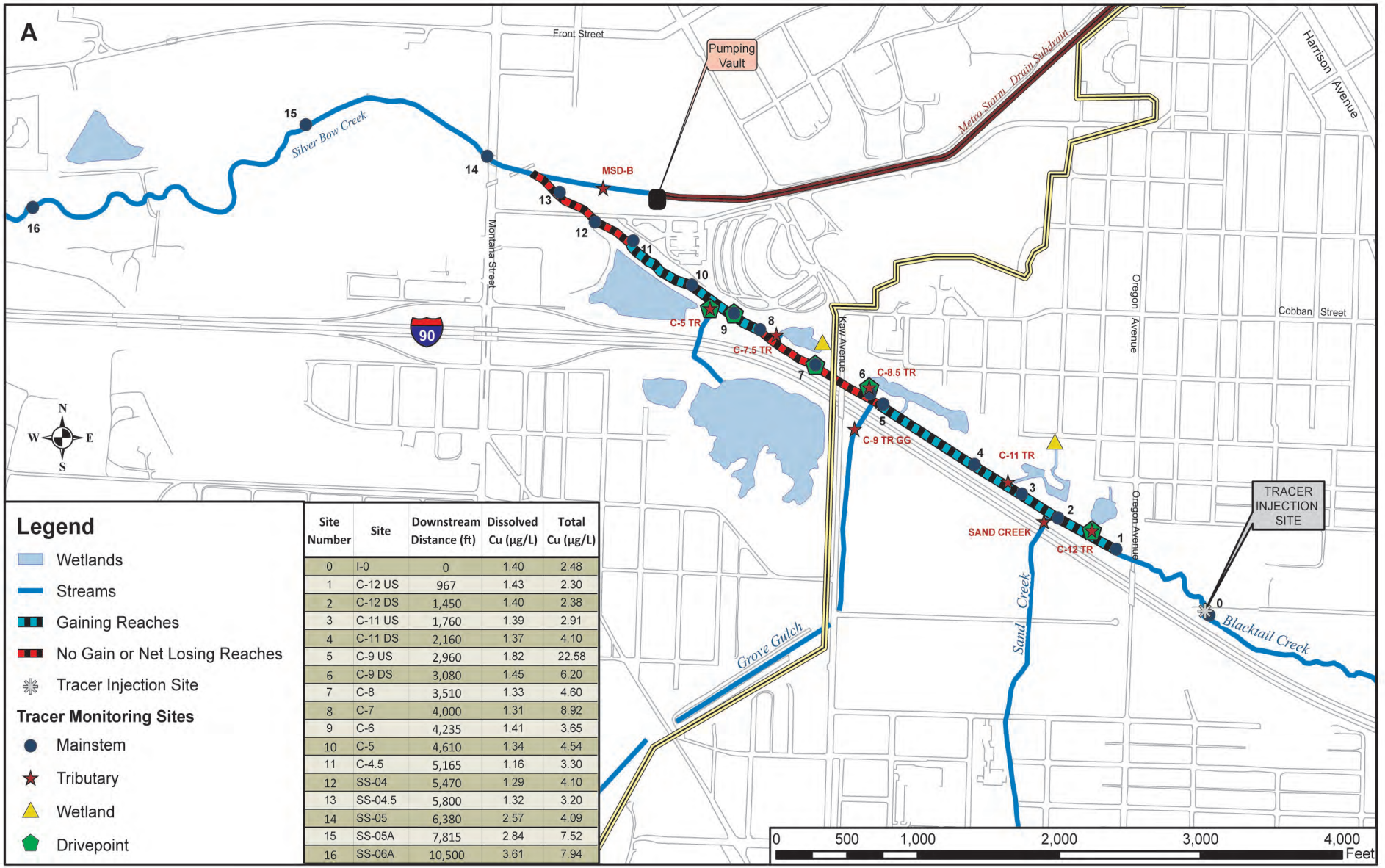
4.0 DISCUSSION

4.1 Tracer Study

Review of the stream hydrograph at USGS gauging station SS-04 (fig. 5), Br-tracer injection rates, and the downstream Br concentration curve at Montana Street (fig. 6) suggest that:

- Baseflow conditions were present for 4 days prior to the initiation of the experiment,
- Baseflow conditions were observed throughout the tracer injection and synoptic sampling,
- Diel fluctuations in flow were minimal throughout the experiment;
- Travel times of the tracer between Oregon Avenue and Montana Street in Blacktail and Silver Bow Creeks are on the order of 5 h,
- Near-constant Br concentrations from samples collected at Montana Street were observed prior to, and maintained during, all synoptic sampling activities, and
- Constant tracer injection rates (0.2 L/min) were maintained.

Combined, these data suggest that the requirements necessary to conduct a tracer injection experiment were fulfilled, and the test was conducted under optimal conditions. For the purposes of this study, synoptic means that all samples were collected during a 5-h window during the time that Br concentrations and diel fluctuations of physical parameters in Silver Bow Creek were constant.



Legend

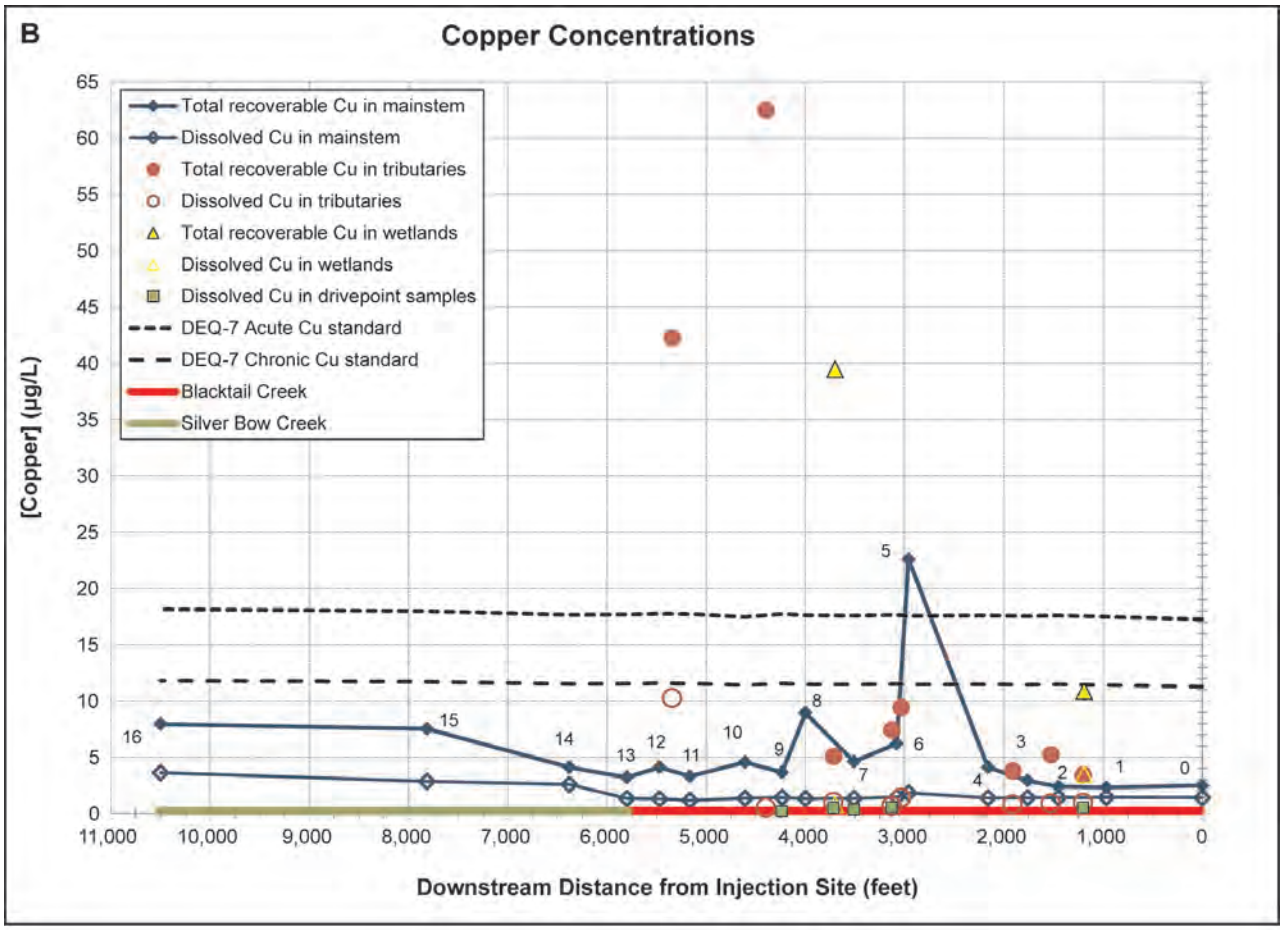
- Wetlands
- Streams
- Gaining Reaches
- No Gain or Net Losing Reaches
- Tracer Injection Site

Tracer Monitoring Sites

- Mainstem
- Tributary
- Wetland
- Drivepoint

Site Number	Site	Downstream Distance (ft)	Dissolved Cu (µg/L)	Total Cu (µg/L)
0	I-0	0	1.40	2.48
1	C-12 US	967	1.43	2.30
2	C-12 DS	1,450	1.40	2.38
3	C-11 US	1,760	1.39	2.91
4	C-11 DS	2,160	1.37	4.10
5	C-9 US	2,960	1.82	22.58
6	C-9 DS	3,080	1.45	6.20
7	C-8	3,510	1.33	4.60
8	C-7	4,000	1.31	8.92
9	C-6	4,235	1.41	3.65
10	C-5	4,610	1.34	4.54
11	C-4.5	5,165	1.16	3.30
12	SS-04	5,470	1.29	4.10
13	SS-04.5	5,800	1.32	3.20
14	SS-05	6,380	2.57	4.09
15	SS-05A	7,815	2.84	7.52
16	SS-06A	10,500	3.61	7.94

Figure 11. Map of study area (A), with dissolved and total recoverable Cu concentrations (B), and Cu loading analysis (C) for mainstem, tributary, wetland, and drivepoint samples. Site ID numbers are plotted onA, B, and C for comparison purposes. Gaining reaches of Blacktail Creek are shown. Dissolved and total recoverable Cu concentrations are shown in table. Distance from tracer injection are plotted (B and C) in reverse order. Hardness-based DEQ-7 acute and chronic aquatic-life standards presented in B. Cu loading analyses (C) were calculated using calculated discharges from tracer dilution method.



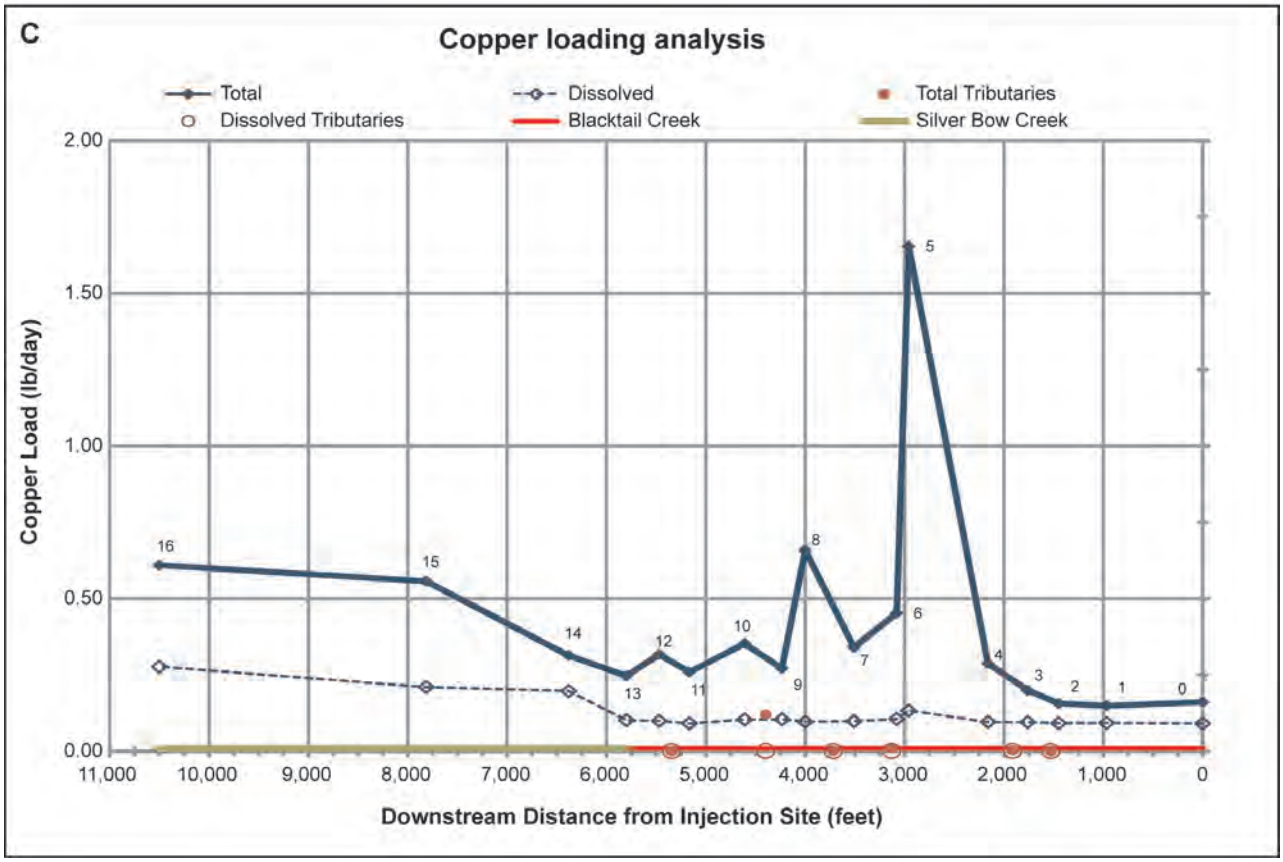
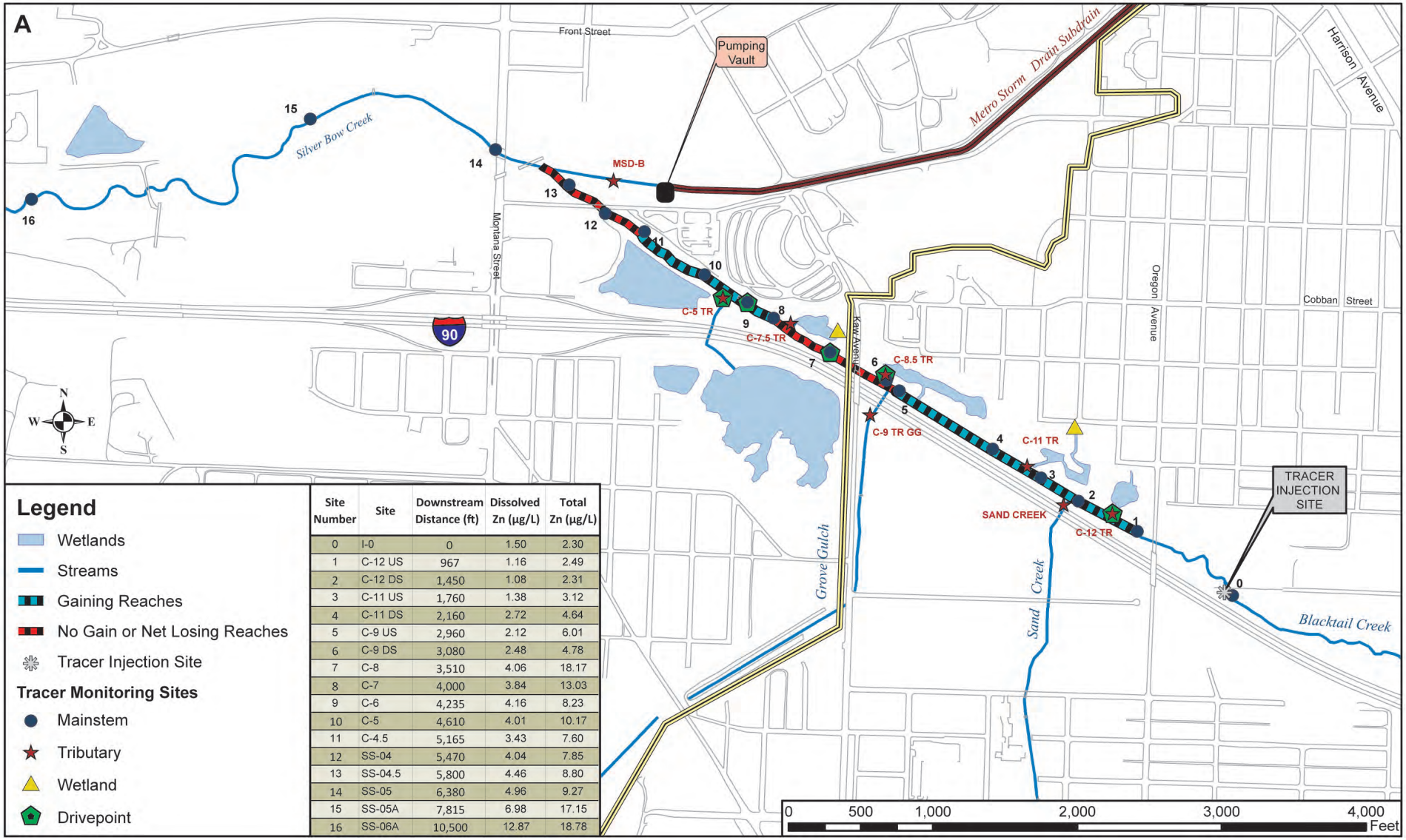


Figure 11, continued.



Legend

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Tracer Monitoring Sites

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Site Number	Site	Downstream Distance (ft)	Dissolved Zn (µg/L)	Total Zn (µg/L)
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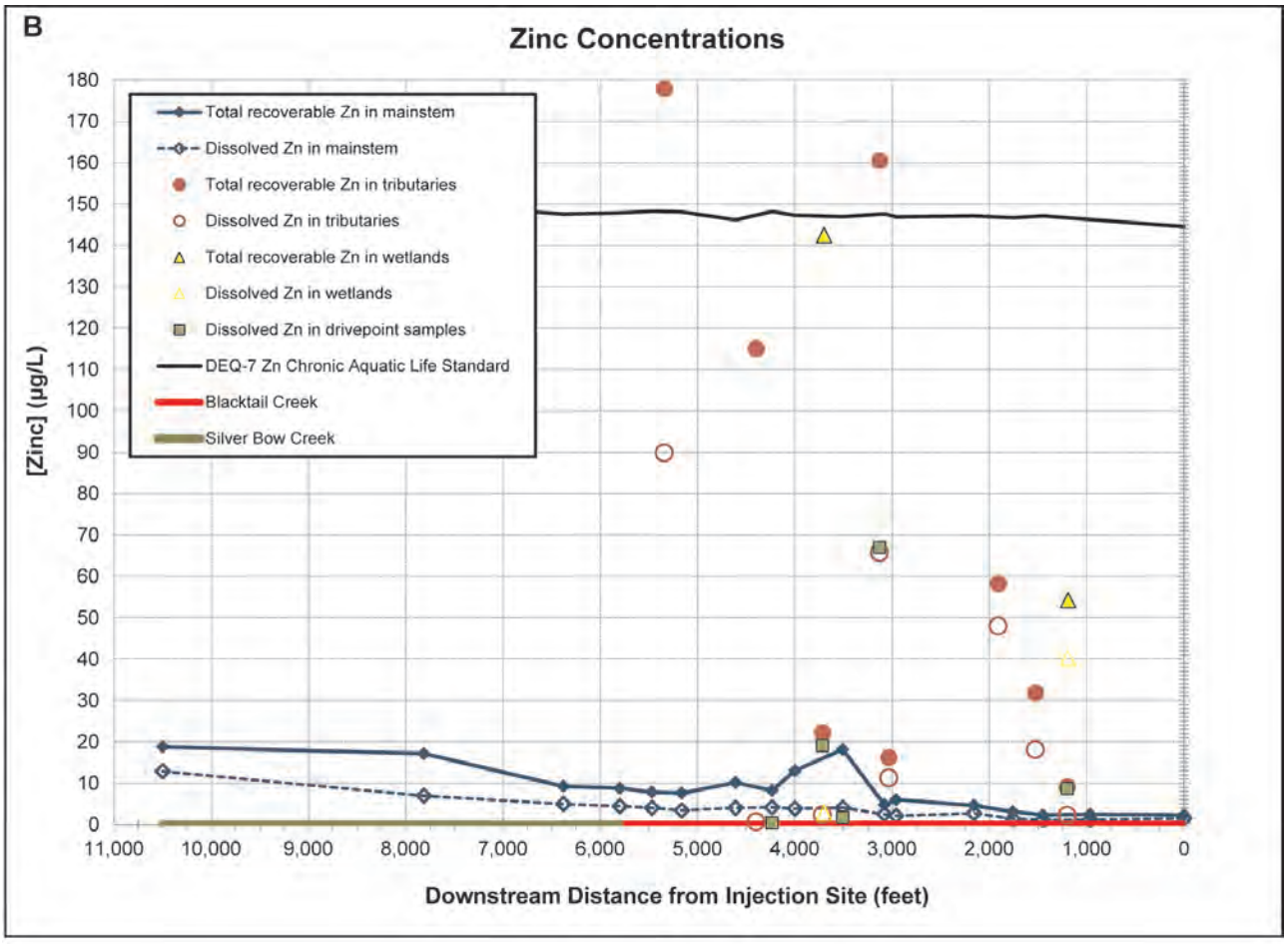
3	C-11 US	1,760	1.38	3.12
4	C-11 DS	2,160	2.72	4.64
5	C-9 US	2,960	2.12	6.01
6	C-9 DS	3,080	2.48	4.78
7	C-8	3,510	4.06	18.17
8	C-7	4,000	3.84	13.03
9	C-6	4,235	4.16	8.23
10	C-5	4,610	4.01	10.17
11	C-4.5	5,165	3.43	7.60
12	SS-04	5,470	4.04	7.85
13	SS-04.5	5,800	4.46	8.80
14	SS-05	6,380	4.96	9.27
15	SS-05A	7,815	6.98	17.15
16	SS-06A	10,500	12.87	18.78

Figure 12. Map of study area (A), with dissolved and total recoverable Zn concentrations (B) and Zn loading analysis (C) for mainstem, tributary, wetland, and drivepoint samples. Site ID numbers are plotted in A, B, and C for comparison purposes. Gaining reaches of Blacktail Creek are shown. Dissolved and total recoverable Zn concentrations are shown in table. Distance from tracer injection are plotted (B and C) in reverse order. Hardness-based DEQ-7 acute and chronic aquatic-life standards presented in B. Zn loading analyses (C) were calculated using calculated discharges from tracer dilution method.



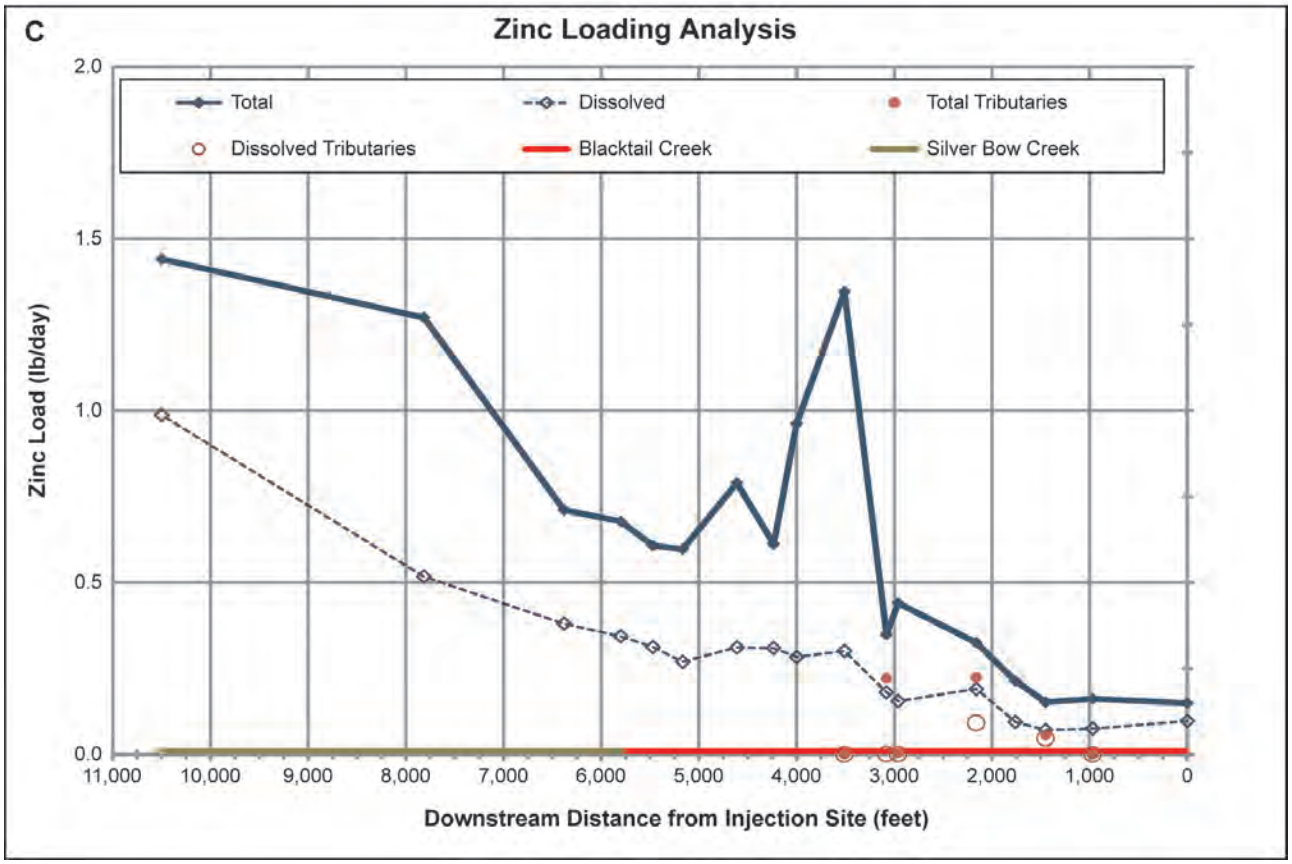


Figure 12, continued.

4.2 Hydrologic Evaluation

Although the two methods of discharge measurement generated data that differed in some cases, they both agreed that Blacktail Creek (fig. 1, stations 1 to 12) had a net-gain in flow of 2.2 cfs (~22 percent) between the injection site and site C-4.5 (fig. 8, site 11). Discharge data obtained from the FlowTracker measurements were much more variable than calculated data, because the method was able to account for stream loss within each reach. The largest increases in calculated discharge (between C-12 US and C-4.5) were determined in two reaches:

- Oregon Avenue reach (fig. 8, stations 1–4): 1.0 cfs gain
- Downstream of Kaw Avenue (fig. 8, stations 8–11): 0.9 cfs gain

Combined, these reaches account for 86 percent of the gain observed in Blacktail Creek.

Groundwater (61%) and adjacent wetlands under the influence of groundwater (39%) accounted for the vast majority (>99%) of flow increase observed in Blacktail Creek. Wetlands were inspected for surface-water recharge sources (i.e., surface-water channels, storm drains flowing into wetlands); only one site (fig. 1, C-11TR, yellow triangle) had surface-water baseflow inputs contributing to recharge. The surface-water contribution to wetland C-11TR had unquantifiable flows (<0.1 cfs), and water-quality results revealed compliance with DEQ-7 aquatic-life standards.

Downstream of C-4.5 (fig. 8C, site 11), both methods of flow measurement agreed that Blacktail and Silver Bow Creeks were either non-gaining, or net-losing streams. Unfortunately, discharge was not measured at the two synoptic sites located farthest downstream (SS-05A and SS-06), and Br-obtained discharge rates cannot account for stream loss. Tracer-calculated measurements of discharge rely on the conservation of Br in surface water. A losing reach of stream violates this requirement (USGS, 1997). Therefore, calculated discharge values were unreliable downstream of site C-4.5 (fig. 8, station 11).

Discrepancies were observed in the two types of discharge measurements (fig. 8C, measured vs. calculated discharge) in the reach between sampling sites C-9 US and C-7 (fig. 8, stations 5–8), where calculated discharge measurements remained stable while manual discharge measurements decreased across the reach. This discrepancy suggests one of two scenarios:

1. Blacktail Creek is losing to tributaries in this reach [Grove Gulch (C-9 TR GG)], and/or
2. Blacktail Creek is losing to hyporheic flow downstream of C-9 US (5).

Manually measured discharge suggests a 2 cfs loss within this reach, while Br-calculated discharge rates are stable. The magnitude of the difference is far greater than the calculated experimental errors provided in the discharge reports in appendix D.

Measured discharge rates (table 2) and Br concentrations (fig. 8C) for the two tributaries within this reach [C-8.5 TR and C-9 TR GG (Grove Gulch)] suggest that only Grove Gulch was receiving Br load from Blacktail Creek. The tributary and wetland to the north (C-8.5 TR) had measureable discharge into the creek (0.25 cfs). Blacktail Creek loss to Grove Gulch is a possible explanation for the discrepancy, but the discharge measured in Grove Gulch should have accounted for the loss measured within this reach of Blacktail Creek (2 cfs). Discharge data in Grove Gulch showed negligible flow with a calculated error of 202 percent (appendix D). The high error calculated at this site was a function of high signal-to-noise ratios caused from extremely low-flow conditions. Grove Gulch most likely received flow from the creek, but the quantity was insignificant compared to the magnitude of the decrease in discharge observed in this reach of Blacktail Creek (2 cfs). Some other explanation must account for the loss of discharge in this reach of Blacktail Creek.

Grove Gulch (fig. 1; site C-9 TR GG) was sampled on the south side of Interstate I-90 (fig. 1) approximately 300 ft south of its confluence with Blacktail Creek. The elevated Br concentration (fig. 8B, analytical value at ~3,080 µg/L downstream from the injection site) in the Grove Gulch sample suggests that this site is receiving Br from Blacktail Creek, either through surface water or groundwater.

A parallel baseflow investigation done in coordination with the current study was conducted by AR in 2011. An analysis of radon (^{222}Rn) concentrations from four shallow groundwater wells located adjacent to Blacktail Creek showed "very low" ^{222}Rn concentrations, concentrations too low to be representative of background radon in groundwater. These results suggest the possibility of subsurface hyporheic flow, as indicated by "mixing between recent (days) surface water and shallow groundwater" in the subsurface (AR, 2012).

Industrial water demands in Butte and stream channelization in the early 20th century changed Blacktail Creek from a meandering intermontane stream to a linear channel between Harrison Avenue and its confluence with Silver Bow Creek (fig. 1). Furthermore, the construction of I-90 in the 1960s most likely further altered Blacktail Creek's morphology. Preferential subsurface flow paths may exist within Blacktail Creek's original stream channel, and may be masked by the anthropomorphic manipulation and infrastructure upgrades now present near the stream. It seems possible that these actions resulted in enhanced hyporheic flows in the streambed, where the stream is preferentially following its original course. The hypothesis of anthropogenically enhanced hyporheic flow in this reach of Blacktail Creek is supported by the discrepancy observed in flow measurements, increased concentrations of Br observed in Grove Gulch, and the observations reported by AR (2012), but would need further evaluation to advance as a probable hypothesis.

4.3 Downstream Trends in Contaminants of Concern

Dissolved and TR Cu concentrations increased downstream from the injection point in the Blacktail Creek reaches within the study area (fig. 10). Total recoverable analytical results from one mainstem site (C-9 US) exceeded MDEQ-7 aquatic-life standards, while all dissolved Cu concentrations remained below the aquatic-life standards (MDEQ, 2010). Consistent with Cu concentrations, dissolved and TR Zn concentrations in mainstem samples increased over the entire study area (fig. 11); however, all concentrations in mainstem samples remained below standards. Dissolved concentrations of As, Cd, Cu, and Zn in all mainstem samples remained below MDEQ-7 aquatic-life standards (MDEQ, 2010).

In the Kaw Avenue reach of Blacktail Creek (stations 5–8), elevated concentrations of Cu (fig. 10) and Zn (fig. 11) in mainstem samples were observed. This reach of Blacktail Creek was heavily impacted by historic sediment transport from the Grove Gulch confluence, which may explain the elevated TR concentrations of Cu and Zn found in mainstem samples within this reach. However, wetland, drivepoint, and tributary samples collected within this reach suggest that groundwater discharging to this area may have elevated Cu and Zn concentrations. Unfortunately, the quality of the groundwater recharging the wetlands was not a focal point of this investigation, and cannot be ruled out as a potential source.

The reach of Blacktail Creek where elevated Cu and Zn concentrations were observed in mainstem, tributary, wetland, and drivepoint samples overlie the area where historic impacts to Blacktail Creek have occurred from Grove Gulch, and hyporheic flow may be occurring.

Whether elevated Cu and Zn concentrations in samples collected near the downstream end of this reach are the result of increased pore water interactions between groundwater and/or surface water with metal-laden sediment is speculative, but possible. Streambed sediment data sampled in Blacktail Creek, roughly 100 m downstream of the Grove Gulch confluence, show elevated concentrations of Cu (1,000 mg/L) and Zn (1,000 mg/L) in streambed sediments. The streambed and bank sediments within this reach should be further characterized to see if restoration activities (e.g., removal) are needed.

A detailed analysis of streambed and bank sediments is needed in the Kaw Avenue reach of Blacktail Creek (from Grove Gulch confluence to George Street). If streambed sediments with elevated concentrations of COCs are present in the Kaw Avenue reach, then these sediments present potential point sources for downgradient sites during high flow or storm-water events.

Tucci and Icopini (2012) and several unpublished water-quality sampling events showed an increasing trend in dissolved Cu in Blacktail Creek (between Oregon Avenue and George Street). While dissolved Cu concentrations increased slightly in Silver Bow Creek (~2 ppb), the previously reported trend in Blacktail Creek was not observed in the current study. However, an increase similar to previously observed increasing trends in TR Cu, dissolved Zn, and TR Zn was observed in this reach during the current investigation. The most likely sources of Cu and Zn in Blacktail Creek (fig. 1, stations 5–12) is from sediment (i.e., historic Grove Gulch sediment loads or mine waste from the BTC Berm) in, or adjacent to, the streambed.

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APPENDIX A

SAMPLING AND ANALYSIS PLAN

INTRODUCTION

An unidentified loading source to Blacktail Creek, for both total recoverable and dissolved constituents of copper and zinc, has been identified in the reach between Oregon Avenue and Montana Street. This reach of Blacktail Creek represents the eastern boundary of the Butte Priority Soil Operable Unit (BPSOU) in Butte, MT. In order to identify this source clearly, a base flow sodium bromide tracer study on Blacktail Creek has been scheduled for late February/early March. The timeframe for this study is dependent upon flows in the creek and temperature conditions, and therefore schedules and timelines for this project have not been finalized.

The current study area along Blacktail Creek is a gaining reach. At base flow conditions, significant increases in flow (40% increases) are seen within this reach. Both groundwater and surface water (Sand Creek, Grove Gulch, and multiple wetlands to the north and south of Blacktail Creek) inputs occur within this reach, all of which present themselves as possible sources of metal loading to Blacktail Creek. The current study was designed to quantify flow to this reach, identify the contribution of various inputs to the creek, and identify possible point sources for metal loading.

The primary goal of a tracer injection study is demonstrating a direct linkage between waste sources and seeps where discharge into surface water occurs. In this case, a number of possible sources of contamination to the area of concern are possible, and therefore a sizable and detailed sampling regime of both groundwater and surface water was constructed to pin point the area of loading. Prior to the tracer injection, a complete synoptic groundwater sampling event will be conducted on selected groundwater wells located adjacent to the reach of Blacktail Creek between Oregon Avenue and George Street. In addition to the sampling of wells, the quality of groundwater seepage into the streambed will be monitored in selected locations with drive-point piezometers. Understanding the link between groundwater/surface water interactions may be crucial to understanding the fate of dissolved constituents within Blacktail Creek; therefore, pore water sediment dialyses samplers (Hesslein peepers) will be used for this purpose. The groundwater sampling will be conducted in close proximity to the tracer injection study. In addition to groundwater discharge, surface water inputs within this reach are numerous and will be sampled during the tracer injection study.

METHODS AND SAMPLING PROTOCOL

Tracer Injection Protocol

A sodium bromide tracer study will be conducted on Blacktail Creek in Butte Montana between Oregon Avenue and Montana Street. Concentrated NaBr (256,800 mg/L) will be injected into Blacktail Creek near the gazebo east of Oregon Avenue using a constant rate peristaltic pump at a rate of 130 mL/minute. The injection rate and concentration of NaBr tracer solution have been selected to assure a residual concentration of Br in the most downstream sampling site (SS-05) of 1 mg/L. Tracer will

be injected into Blacktail Creek for a minimum of 24 hours prior to sampling. To assure stable bromide concentrations are obtained in the creek, a breakthrough curve will be generated using a bromide ion selective probe on samples collected on an hourly basis (ISCO Sampler) from the farthest down-stream sampling site (SS-05).

Bulk 25% Bromide tracer solution will be pre-mixed in a 250 gallon polyethylene storage tank by mixing 140 gallons of Blacktail Creek water with six 55-pound bags of sodium bromide. Since this study will be conducted during freezing conditions, precautionary measures will have to be taken to assure the tracer solution does not freeze. The concentration of tracer solution will be of sufficient salinity to significantly lower the freezing point of the solution. If need be, a generator and electric heater will be present to keep the ambient temperature in the tracer solution above freezing. The injection line will be guarded from freezing by installing foam insulation over the discharge line. The tracer apparatus will be checked frequently to assure freezing does not occur. Constant mixing will be conducted inside the tracer tank with a small submersible pump. Furthermore, temperatures of the tracer will be monitored on a frequent basis.

Sampling Procedures

All groundwater and surface water monitoring will be conducted in accordance with methods and practices established in the Butte Mine Flooding Operable Unit Sampling and Analysis Plan released in 2002 (EPA Docket No. CERCLA – VIII-96-19).

Physical Parameter Measurement

Physical parameters (temperature, pH, Eh, SC, LDO, and turbidity) will be measured in-situ using a Hach Hydrolab Minisonde-5 for all groundwater and surface water samples. A total of 30 groundwater samples and 25 surface water samples will be collected for this project.

Stream Flow Measurement

Stream flow will be measured during the tracer injection according to the tracer dilution method of a gaining stream, which involves adding a known strong concentration of tracer (sodium bromide) solution at a constant rate to a known flow. Through chemical analysis of bromide, the flow downstream can be measured. In addition to chemical analysis of bromide, flow measurements will be obtained using a SonTek FlowTracker ADV flow meter using the Marsh McBirney method of calculating stream flow. Percent error for flow measurement is typically between 3-4 percent using a Flow Tracker.

Groundwater Sampling

A total of 30 groundwater samples will be collected; 22 samples collected from groundwater wells, and eight samples collected from drive point sampling of the stream bed. Groundwater wells will be sampled using 2-in submerisble 12 volt pumps. A minimum of three well casing volumes will be purged and stable physical parameters obtained prior to sampling. The sampling matrix for groundwater is listed in table 1, and a list of monitoring sites is found in table 2. Physical parameters of temperature, pH, Eh, specific conductance, dissolved oxygen, and turbidity will be measured.

Table 1. Sampling Matrix for Groundwater.

Analysis	Method	Matrix	Sample Preparation
Dissolved metals	EPA 200.7 & 200.8	water	1-500mL Filtered (0.45micron) + Acidified (2% HNO_3)
Major cations and anion	EPA 200.7 & 300.0	water	1-250 filtered (0.45 micron) + untreated
Physical parameters and alkalinity	EPA 150.1, SM2510B & 2302B	water	1-500mL unfiltered + untreated
Nitrate/Nitrite/Total Nitrogen	USGS Method I-2650-03	water	1-250mL filtered (0.45 micron) + acidified (0.5% H_2SO_4)
Total organic carbon	Standard Method D5904	water	1-60mL unfiltered + acidified (2% HCl)
Dissolved organic carbon	Standard Method D5904	water	1-60mL filtered (0.45 micron) + acidified (2% HCl)

Table 2. Groundwater sampling list of sites.

Wells	GWIC #	Comments
GS-28	150389	Northwest wetland
AMW-11	161962	BTL Berm south
Berm Well		BTL Berm south
AMW-13	137597	BTL shallow Floodplain (Visitors Center)
AMW-13B	240863	BTL middle alluvial (Visitors Center)
AMW-13C	255975	BTL deep alluvial (Visitors Center)
BPS07-16A	248566	Northeast wetland
BPS07-16B	248565	Northeast wetland
AMW-04A	162029	Wetland South
AMW-04B	162043	Wetland South
AMW-03S	137599	Grove Gulch shallow alluvial
AMW-03D	137600	Grove Gulch deep alluvial
GG99-01	191293	Grove Gulch shallow alluvial
BT99-03	171291	Sand Creek shallow alluvial
AMW-10	137602	Sand Creek shallow alluvial
BT99-01	171289	Butte south shallow alluvial
BT99-02	171290	Butte south shallow alluvial
BT98-05	171288	BTL Creek floodplain (Oregon Ave)
BT98-06		BTL Creek floodplain (Oregon Ave)
BT98-01	171295	BTL Creek floodplain (Oregon Ave)
BT98-02	171294	Butte North Shallow Alluvial (Cobben)
BT98-02B	240865	Butte North Middle Alluvial (Cobben)

Drive Point Piezometer Sampling

Eight drive point piezometer will be installed in the Blacktail Creek streambed for collection of water samples. , The drive points are specialized small diameter stainless steel samplers custom made for members of CDM, designed specifically to be attached to a peristaltic pump tubing for purging purposes. Locations will be chosen upon completion of ARCO's thermal imaging study to determine areas of groundwater recharge. The timing of this work and choice of piezometer locations will be tied in closely with the tracer injection test. For instance, chosen surface water monitoring sites during the tracer study will be located adjacent to the piezometer sampling locations. Table 1 lists the sampling matrix for this sampling.

Dialysis Membrane Peeper Sampling

The peeper investigation will be conducted by a Montana Tech graduate student under the direct supervision of Dr. Chris Gammons, a Geology Professor at Montana Tech. One modified 28 cell Hesslein peeper was purchased from Rickly Hydrological, along with a set of pre-cut dialysis membranes (5 micron pore diameter). The peepers will be assembled with each of the chambers (28 chambers) filled with deionized and de-aerated water. The peepers will be placed upright in a cylinder through which N_2 gas is bubbled slowly and steadily for a period of 48-h. The N_2 tank and cylinder filled with water are taken out in the field, to maintain anoxic conditions.

The peeper will be deployed in the north wetland west of Kaw Avenue, by partially immersing it into the sediment. At least four rows will be exposed to open water, while the remainder will be submerged in the sediment of the wetland. The peepers will be left in the sediment for a period of 2 to 3 weeks to allow equilibration between the pore water and the dialysis chambers. The peepers will then be withdrawn from the sediment, placed in a cooler containing a stream of N_2 gas, and transported to the laboratory for sampling.

The sampling matrix for the peepers is a modified version of that shown in table 1. Each peeper row will be assigned a number from 1 to 28. Every 2nd row consists of a pair of cells, labeled "A" or "B". The even-numbered rows have a single cell that had more than twice the volume (~ 12 mL) of the smaller A and B cells (~ 5 mL each). The large even-numbered cells will be used for pH/Eh determination (EPA 150.1, SM2510B & 2302B), extraction of samples for ICP-metals (EPA 200.7 & 200.8). The A cells will be used for colorimetric analysis of phosphate and H_2S. The B cells will be used for extraction of samples for colorimetric analysis of ammonium, alkalinity titration, and anions (EPA 200.7 and 200.8).

Surface Water Sampling

A total of 25 surface water samples will be collected from in-stream and tributary locations along the Blacktail Creek reach between Oregon Avenue and Montana Street (SS-05). In-stream surface water sites will comprise both up-gradient and down-gradient reaches of all surface water tributaries, and reaches of significant groundwater gain.

Areas of significant groundwater gain will be determined during ARCO's thermal imaging study. Additionally, all tributaries (wetlands, streams, storm water inputs) will be sampled in this reach. Sampling locations will be selected upon completion of ARCO thermal imaging studies and several recon field trips.

During the tracer study, a sampling preparation station will be set up near the Butte Chamber of Commerce Visitor Center on George Street. Bulk composite samples will be collected in 3.6-liter acid washed HDPE sampling bottles at both in-stream and tributary locations and transported to the sampling preparation station. After samples have been processed (table 3), they will be stored on ice and transported to MBMG Laboratories. Table 3 shows the sampling matrices for surface water.

Table 3. Sampling matrix for surface water.

Analysis	Method	Matrix	Sample Prep
Dissolved metals	EPA 200.7 & 200.8	water	1-250mL Filtered (0.45micron) + Acidified (2% HNO_3)
Major cations and anion	EPA 200.7 & 300.0	water	1-250 filtered (0.45 micron) + untreated
Physical parameters and alkalinity	EPA 150.1, SM2510B & 2302B	water	1-250mL unfiltered + untreated
Nitrate/Nitrite/Total Nitrogen	USGS Method I-2650-03	water	1-250mL filtered (0.45 micron) + acidified (0.5% H_2SO_4)
Total recoverable metals	EPA 200.7, &200.8	water	1-250mL unfiltered + acidified (2% HNO_3)
Total organic carbon	Standard Method D5904	water	1-60mL unfiltered + acidified (2% HCl)
Dissolved organic carbon	Standard Method D5904	water	1-60mL filtered (0.45 micron) + acidified (2% HCL)

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control procedures for the tracer study will involve one field blank and one field duplicate sample per sampling event (groundwater and surface water). Additionally, the bromide tracer solution will be sampled twice during the course of the experiment.

Calibration of field equipment is described in Table 4. Field equipment will be calibrated daily. Prior to using field instrumentation, equipment will be washed thoroughly using deionized water (DI). Furthermore, decontamination procedures of sampling equipment (sampling pumps, hoses, etc...) will involve flushing and washing thoroughly with DI water.

Table 4. Calibration procedures of field equipment.

Probe/meter	Calibration Method	Frequency
pH	Buffer: 7, 4	daily
Eh	Zobelle's Solution (428mV)	daily
Specific Conductance	SC standard 1470us/cm	daily
Dissolved Oxygen (LDO)	100% Saturation	daily
Turbidity (NTU)	0, 100 point NTU	daily
Marsh McBirney Flow	0 Point calibration	daily
Br Ion Selective Probe	Calibration Curve (1,10, 100 ppm)	daily

TIME LINE

As previously mentioned, the time line for this project have not been finalized as sample site selection for surface water is dependent upon ARCO's completion of the thermal imaging study, and the tracer study itself is dependent upon weather conditions. Table 5 gives a general timeline for this project however.

Table 5. Time-line for MBMG tracer study

Event	Date
Groundwater sampling	2/6/11 - 2/18/11
Tracer study injection	3/7/11 - 3/15/11
Surface water sampling	2/28/11 - 3/15/11
Drive point groundwater sampling	2/28/11 - 3/15/11
All samples submitted to MBMG Labs	4/1/2011
Preliminary MBMG lab Results	5/15/2011

SampleTeam PROCEDURES

Garret Smith (MBMG)
Matt Berzel (MBMG)
Tina Donovan (Trec)

Please follow the procedures outlined below

- Work from farthest downstream sites up.
- Label container with a sharpie prior to getting wet. Label with sample ID, date and time.
- Wash out sampling container three times with sample water, similar to BMF sampling methods.
- Collect depth-integrated sample by dipping sample container in flowing portion of the stream (no pools or eddy's) along a single transect. Depending on width of channel chose between 5 and 20 locations along the transect, starting at the surface dipping down to the floor of the channel.
- Make sure there is no head space in bulk sampling containers.
- If the channel is not deep enough to fully saturate the 1-gallon bulk sample, smaller sampling containers are provided to ensure zero head-space in 1-gallon sampling container. Do not re-use the smaller sampling containers.

Blacktail Creek Tracer Study Checklist		
Sampling Prep Team		
	Team: GI, TP, AB	
	Vehicle: Suburban	
1)	Sample bottles	
	A) 120- 250 mL sample bottles	
	B) 75 glass vials for TOC and DOC	
2)	Acid	
	A) 40 total Sulfuric	
	B) 80 total Nictric	
3)	nitrile gloves	
	A) m and L	
4)	Cart Tables- 2, one from house and cart table	
5)	tubing	
6)	Filters	
	A) 40 medium flow	
7)	DI water-2 Carboys	
8)	HNO3 acid DI- 1 carboy	
9)	spray bottles	
10)	chem wipes	
11)	paper towels	
12)	NaBr Tracer probe box	
13)	2- peristaltic pumps	
14)	Alll peristaltic batteries	
15)	log book	
16)	First aid Kit	
17)	Towels	
18)	Coolers	
19)	Ice (GI pick up couple bags weds am)	
20)	zip locs	
Injection Site		
	Team: GI, TP, AB	
	vehicle: Canyon	
1)	Tracer	
2)	peristaltic pump	
3)	tubing	
4)	batteries- charged car batterie	
5)	extra gasoline	
6)	Tool box	
7)	zip ties	
Sampling Team		
	Team: MB, GS	
	vehicle: truck with topper	
1)	2 - MS-5 hydrolabs w/ tubidity	
2)	Location map of sites and spreadsheet of sites	
3)	Cages for MS-5	
4)	charged surveyors -2 (1 is for back-up)	
5)	2 - cables	
6)	pig-tailed adaptors	
7)	cigarette lighter chargers for surveyors	
8)	1-gallon jugs, both boxes	
9)	log books	
10)	pens/penncils	
11)	small transer containers (1-bag)	
12)	DI water, 1-carboy	
13)	spray bottles for DI water	
14)	Waders	
15)	Wading Shoes	
16)	nitrile gloves	
17)	Bucket	
Flow measurement team		
	Team: NJT, JV	
	vehicle: Cherokee	
1)	Flow Tracker	
2)	8 spare batteries	
3)	Tape measurer	
4)	log book	
5)	waders	
6)	bicycle	
7)	back pack	
8)	water	
9)	Sharpies, pens	
10)	stakes	
11)	Flumes, both big and small	
ISCO Sampler (Tuesday)		
	Team: MB, ZB	
	vehicle: Cherokee	
1)	ISCO Sampler	
2)	24 sampling containers	
3)	charged battery	
4)	set up to log every 1 hour	
5)	Set-up Tuesday morning around noon	

APPENDIX B

GROUNDWATER DATA

				FIELD PARAMETERS							Organic Carbon		MBMG LAB Parameters				
						FIELD								LAB			
Site	GWIC	DATE	TIME	SWL	FLOW	pH	SC	TEMP	Eh	DO	DOC	TOC	TDS	pH	SC	HARDNESS	ALKALINITY
			(HRS)	(FT)	(GPM)		(UMHOS)	(C)	(mv)	MG/l	mg/L	mg/L	mg/L		(UMHOS)	(MG/L)	(MG/L)
BT-98-02	171294	02/14/11	14:30	11.48	3.3	5.80	340	9.24	302	1.75	<0.25	1.82	203	5.94	376	100	26.25
BT-98-02B	240865	02/14/11	16:00	9.86	3.3	6.46	743	10.03	298	4.9	<0.25	1.37	514	6.58	777	320	45.93
BPS07-16A	248566	02/14/11	17:46	7.47	3.3	7.03	143	5.29	295	10.38	<0.25	<0.25	87	6.82	157	58	51.67
BPS07-16B	248565	02/14/11	17:00	8.18	3.3	7.08	284	10.09	294	4.92	<0.25	1.18	190	7.55	326	103	82.02
AMW-03S	137599	02/10/11	14:20	7.62		4.86	408	6.82	541	2.84	<0.25	3.17	386	5.61	594	217	35.27
AMW-03D	137600	02/10/11	15:02	NR		6.59	1,694	7.37	485	3.11	1.94	2.6	968	7.22	1,624	670	370.72
GG99-01	171293	02/10/11	15:48	5.71		6.22	465	4.99	524	3.89	0.72	2.86	294	6.49	516	164	100.88
AMW-04A	162029	02/11/11	11:48	13.61		6.55	789	8.32	440	4.61	<0.25	1.24	482	7.19	834	321	228.01
BT-99-03	171291	02/11/11	13:32	9.1		6.87	533	7.35	451	5.18	<0.25	1.76	306	7.25	579	206	171.42
AMW-10	137602	02/14/11	12:03	5.85		6.67	651	5.69	451	4.38	<0.25	0.77	374	7.17	699	257	174.70
BT-99-01	171289	02/14/11	15:48	5.59		6.94	443	6.75	268	3.63	<0.25	2.14	263	7.16	490	187	127.13
BT-99-02	171290	02/15/11	11:46	7.1	3.3	6.30	417	7.01	464	7.63	<0.25	1.11	237	7.12	459	168	100.88
BT-98-01	171295	02/10/11	14:05	9.83	3.3	7.08	220	10.91	196	2.9	<0.25	0.87	141	7.1	200	81	86.12
MT-98-06	260255	02/10/11	13:00	3.55	3.3	7.04	242	8.09	196	2.08	<0.25	1.4	151	6.94	248	93	88.58
MT-98-05	261583	02/10/11	13:32	5.03	3.3	6.67	353	8.62	183	2.92	<0.25	1.99	213	6.8	369	125	102.52
BERM WELL	260331	02/11/11	15:10	3.75	2	7.05	267	9.7	213	3.81	<0.25	0.61	172	7.03	268	77	86.12
GS-28	150389	02/08/11	14:45	5.3	<1.0	7.06	386	5.56	166	2.65	0.41	2.97	233	7.08	412	138	157.47
AMW-13	137597	02/08/11	13:00	11.58	<1.0	6.76	2,914	6.55	134	2.9	4.11	4.11	2,310	6.56	2,596	1,568	509.33
AMW-13B	240863	02/08/11	12:00	11	3.3	7.79	309	NR	334	2.06	<0.25	2	203	7.17	347	88	82.84
AMW-13C	255975	02/08/11	13:30	10.24	3.3	6.84	834	9.52	167	0.97	<0.25	2.15	615	6.6	851	305	50.85
AMW-11	161962	02/11/11	13:50	6.86	3.3	7.25	334	5.55	195	2.1	<0.25	1.53	206	7.08	364	114	118.92
WELL MF-01	5038	02/18/11	11:20	6.5	3.3	NR	NR	NR	NR	NR	<0.25	1.14	277	7.01	450	162	118.92
QA/QC Samples																	
Field Blank		02/18/11		NR		NR	NR	NR	NR	NR	<0.25	<0.25	1	6.2	1	0	2.46
WELL MF-01 Duplicate	5038	02/18/11	11:22	NR		7.01	462	8.69	336	1.18	<0.25	1.84	276	7.07	467	159	118.92

				MAJOR CATIONS							MAJOR ANIONS					NUTRIENTS	
				Cations							Anions						
Site	GWIC	DATE	TIME	Ca	Mg	Na	K	Fe	Mn	SiO_2	HCO_3	CO_3	Cl	SO_4	F	Total N	NO_3+NO_2
			(HRS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BT-98-02	171294	02/14/11	14:30	27.10	7.85	17.90	3.19	<0.002	0.10	32.90	31.75	0.00	33.46	55.9	0.55	6.27	5.98
BT-98-02B	240865	02/14/11	16:00	92.00	22.00	23.00	4.18	<0.002	<0.001	31.00	55.67	0.00	13.53	294.2	0.21	5.59	5.25
BPS07-16A	248566	02/14/11	17:46	16.20	4.17	4.93	1.72	0.00	<0.001	12.50	63.45	0.00	4.12	11.3	0.11	<1.0	<0.2
BPS07-16B	248565	02/14/11	17:00	30.60	6.35	15.30	2.28	<0.002	<0.001	31.60	99.68	0.00	5.17	49.9	0.32	<1.0	0.39
AMW-03S	137599	02/10/11	14:20	65.50	13.10	25.60	4.55	<0.002	0.73	14.40	42.83	0.00	21.75	215.0	0.13	1.76	0.60
AMW-03D	137600	02/10/11	15:02	192.00	46.30	96.20	6.32	<0.01	<0.005	30.70	451.50	0.00	122.70	220.7	0.21	120.00	8.01
GG99-01	171293	02/10/11	15:48	47.00	11.40	23.30	6.53	0.02	1.79	20.10	123.40	0.00	20.01	99.8	1.04	<1.0	<0.2
AMW-04A	162029	02/11/11	11:48	91.80	22.30	36.50	3.77	0.00	<0.001	34.60	278.00	0.00	49.52	98.8	0.15	5.51	5.23
BT-99-03	171291	02/11/11	13:32	57.80	14.90	25.20	5.29	<0.002	<0.001	26.20	209.00	0.00	30.21	38.6	0.74	3.92	3.80
AMW-10	137602	02/14/11	12:03	75.30	16.70	28.30	5.18	<0.002	<0.001	27.00	213.40	0.00	51.17	59.2	1.95	5.20	4.83
BT-99-01	171289	02/14/11	15:48	56.30	11.20	13.00	4.52	0.08	0.01	25.80	155.40	0.00	21.61	46.6	0.59	4.87	4.66
BT-99-02	171290	02/15/11	11:46	48.80	11.10	13.20	3.89	<0.002	<0.001	24.50	122.50	0.00	30.74	36.8	0.34	6.42	6.07
BT-98-01	171295	02/10/11	14:05	23.10	5.69	12.60	2.19	<0.002	<0.001	24.20	104.50	0.00	4.68	14.7	0.23	1.26	0.73
MT-98-06	260255	02/10/11	13:00	26.40	6.53	11.60	2.30	<0.002	<0.001	23.90	108.40	0.00	5.68	19.6	0.19	<1.0	0.95
MT-98-05	261583	02/10/11	13:32	36.30	8.46	18.30	2.34	<0.002	<0.001	25.60	124.60	0.00	10.87	47.0	0.28	2.96	2.81
BERM WELL	260331	02/11/11	15:10	21.90	5.37	23.80	2.89	0.01	<0.001	29.30	105.30	0.00	9.50	25.5	1.27	1.14	0.78
GS-28	150389	02/08/11	14:45	38.60	10.10	21.90	3.99	0.14	0.11	28.80	192.40	0.00	9.63	24.1	0.55	<1.0	<0.2
AMW-13	137597	02/08/11	13:00	475.00	92.90	62.90	42.40	27.90	1.14	19.30	620.70	0.00	24.19	1,259.0	0.16	1.83	<0.2
AMW-13B	240863	02/08/11	12:00	25.20	5.99	25.10	2.76	<0.002	<0.001	29.50	100.60	0.00	6.69	55.9	1.08	<1.0	0.32
AMW-13C	255975	02/08/11	13:30	88.30	20.60	50.30	8.28	<0.002	0.01	41.20	62.32	0.00	7.21	368.3	0.91	<1.0	<0.2
AMW-11	161962	02/11/11	13:50	33.60	7.31	20.70	3.11	0.53	1.26	27.40	144.60	0.00	14.16	26.0	0.96	<1.0	<0.2
WELL MF-01	5038	02/18/11	11:20	46.20	11.30	24.10	3.73	<0.002	0.01	27.80	144.90	0.00	29.81	59.4	0.73	2.28	2.21
QA/QC Samples																	
Field Blank		02/18/11		<0.015	<0.105	<0.124	<0.006	<0.002	<0.001	<0.16	3.26	0.00	<0.5	<2.5	<0.05	<1.0	<0.2
WELL MF-01 Duplicate	5038	02/18/11	11:22	45.40	11.10	23.90	3.66	<0.002	0.01	27.70	144.90	0.00	29.98	59.0	0.72	2.20	2.20

				NUTRIENTS				DISSOLVED METALS										
Site	GWIC	DATE	TIME	NO_3-N	NO_2-N	TKN	P	Al	Ag	As	B	Ba	Be	Cd	Co	Cr	Cu	Hg
			(HRS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
BT-98-02	171294	02/14/11	14:30	5.98	<0.05	0.29	0.03	29.00	<0.2	0.96	54.40	53.90	<0.2	8.64	<0.2	<0.2	6.5	NR
BT-98-02B	240865	02/14/11	16:00	5.25	<0.05	0.34	0.06	<2.0	<0.2	0.84	14.90	16.10	<0.2	1.50	<0.2	<0.2	1.2	NR
BPS07-16A	248566	02/14/11	17:46	0.18	<0.05	<1.0	0.04	6.59	<0.2	1.25	25.30	12.50	<0.2	0.29	<0.2	<0.2	1.8	NR
BPS07-16B	248565	02/14/11	17:00	0.39	<0.05	<1.0	0.05	5.88	<0.2	1.50	12.80	21.50	<0.2	0.34	<0.2	0.58	<0.5	NR
AMW-03S	137599	02/10/11	14:20	0.54	0.06	1.16	<0.025	885.00	<0.2	0.47	69.50	15.80	<0.2	1.80	2.21	<0.02	1,058.0	NR
AMW-03D	137600	02/10/11	15:02	8.01	<0.05	111.99	0.11	<10	<1.0	2.39	108.00	44.30	<1.0	<1.0	<0.9	<1.0	2.7	NR
GG99-01	171293	02/10/11	15:48	<0.2	<0.05	<1.0	0.07	35.60	<0.2	1.02	32.60	31.20	<0.2	2.43	1.55	<0.2	426.0	NR
AMW-04A	162029	02/11/11	11:48	5.23	<0.05	0.28	0.12	5.88	<0.2	4.41	55.10	152.00	<0.2	<0.2	0.21	0.44	1.8	NR
BT-99-03	171291	02/11/11	13:32	3.80	<0.05	0.12	0.12	<2.0	<0.2	1.88	89.10	112.00	<0.2	<0.2	<0.2	0.35	0.9	NR
AMW-10	137602	02/14/11	12:03	4.83	<0.05	0.37	0.20	<2.0	<0.2	33.70	51.50	147.00	<0.2	<0.2	<0.2	0.36	2.8	NR
BT-99-01	171289	02/14/11	15:48	4.66	<0.05	0.21	0.13	<2.0	<0.2	1.79	35.60	99.20	<0.2	<0.2	<0.2	0.37	1.8	NR
BT-99-02	171290	02/15/11	11:46	6.07	<0.05	0.35	0.21	<2.0	<0.2	2.38	32.70	106.00	<0.2	<0.2	<0.2	0.48	1.8	NR
BT-98-01	171295	02/10/11	14:05	0.73	<0.05	0.54	0.05	<2.0	<0.2	1.12	10.40	29.90	<0.2	<0.2	<0.2	0.49	<0.5	NR
MT-98-06	260255	02/10/11	13:00	0.95	<0.05	<0.05	0.05	<2.0	<0.2	1.07	10.70	32.30	<0.2	<0.2	<0.2	0.32	<0.5	NR
MT-98-05	261583	02/10/11	13:32	2.81	<0.05	0.15	0.06	<2.0	<0.2	1.38	21.50	36.10	<0.2	<0.2	<0.2	0.42	0.5	NR
BERM WELL	260331	02/11/11	15:10	0.78	<0.05	0.37	0.06	13.50	<0.2	4.58	23.90	14.90	<0.2	0.53	<0.2	0.43	1.7	NR
GS-28	150389	02/08/11	14:45	0.14	<0.05	<1.0	0.09	<2.0	<0.2	3.30	27.70	58.40	<0.2	<0.2	0.35	<0.2	1.0	NR
AMW-13	137597	02/08/11	13:00	<0.05	<0.05	1.83	0.15	<10	<1.0	5.95	2290.00	49.90	<1.0	<1.0	1.00	<1.0	<2.5	NR
AMW-13B	240863	02/08/11	12:00	0.45	<0.05	<1.0	0.05	<2.0	<0.2	3.69	27.00	27.20	<0.2	0.28	<0.2	0.41	1.4	NR
AMW-13C	255975	02/08/11	13:30	0.16	<0.05	<1.0	0.07	<2.0	<0.2	5.69	21.80	13.40	<0.2	2.64	<0.2	<0.2	2.1	NR
AMW-11	161962	02/11/11	13:50	<0.05	<0.05	<1.0	0.15	<2.0	<0.2	15.40	20.10	1041.00	<0.2	0.74	1.24	<1.0	1.2	NR
WELL MF-01	5038	02/18/11	11:20	2.21	<0.05	0.07	0.05	<2.0	<0.2	3.82	25.20	60.50	<0.2	1.30	<0.2	0.26		NR
QA/QC Samples																		
Field Blank		02/18/11		<0.05	<0.05		<0.025	<2.0	<0.2	<0.2	<2.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	NR
WELL MF-01 Duplicate	5038	02/18/11	11:22	2.34	<0.05	0.00	0.05	<2.0	<0.2	4.03	25.40	61.70	<0.2	1.34	<0.2	0.26	20.7	NR

				DISSOLVED METALS								RARE EARTH						
Site	GWIC	DATE	TIME	Li	Mo	Ni	Pb	Se	Sr	U	Zn	Ce	Cs	Ga	La	Nb	Nd	Pd
			(HRS)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
BT-98-02	171294	02/14/11	14:30	25.50	<0.2	11.90	<0.2	0.84	249	<0.2	2,685.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BT-98-02B	240865	02/14/11	16:00	9.83	4.34	0.88	<0.2	1.01	526	0.67	62.8	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BPS07-16A	248566	02/14/11	17:46	3.70	0.97	0.33	<0.2	0.20	106	0.39	113.0	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5
BPS07-16B	248565	02/14/11	17:00	<2.0	22.30	0.25	<0.2	0.48	221	5.18	9.4	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
AMW-03S	137599	02/10/11	14:20	2.51	1.11	2.29	0.49	0.59	276	5.34	135.0	9.35	<0.5	<0.2	5.44	<0.5	3.47	<0.5
AMW-03D	137600	02/10/11	15:02	12.10	5.22	1.35	<1.0	1.63	1,043	108.00	<5	<1.0	<2.5	<0.9	<1.0	<2.5	<1.0	<2.5
GG99-01	171293	02/10/11	15:48	5.38	3.84	4.20	<0.2	0.45	286	1.17	1,063.0	0.43	<0.5	<0.2	0.31	<0.5	<0.2	<0.5
AMW-04A	162029	02/11/11	11:48	7.87	3.85	0.67	<0.2	0.99	606	41.40	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BT-99-03	171291	02/11/11	13:32	3.90	5.12	0.40	<0.2	1.12	393	19.70	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
AMW-10	137602	02/14/11	12:03	4.73	5.26	0.67	<0.2	0.92	503	30.20	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BT-99-01	171289	02/14/11	15:48	4.28	8.17	0.50	<0.2	0.76	253	21.00	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BT-99-02	171290	02/15/11	11:46	3.84	2.35	0.36	<0.2	0.57	311	3.53	1.8	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BT-98-01	171295	02/10/11	14:05	<2.0	8.18	<0.2	<0.2	0.27	171	2.56	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
MT-98-06	260255	02/10/11	13:00	<2.0	7.44	<0.2	<0.2	0.32	188	3.30	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
MT-98-05	261583	02/10/11	13:32	2.19	15.00	<0.2	<0.2	0.64	239	7.70	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
BERM WELL	260331	02/11/11	15:10	9.58	38.30	0.22	<0.2	0.51	201	4.50	61.4	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
GS-28	150389	02/08/11	14:45	14.80	32.80	0.35	<0.2	0.32	362	12.20	21.3	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
AMW-13	137597	02/08/11	13:00	79.80	1.24	3.06	<1.0	<0.9	4,410	1.79	197.0	<1.0	<2.5	<0.9	<1.0	<2.5	<1.0	<2.5
AMW-13B	240863	02/08/11	12:00	6.60	30.80	0.20	<0.2	0.45	199	3.45	25.1	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
AMW-13C	255975	02/08/11	13:30	37.60	158.00	1.21	<0.2	0.30	695	1.60	251.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
AMW-11	161962	02/11/11	13:50	9.70	11.90	0.67	1.04	0.20	291	1.66	121.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
WELL MF-01	5038	02/18/11	11:20	12.60	10.70	0.36	<0.2	0.73	411	6.52	125.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
QA/QC Samples																		
Field Blank		02/18/11		<2.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5
WELL MF-01 Duplicate	5038	02/18/11	11:22	12.70	10.70	0.35	<0.2	0.79	416	6.76	129.0	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.5

				RARE EARTH						
Site	GWIC	DATE	TIME	Pr	Rb	Tl	Th	Sn	Ti	W
			(HRS)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
BT-98-02	171294	02/14/11	14:30	<0.2	<0.5	<0.2	<0.2	<0.5	0.75	<0.5
BT-98-02B	240865	02/14/11	16:00	<0.2	1.10	<0.2	<0.2	<0.5	3.90	<0.2
BPS07-16A	248566	02/14/11	17:46	<0.2	<0.5	<0.2	<0.2	<0.5	0.46	<0.2
BPS07-16B	248565	02/14/11	17:00	<0.2	0.93	<0.2	<0.2	<0.5	0.90	1.02
AMW-03S	137599	02/10/11	14:20	0.99	1.74	<0.2	<0.2	<0.5	3.05	<0.2
AMW-03D	137600	02/10/11	15:02	<1.0	<2.5	<1.0	<1.0	<2.5	3.79	1.73
GG99-01	171293	02/10/11	15:48	<0.2	0.93	<0.2	<0.2	1.54	2.14	<0.2
AMW-04A	162029	02/11/11	11:48	<0.2	<0.5	<0.2	<0.2	4.55	2.06	0.33
BT-99-03	171291	02/11/11	13:32	<0.2	<0.5	<0.2	<0.2	3.61	0.58	<0.2
AMW-10	137602	02/14/11	12:03	<0.2	<0.5	<0.2	<0.2	4.03	0.89	<0.2
BT-99-01	171289	02/14/11	15:48	<0.2	<0.5	<0.2	<0.2	3.30	0.66	<0.2
BT-99-02	171290	02/15/11	11:46	<0.2	<0.5	<0.2	<0.2	3.07	0.58	<0.2
BT-98-01	171295	02/10/11	14:05	<0.2	<0.5	<0.2	<0.2	<0.5	0.28	1.62
MT-98-06	260255	02/10/11	13:00	<0.2	<0.5	<0.2	<0.2	<0.5	0.30	1.03
MT-98-05	261583	02/10/11	13:32	<0.2	<0.5	<0.2	<0.2	<0.5	0.71	0.64
BERM WELL	260331	02/11/11	15:10	<0.2	1.30	<0.2	<0.2	<0.5	0.92	5.75
GS-28	150389	02/08/11	14:45	<0.2	<0.5	<0.2	<0.2	<0.5	0.46	0.59
AMW-13	137597	02/08/11	13:00	<1.0	17.00	<1.0	<1.0	<2.5	19.20	<1.0
AMW-13B	240863	02/08/11	12:00	<0.2	0.98	<0.2	<0.2	<0.5	0.81	13.30
AMW-13C	255975	02/08/11	13:30	<0.2	5.26	<0.2	<0.2	<0.5	4.38	0.43
AMW-11	161962	02/11/11	13:50	<0.2	0.51	<0.2	<0.2	<0.5	0.32	2.53
WELL MF-01	5038	02/18/11	11:20	<0.2	<0.5	<0.2	<0.2	<0.5	0.86	3.68
QA/QC Samples										
Field Blank		02/18/11		<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.2
WELL MF-01 Duplicate	5038	02/18/11	11:22	<0.2	<0.5	<0.2	<0.2	<0.5	0.86	3.78

APPENDIX C

SURFACE-WATER DATA

						NAV-GPS Coordinates			FLOW		
Site Name	Distance	Stream	Type	Sample	GWIC	Lat	Long	DATE	Measured Flow		Calculated Flow
	(km)			ID	ID	Decimal Degrees			(cfs)	notes	(cfs)
C-12 TR	0.31	Tributary	Drivepoint	200837	262795	45.9893060	-112.5219890	9/21/11 11:20	na		
C-8.5 TR	0.89	Tributary	Drivepoint	200836	262805	45.9917860	-112.5283220	9/21/11 10:55	na		
C-8	1.00	Primary	Drivepoint	200835	262804	45.9921550	-112.5298490	9/21/11 10:10	na		
C-7.5 TR	1.05	Tributary	Drivepoint	200838	262803	45.9931230	-112.5328300	9/21/11 8:55	na		
C-6	1.20	Primary	Drivepoint	200839	262800	45.9930470	-112.5321580	9/21/11 9:25	na		
C-7.5 POND	1.01	Pond	Surface	200799	262802	45.9925810	-112.5296670	9/21/11 10:28	na		
I-0	0.00	Primary	Surface	200823	262809	45.9878290	-112.5186340	9/21/11 13:03	10.3721	Very Good	12.0391
C-12 US	0.24	Primary	Surface	200821	262796	45.9889780	-112.5212960	9/21/11 12:52	10.1238	Very Good	12.0391
C-12 DS	0.39	Primary	Surface	200819	262793	45.9895110	-112.5229340	9/21/11 12:46	11.6812	Very Good	12.2028
C-11 US	0.48	Primary	Surface	200811	262791	45.9899270	-112.5239740	9/21/11 11:45	11.6718	Very Good	12.7215
C-11 DS	0.59	Primary	Surface	200807	262789	45.9904350	-112.5253210	9/21/11 11:16	12.9308	OK	12.9977
C-9 US	0.83	Primary	Surface	200805	262807	45.9914780	-112.5279250	9/21/11 11:07	12.4177	OK	13.5879
C-9 DS	0.86	Primary	Surface	200803	262806	45.9916620	-112.5282890	9/21/11 11:01	na		13.5367
C-8	1.00	Primary	Surface	200797	262804	45.9921550	-112.5298490	9/21/11 10:24	11.1156	Very Good	13.7439
C-7	1.13	Primary	Surface	200793	262801	45.9927610	-112.5314250	9/21/11 10:08	11.7164	Very Good	13.6915
C-6	1.20	Primary	Surface	200791	262800	45.9930470	-112.5321580	9/21/11 9:55	12.9092	Very Good	13.7967
C-5	1.31	Primary	Surface	200787	262798	45.9935380	-112.5333580	9/21/11 9:38	12.6594	OK	14.4054
C-4.5	1.47	Primary	Surface	200785	262797	45.9943120	-112.5350410	9/21/11 9:27	11.2747		14.5809
SS-04.5	1.56	Primary	Surface	200783	127593	45.9946292	-112.5361219	9/21/11 9:16	12.2859	Good	14.3479
SS-04.5	1.65	Primary	Surface	200775	262810	45.9951480	-112.5371380	9/21/11 8:38	11.7803		14.2908
SS-05	1.82	Primary	Surface	200773	127536	45.9957626	-112.5391870	9/21/11 8:17	11.2747	Very Good	14.2341
SS-05A	2.66	Primary	Surface	200778	249187	45.9962074	-112.5442602	9/21/11 8:50	na		13.7439
SS-06A	3.00	Primary	Surface	200779	217884	45.9944757	-112.5517715	9/21/11 8:55	na		14.2341
C-12 TR	0.31	Tributary	Surface	200816	262795	45.9893060	-112.5219890	9/21/11 12:40	-2.97E-02	1.5574	-2.97E-02
SAND CREEK	0.41	Tributary	Surface	200813	262812	45.98944	-112.52333	9/21/11 11:50	0.00E+00	assume	0.00E+00
C-11 TR	0.51	Tributary	Surface	200809	262790	45.9901410	-112.5243680	9/21/11 11:21	1.81E-01		1.81E-01
C-9 TR GG	0.85	Tributary	Surface	200827	262808	45.9910070	-112.5286920	9/21/11 13:32	-5.40E-03		-5.40E-03
C-8.5 TR	0.89	Tributary	Surface	200801	262805	45.9917860	-112.5283220	9/21/11 10:56	2.59E-01		2.59E-01
C-7.5 TR	1.05	Tributary	Surface	200795	262803	45.9926890	-112.5309570	9/21/11 10:14	4.32E-02		4.32E-02
C-5 TR	1.25	Tributary	Surface	200789	262799	45.9931230	-112.5328300	9/21/11 9:47	3.57E-01		3.57E-01
MSD-B	1.58	Tributary	Surface	200781	262811	45.9952670	-112.5359320	9/21/11 9:11	0.00E+00	very close	0.00E+00

			PHYSICAL PARAMETERS								MAJOR CATIOS			
Site Name	Distance	Stream	pH	SC	TEMP		DO	pH	SC	Hardness	Ca	Ca, TR	Mg	Mg, TR
	(km)			(UMHOS)	(C)	(mv)	(mg/L)		(UMHOS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
			Field	Field	Field	Field	Field	LAB	LAB		Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	NR	NR	NR	NR	NR	7.18	298.90		29.30	NR	7.49	NR
C-8.5 TR	0.89	Tributary	NR	NR	NR	NR	NR	7.13	344.50		31.61	NR	7.32	NR
C-8	1.00	Primary	NR	NR	NR	NR	NR	7.59	848.10		33.21	NR	7.80	NR
C-7.5 TR	1.05	Tributary	NR	NR	NR	NR	NR	7.19	329.00		28.03	NR	6.98	NR
C-6	1.20	Primary	NR	NR	NR	NR	NR	7.48	140.40		41.11	NR	10.04	NR
C-7.5 POND	1.01	Pond	7.47	381.70	9.93	372.00	2.92	7.51	415.70		41.52	44.16	11.63	13.26
I-0	0.00	Primary	7.69	299.70	10.63	406.00	10.93	7.74	384.20	124.78	35.63	38.48	8.70	9.29
C-12 US	0.24	Primary	7.41	307.60	9.85	408.00	10.48	7.73	390.40	126.53	36.66	38.72	8.50	9.30
C-12 DS	0.39	Primary	7.49	286.20	13.08	400.00	9.11	7.71	369.70	127.40	36.88	38.90	8.58	9.32
C-11 US	0.48	Primary	7.31	306.90	10.61	399.00	9.58	7.67	339.00	126.96	36.80	36.71	8.52	8.82
C-11 DS	0.59	Primary	7.46	312.60	9.01	360.00	9.78	7.73	345.50	127.40	37.03	37.81	8.52	9.07
C-9 US	0.83	Primary	7.48	311.90	8.84	354.00	9.71	7.66	339.60	127.16	36.93	38.39	8.49	9.24
C-9 DS	0.86	Primary	7.45	310.20	9.23	353.00	9.30	7.73	335.10	127.90	37.08	38.06	8.58	9.15
C-8	1.00	Primary	7.38	312.00	8.15	376.00	8.98	7.59	334.50	127.24	36.98	37.69	8.48	9.05
C-7	1.13	Primary	7.49	305.70	8.77	369.00	8.68	7.58	342.30	127.55	37.07	38.20	8.50	9.18
C-6	1.20	Primary	7.51	311.50	7.90	376.00	8.87	7.56	338.50	128.50	37.35	38.17	8.56	9.11
C-5	1.31	Primary	7.47	313.20	7.74	367.00	8.63	7.58	320.00	126.44	36.66	37.44	8.48	9.07
C-4.5	1.47	Primary	7.50	313.90	7.68	370.00	8.55	7.55	319.40	128.42	36.66	36.49	8.96	8.86
SS-04.5	1.56	Primary	7.43	314.40	7.60	365.00	8.30	7.53	312.50	128.58	36.66	37.46	9.00	9.05
SS-04.5	1.65	Primary	7.43	309.70	7.45	361.00	8.14	7.50	336.50	128.17	36.61	37.83	8.93	9.17
SS-05	1.82	Primary	7.18	313.30	7.51	372.00	7.96	7.43	328.60	127.86	36.50	36.64	8.92	8.94
SS-05A	2.66	Primary	NR	NR	NR	NR	NR	7.56	313.80	130.41	37.21	37.61	9.11	9.13
SS-06A	3.00	Primary	7.56	323.90	7.41	359.00	8.44	7.59	346.00	131.70	37.58	38.47	9.20	9.35
C-12 TR	0.31	Tributary	7.40	462.20	12.72	403.00	5.85	7.48	506.10	154.66	56.61	59.75	11.55	12.49
SAND CREEK	0.41	Tributary	7.14	363.70	9.35	397.00	9.72	7.57	395.70	147.10	42.61	41.93	9.89	10.11
C-11 TR	0.51	Tributary	6.92	412.70	9.08	366.00	7.19	7.15	456.90	163.20	48.23	48.41	10.39	10.84
C-9 TR GG	0.85	Tributary	7.17	418.40	11.99	409.00	10.89	7.65	454.50	143.20	40.29	39.95	10.35	10.75
C-8.5 TR	0.89	Tributary	7.03	322.80	12.43	291.00	8.49	7.21	349.00	121.71	35.87	36.09	7.81	8.25
C-7.5 TR	1.05	Tributary	7.55	383.00	9.95	367.00	2.03	7.59	391.20	154.13	41.27	40.85	12.41	12.95
C-5 TR	1.25	Tributary	8.24	349.20	9.73	368.00	5.53	7.95	353.40	125.40	32.07	35.63	11.01	12.51
MSD-B	1.58	Tributary	7.21	479.60	8.95	364.00	6.79	7.16	492.40	173.01	48.73	49.24	12.47	12.77

			MAJOR CATIONS								ANIONS		
Site Name	Distance	Stream	Na	Na, TR	K	K, TR	Fe	Fe, TR	Mn	Mn, TR	HCO3	CO3	Br
	(km)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	DISS	TR	DISS	TR	DISS		Dissolved
C-12 TR	0.31	Tributary	11.32	NR	3.33	NR	<0.002 U	NR	<0.001 U	NR	123.08		113.00
C-8.5 TR	0.89	Tributary	17.22	NR	3.35	NR	0.10	NR	0.01	NR	116.93		81.00
C-8	1.00	Primary	14.64	NR	4.04	NR	3.55	NR	0.83	NR	161.64		121.00
C-7.5 TR	1.05	Tributary	17.50	NR	3.08	NR	0.008 J	NR	<0.001 U	NR	110.95		112.00
C-6	1.20	Primary	14.00	NR	3.92	NR	2.07	NR	1.24	NR	167.98		114.00
C-7.5 POND	1.01	Pond	18.89	20.67	4.78	5.77	0.10	2.94	0.34	0.44	173.56		81.00
I-0	0.00	Primary	11.74	12.15	2.80	2.95	0.06	0.50	0.04	0.05	125.97		87
C-12 US	0.24	Primary	12.55	13.20	2.67	3.00	0.06	0.45	0.04	0.05	127.33		3070
C-12 DS	0.39	Primary	12.42	13.21	2.75	3.01	0.05	0.46	0.04	0.05	126.68		3030
C-11 US	0.48	Primary	12.17	12.33	2.78	2.92	0.06	0.50	0.04	0.05	128.07		2910
C-11 DS	0.59	Primary	12.26	13.25	2.76	2.96	0.05	0.43	0.04	0.05	127.62		2850
C-9 US	0.83	Primary	12.26	13.76	2.73	3.05	0.05	0.56	0.05	0.06	128.49		2730
C-9 DS	0.86	Primary	12.22	13.54	2.74	3.01	0.09	0.47	0.05	0.06	127.62		2740
C-8	1.00	Primary	12.22	13.80	2.78	2.96	0.08	0.52	0.05	0.06	126.84		2700
C-7	1.13	Primary	12.33	13.84	2.76	3.01	0.07	0.57	0.06	0.07	127.69		2710
C-6	1.20	Primary	12.67	13.58	2.71	2.97	0.10	0.43	0.06	0.07	127.81		2690
C-5	1.31	Primary	12.53	13.79	2.81	2.99	0.08	0.47	0.06	0.07	128.24		2580
C-4.5	1.47	Primary	13.85	13.35	2.89	2.88	0.08	0.39	0.06	0.06	128.80		2550
SS-04.5	1.56	Primary	13.77	13.54	2.89	3.04	0.12	0.42	0.06	0.07	129.31		2590
SS-04.5	1.65	Primary	13.76	13.76	2.92	3.07	0.09	0.43	0.06	0.07	129.32		2600
SS-05	1.82	Primary	13.59	13.63	2.94	2.99	0.10	0.40	0.06	0.07	129.06		2610
SS-05A	2.66	Primary	14.90	14.37	2.96	3.06	0.09	0.51	0.07	0.08	129.49		2700
SS-06A	3.00	Primary	15.00	14.99	2.95	3.07	0.08	0.41	0.07	0.09	130.21		2610
C-12 TR	0.31	Tributary	23.06	24.25	3.60	3.89	0.006 J	0.33	0.05	0.16	179.80		418
SAND CREEK	0.41	Tributary	14.41	14.76	3.44	3.57	0.02	0.82	0.10	0.10	146.94		1140
C-11 TR	0.51	Tributary	19.36	19.64	3.20	3.38	0.01	0.27	0.09	0.10	139.79		177
C-9 TR GG	0.85	Tributary	15.79	16.33	3.29	3.39	0.03	0.59	0.12	0.14	140.34		2100
C-8.5 TR	0.89	Tributary	16.09	17.15	2.63	3.02	0.07	0.40	0.11	0.13	103.03		81
C-7.5 TR	1.05	Tributary	18.93	19.79	4.77	5.07	0.06	0.54	0.27	0.31	178.61		80
C-5 TR	1.25	Tributary	21.79	23.67	4.60	5.38	0.16	4.68	0.08	0.32	148.78		121
MSD-B	1.58	Tributary	29.98	29.65	6.42	6.63	0.07	1.63	0.24	0.32	126.84		149

			ANIONS		NON-METALS				
Site Name	Distance	Stream	Cl	SO4	SiO2	NO3-N	PO4	Carbon	Carbon
	(km)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
			DISS	DISS	Dissolved	Dissolved	Dissolved	TOC	DOC
C-12 TR	0.31	Tributary	6.86	20.59	25.26	0.61	0.12	NR	NR
C-8.5 TR	0.89	Tributary	7.34	43.65	30.90	0.14	0.27	NR	NR
C-8	1.00	Primary	8.51	11.48	30.30	<0.010 U	<0.020 U	NR	NR
C-7.5 TR	1.05	Tributary	6.00	41.22	26.11	0.40	0.14	NR	NR
C-6	1.20	Primary	12.84	26.12	28.08	<0.010 U	0.16	NR	NR
C-7.5 POND	1.01	Pond	8.82	45.31	21.22	<0.010 U	<0.020 U	NR	NR
I-0	0.00	Primary	12.62	31.07	23.53	1.14	<0.020 U	2.96	2.96
C-12 US	0.24	Primary	12.71	31.73	24.91	1.22	<0.020 U	2.92	2.92
C-12 DS	0.39	Primary	12.77	31.40	24.26	1.21	<0.020 U	NR	NR
C-11 US	0.48	Primary	12.71	31.26	24.75	1.20	<0.020 U	4.24	2.80
C-11 DS	0.59	Primary	12.75	32.43	24.63	1.23	<0.020 U	NR	NR
C-9 US	0.83	Primary	12.78	32.24	24.73	1.20	<0.020 U	2.70	2.70
C-9 DS	0.86	Primary	12.72	32.08	24.20	1.21	<0.020 U	NR	NR
C-8	1.00	Primary	12.58	32.83	24.71	1.18	<0.020 U	NR	NR
C-7	1.13	Primary	12.47	32.22	24.62	1.16	<0.020 U	NR	NR
C-6	1.20	Primary	12.48	32.17	25.17	1.15	<0.020 U	NR	NR
C-5	1.31	Primary	12.58	32.19	23.84	1.10	<0.020 U	NR	NR
C-4.5	1.47	Primary	12.60	32.39	23.47	1.09	<0.020 U	NR	NR
SS-04.5	1.56	Primary	12.57	32.35	23.29	1.12	<0.020 U	3.10	3.10
SS-04.5	1.65	Primary	12.45	32.14	23.57	1.08	<0.020 U	2.79	2.79
SS-05	1.82	Primary	12.47	32.16	23.26	1.08	<0.020 U	2.69	2.69
SS-05A	2.66	Primary	13.94	33.02	23.35	1.07	<0.020 U	NR	NR
SS-06A	3.00	Primary	14.12	33.41	23.04	1.07	<0.020 U	NR	NR
C-12 TR	0.31	Tributary	18.71	69.45	27.82	1.05	0.12	3.20	3.20
SAND CREEK	0.41	Tributary	17.72	36.50	25.38	0.87	<0.020 U	2.19	2.19
C-11 TR	0.51	Tributary	13.85	70.26	26.68	2.18	<0.020 U	1.38	1.38
C-9 TR GG	0.85	Tributary	18.98	38.18	23.21	0.99	<0.020 U	2.95	2.95
C-8.5 TR	0.89	Tributary	8.09	64.75	30.02	0.75	0.13	1.43	1.43
C-7.5 TR	1.05	Tributary	8.81	44.67	20.73	<0.010 U	0.11	3.77	3.77
C-5 TR	1.25	Tributary	16.74	33.43	4.75	<0.010 U	<0.020 U	5.87	5.87
MSD-B	1.58	Tributary	17.66	110.50	18.16	0.07	<0.020 U	NR	NR

			MINOR AND TRACEMETALS								
Site Name	Distance	Stream	Ag	Ag, TR	Al	Al, TR	As	As, TR	B	B, TR	Ba
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved
C-12 TR	0.31	Tributary	<0.100 U	NR	2.35	NR	2.64	NR	12.54	NR	33.41
C-8.5 TR	0.89	Tributary	<0.100 U	NR	2.72	NR	7.34	NR	20.09	NR	28.88
C-8	1.00	Primary	<0.100 U	NR	4.08	NR	14.54	NR	17.16	NR	66.81
C-7.5 TR	1.05	Tributary	<0.100 U	NR	4.30	NR	1.93	NR	22.57	NR	3.70
C-6	1.20	Primary	<0.100 U	NR	14.13	NR	16.28	NR	23.03	NR	54.46
C-7.5 POND	1.01	Pond	<0.100 U	<0.250 U	16.94	1754.18	6.41	11.36	39.64	NR	29.79
I-0	0.00	Primary	<0.100 U	<0.250 U	0.722 J	66.49	2.89	3.80	19.20	NR	45.38
C-12 US	0.24	Primary	<0.100 U	<0.250 U	0.782 J	54.23	7.25	7.32	16.39	NR	45.22
C-12 DS	0.39	Primary	<0.100 U	<0.250 U	0.651 J	50.85	7.13	7.44	17.36	NR	45.01
C-11 US	0.48	Primary	<0.100 U	<0.250 U	0.928 J	105.74	6.64	7.20	17.84	NR	44.87
C-11 DS	0.59	Primary	8.78	<0.250 U	0.603 J	74.30	6.78	7.25	17.86	NR	44.86
C-9 US	0.83	Primary	<0.100 U	<0.250 U	0.603 J	142.17	6.65	7.50	18.05	NR	44.88
C-9 DS	0.86	Primary	<0.100 U	1.44	2.30	106.13	6.69	7.23	17.70	NR	45.83
C-8	1.00	Primary	<0.100 U	<0.250 U	12.18	134.99	7.31	7.76	17.96	NR	45.11
C-7	1.13	Primary	<0.100 U	<0.250 U	0.998 J	144.74	6.88	7.72	18.26	NR	45.60
C-6	1.20	Primary	<0.100 U	<0.250 U	1.570 J	81.95	6.79	7.35	19.29	NR	46.22
C-5	1.31	Primary	4.35	<0.250 U	8.00	105.34	6.83	7.61	22.09	NR	45.39
C-4.5	1.47	Primary	<0.100 U	<0.250 U	18.42	52.56	7.13	7.58	20.07	NR	45.56
SS-04.5	1.56	Primary	<0.100 U	<0.250 U	14.52	53.07	7.21	7.68	21.25	NR	46.18
SS-04.5	1.65	Primary	<0.100 U	<0.250 U	0.924 J	67.41	10.45	9.88	20.63	NR	46.41
SS-05	1.82	Primary	<0.100 U	<0.250 U	11.66	64.76	7.13	7.44	20.84	NR	46.45
SS-05A	2.66	Primary	<0.100 U	<0.250 U	12.98	119.81	8.05	10.70	22.41	NR	46.81
SS-06A	3.00	Primary	<0.100 U	<0.250 U	14.71	93.11	7.65	8.19	22.02	NR	46.87
C-12 TR	0.31	Tributary	<0.100 U	<0.250 U	0.610 J	91.14	4.63	8.03	39.63	NR	53.39
SAND CREEK	0.41	Tributary	0.231 J	<0.250 U	12.95	323.47	4.66	6.30	22.45	NR	52.83
C-11 TR	0.51	Tributary	<0.100 U	<0.250 U	11.57	100.34	2.68	3.05	26.37	NR	35.77
C-9 TR GG	0.85	Tributary	<0.100 U	<0.250 U	15.76	46.16	7.64	11.09	47.46	NR	52.79
C-8.5 TR	0.89	Tributary	<0.100 U	<0.250 U	4.12	176.47	3.04	3.71	16.83	NR	22.32
C-7.5 TR	1.05	Tributary	<0.100 U	<0.250 U	7.25	250.94	7.70	7.43	42.64	NR	43.15
C-5 TR	1.25	Tributary	1.16	<0.250 U	1.350 J	1516.23	8.63	20.00	30.58	NR	42.21
MSD-B	1.58	Tributary	<0.100 U	<0.250 U	19.86	997.89	6.77	14.67	132.74	NR	39.60

			MINOR AND TRACE METALS							
Site Name	Distance	Stream	Ba, TR	Be	Be, TR	Br	Cd	Cd, TR	Ce	Ce, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			TR	Dissolved	TR	Dissolved	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	NR	<0.100 U	NR	113.00	<0.100 U	NR	<0.100 U	NR
C-8.5 TR	0.89	Tributary	NR	<0.100 U	NR	81.00	<0.100 U	NR	<0.100 U	NR
C-8	1.00	Primary	NR	<0.100 U	NR	121.00	<0.100 U	NR	<0.100 U	NR
C-7.5 TR	1.05	Tributary	NR	<0.100 U	NR	112.00	0.130 J	NR	<0.100 U	NR
C-6	1.20	Primary	NR	<0.100 U	NR	114.00	<0.100 U	NR	<0.100 U	NR
C-7.5 POND	1.01	Pond	76.96	<0.100 U	<0.250 U	81.00	<0.100 U	0.760 J	<0.100 U	3.39
I-0	0.00	Primary	49.05	<0.100 U	<0.250 U	87.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-12 US	0.24	Primary	48.40	<0.100 U	<0.250 U	3070.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-12 DS	0.39	Primary	49.69	<0.100 U	<0.250 U	3030.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-11 US	0.48	Primary	50.24	<0.100 U	<0.250 U	2910.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-11 DS	0.59	Primary	50.63	<0.100 U	<0.250 U	2850.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-9 US	0.83	Primary	52.96	<0.100 U	<0.250 U	2730.00	<0.100 U	<0.250 U	<0.100 U	0.290 J
C-9 DS	0.86	Primary	50.16	<0.100 U	<0.250 U	2740.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-8	1.00	Primary	50.13	<0.100 U	<0.250 U	2950.00	<0.100 U	<0.250 U	<0.100 U	0.270 J
C-7	1.13	Primary	52.66	<0.100 U	<0.250 U	2710.00	<0.100 U	<0.250 U	<0.100 U	0.290 J
C-6	1.20	Primary	49.87	<0.100 U	<0.250 U	2690.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-5	1.31	Primary	50.60	<0.100 U	<0.250 U	2580.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-4.5	1.47	Primary	48.34	<0.100 U	<0.250 U	2550.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
SS-04.5	1.56	Primary	50.35	<0.100 U	<0.250 U	2590.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
SS-04.5	1.65	Primary	50.44	<0.100 U	<0.250 U	2600.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
SS-05	1.82	Primary	49.43	<0.100 U	<0.250 U	2610.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
SS-05A	2.66	Primary	50.42	<0.100 U	<0.250 U	2700.00	<0.100 U	<0.250 U	<0.100 U	0.250 J
SS-06A	3.00	Primary	52.04	<0.100 U	<0.250 U	2610.00	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-12 TR	0.31	Tributary	63.49	<0.100 U	<0.250 U	4.18E+02	<0.100 U	<0.250 U	<0.100 U	<0.250 U
SAND CREEK	0.41	Tributary	65.58	<0.100 U	<0.250 U	1.14E+03	<0.100 U	<0.250 U	<0.100 U	0.640 J
C-11 TR	0.51	Tributary	40.37	<0.100 U	<0.250 U	1.77E+02	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-9 TR GG	0.85	Tributary	56.95	<0.100 U	<0.250 U	2.10E+03	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-8.5 TR	0.89	Tributary	26.50	<0.100 U	<0.250 U	8.10E+01	0.200 J	0.610 J	<0.100 U	0.370 J
C-7.5 TR	1.05	Tributary	47.07	<0.100 U	<0.250 U	8.00E+01	<0.100 U	<0.250 U	<0.100 U	0.520 J
C-5 TR	1.25	Tributary	86.80	<0.100 U	<0.250 U	1.21E+02	<0.100 U	0.550 J	<0.100 U	3.00
MSD-B	1.58	Tributary	54.21	<0.100 U	<0.250 U	1.49E+02	<0.100 U	0.770 J	<0.100 U	1.93

			MINOR AND TRACE METALS							
Site Name	Distance	Stream	Co	Co, TR	Cr	Cr, TR	Cs	Cs, TR	Cu	Cu, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	<0.100 U	NR	0.210 J	NR	<0.100 U	NR	0.51	NR
C-8.5 TR	0.89	Tributary	<0.100 U	NR	0.160 J	NR	<0.100 U	NR	0.55	NR
C-8	1.00	Primary	0.100 J	NR	0.180 J	NR	<0.100 U	NR	0.360 J	NR
C-7.5 TR	1.05	Tributary	<0.100 U	NR	0.480 J	NR	<0.100 U	NR	0.50	NR
C-6	1.20	Primary	<0.100 U	NR	0.170 J	NR	<0.100 U	NR	0.190 J	NR
C-7.5 POND	1.01	Pond	0.210 J	0.960 J	0.150 J	1.030 J	<0.100 U	0.710 J	0.79	39.44
I-0	0.00	Primary	0.210 J	<0.250 U	0.180 J	0.300 J	<0.100 U	<0.250 U	1.40	2.48
C-12 US	0.24	Primary	0.340 J	<0.250 U	0.180 J	0.290 J	<0.100 U	<0.250 U	1.43	2.30
C-12 DS	0.39	Primary	0.340 J	<0.250 U	0.220 J	0.500 J	<0.100 U	<0.250 U	1.40	2.38
C-11 US	0.48	Primary	0.170 J	<0.250 U	0.250 J	0.390 J	<0.100 U	<0.250 U	1.39	2.91
C-11 DS	0.59	Primary	0.340 J	<0.250 U	0.220 J	0.330 J	<0.100 U	<0.250 U	1.37	4.10
C-9 US	0.83	Primary	0.260 J	<0.250 U	0.250 J	0.360 J	<0.100 U	<0.250 U	1.82	22.58
C-9 DS	0.86	Primary	0.130 J	<0.250 U	0.240 J	0.350 J	<0.100 U	<0.250 U	1.45	6.20
C-8	1.00	Primary	0.110 J	<0.250 U	0.210 J	0.340 J	<0.100 U	<0.250 U	1.33	4.60
C-7	1.13	Primary	0.250 J	<0.250 U	0.210 J	0.490 J	<0.100 U	<0.250 U	1.31	8.92
C-6	1.20	Primary	0.120 J	<0.250 U	0.210 J	0.330 J	<0.100 U	<0.250 U	1.41	3.65
C-5	1.31	Primary	0.120 J	<0.250 U	0.180 J	0.320 J	<0.100 U	<0.250 U	1.34	4.54
C-4.5	1.47	Primary	0.140 J	<0.250 U	0.180 J	0.310 J	<0.100 U	<0.250 U	1.16	3.30
SS-04.5	1.56	Primary	0.140 J	<0.250 U	0.180 J	0.310 J	<0.100 U	<0.250 U	1.29	4.10
SS-04.5	1.65	Primary	0.130 J	<0.250 U	0.270 J	0.310 J	<0.100 U	<0.250 U	1.32	3.20
SS-05	1.82	Primary	0.240 J	<0.250 U	0.230 J	0.340 J	<0.100 U	<0.250 U	2.57	4.09
SS-05A	2.66	Primary	0.100 J	<0.250 U	0.220 J	0.350 J	<0.100 U	<0.250 U	2.84	7.52
SS-06A	3.00	Primary	<0.100 U	<0.250 U	0.230 J	0.400 J	<0.100 U	<0.250 U	3.61	7.94
C-12 TR	0.31	Tributary	0.380 J	<0.250 U	0.150 J	0.300 J	<0.100 U	<0.250 U	0.94	3.44
SAND CREEK	0.41	Tributary	0.390 J	0.270 J	0.170 J	0.420 J	<0.100 U	<0.250 U	0.88	5.23
C-11 TR	0.51	Tributary	0.230 J	<0.250 U	0.160 J	0.280 J	<0.100 U	<0.250 U	0.79	3.78
C-9 TR GG	0.85	Tributary	0.250 J	<0.250 U	0.170 J	0.320 J	<0.100 U	<0.250 U	1.38	9.42
C-8.5 TR	0.89	Tributary	0.180 J	<0.250 U	0.220 J	0.380 J	<0.100 U	<0.250 U	0.65	7.44
C-7.5 TR	1.05	Tributary	0.120 J	<0.250 U	0.150 J	0.320 J	<0.100 U	<0.250 U	1.00	5.07
C-5 TR	1.25	Tributary	0.110 J	0.860 J	0.150 J	1.110 J	<0.100 U	0.400 J	0.49	62.48
MSD-B	1.58	Tributary	0.320 J	0.600 J	0.210 J	0.690 J	<0.100 U	<0.250 U	10.23	42.27

			MINOR AND TRACE METALS									
Site Name	Distance	Stream		Ga,TR	La	La, TR	Li	Li, TR	Mo	Mo, TR	Nb	Nb, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	<0.100 U	NR	<0.100 U	NR	1.460 J	NR	5.31	NR	<0.100 U	NR
C-8.5 TR	0.89	Tributary	<0.100 U	NR	<0.100 U	NR	3.96	NR	10.95	NR	<0.100 U	NR
C-8	1.00	Primary	<0.100 U	NR	<0.100 U	NR	3.24	NR	5.52	NR	<0.100 U	NR
C-7.5 TR	1.05	Tributary	<0.100 U	NR	<0.100 U	NR	7.11	NR	15.10	NR	<0.100 U	NR
C-6	1.20	Primary	<0.100 U	NR	<0.100 U	NR	8.14	NR	3.12	NR	<0.100 U	NR
C-7.5 POND	1.01	Pond	<0.100 U	0.680 J	<0.100 U	2.00	13.42	14.00	19.80	21.24	<0.100 U	0.320 J
I-0	0.00	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.06	6.11	4.82	4.79	<0.100 U	<0.250 U
C-12 US	0.24	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.38	5.59	5.62	5.45	<0.100 U	<0.250 U
C-12 DS	0.39	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.33	4.160 J	5.78	5.92	<0.100 U	<0.250 U
C-11 US	0.48	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	7.23	3.190 J	5.67	5.92	<0.100 U	<0.250 U
C-11 DS	0.59	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.70	3.730 J	5.88	6.14	<0.100 U	<0.250 U
C-9 US	0.83	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.85	3.580 J	5.92	6.31	<0.100 U	<0.250 U
C-9 DS	0.86	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.86	3.520 J	5.93	6.14	<0.100 U	<0.250 U
C-8	1.00	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.59	3.530 J	6.15	6.28	<0.100 U	<0.250 U
C-7	1.13	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.27	3.200 J	6.11	6.38	<0.100 U	<0.250 U
C-6	1.20	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.11	5.23	6.13	6.27	<0.100 U	<0.250 U
C-5	1.31	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.11	5.83	6.09	6.32	<0.100 U	<0.250 U
C-4.5	1.47	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.56	7.25	5.92	6.25	<0.100 U	<0.250 U
SS-04.5	1.56	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.20	5.95	5.88	6.38	<0.100 U	<0.250 U
SS-04.5	1.65	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.90	5.37	5.90	6.38	<0.100 U	<0.250 U
SS-05	1.82	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	6.49	5.11	5.81	6.22	<0.100 U	<0.250 U
SS-05A	2.66	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	7.59	7.00	6.00	6.29	<0.100 U	<0.250 U
SS-06A	3.00	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	7.77	5.89	5.89	6.30	<0.100 U	<0.250 U
C-12 TR	0.31	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	2.50	6.09	20.03	20.39	<0.100 U	<0.250 U
SAND CREEK	0.41	Tributary	<0.100 U	<0.250 U	<0.100 U	0.470 J	6.98	2.870 J	5.41	5.60	<0.100 U	<0.250 U
C-11 TR	0.51	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	7.30	6.77	9.89	10.62	<0.100 U	<0.250 U
C-9 TR GG	0.85	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	3.84	6.79	5.78	5.65	<0.100 U	<0.250 U
C-8.5 TR	0.89	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	8.82	8.45	11.27	11.76	<0.100 U	<0.250 U
C-7.5 TR	1.05	Tributary	<0.100 U	<0.250 U	<0.100 U	0.300 J	12.72	13.29	19.13	18.92	<0.100 U	<0.250 U
C-5 TR	1.25	Tributary	<0.100 U	0.560 J	<0.100 U	1.79	11.17	10.96	6.05	7.00	<0.100 U	0.300 J
MSD-B	1.58	Tributary	<0.100 U	0.330 J	<0.100 U	1.220 J	44.28	50.44	10.48	11.61	<0.100 U	<0.250 U

			MINOR AND TRACE METALS											
Site Name	Distance	Stream	Nd	Nd, TR	Ni	Ni, TR	Pb	Pb, TR	Pd	Pd, TR	Pr	Pr, TR	Rb	Rb, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	<0.100 U	NR	0.230 J	NR	<0.040 U	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-8.5 TR	0.89	Tributary	<0.100 U	NR	0.63	NR	0.150 J	NR	<0.100 U	NR	<0.100 U	NR	0.62	NR
C-8	1.00	Primary	<0.100 U	NR	0.240 J	NR	0.23	NR	<0.100 U	NR	<0.100 U	NR	0.79	NR
C-7.5 TR	1.05	Tributary	<0.100 U	NR	0.260 J	NR	<0.040 U	NR	<0.100 U	NR	<0.100 U	NR	0.470 J	NR
C-6	1.20	Primary	<0.100 U	NR	0.240 J	NR	<0.040 U	NR	<0.100 U	NR	<0.100 U	NR	0.470 J	NR
C-7.5 POND	1.01	Pond	<0.100 U	1.47	0.62	2.38	0.49	15.85	<0.100 U	<0.250 U	<0.100 U	0.350 J	1.20	6.95
I-0	0.00	Primary	<0.100 U	<0.250 U	0.340 J	0.300 J	<0.040 U	0.310 J	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.450 J	0.660 J
C-12 US	0.24	Primary	<0.100 U	<0.250 U	0.360 J	0.300 J	<0.040 U	0.270 J	<0.100 U	<0.250 U	<0.100 U		0.450 J	0.600 J
C-12 DS	0.39	Primary	<0.100 U	<0.250 U	0.350 J	0.370 J	<0.040 U	0.290 J	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.450 J	0.620 J
C-11 US	0.48	Primary	<0.100 U	<0.250 U	0.370 J	0.420 J	<0.040 U	0.55	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.440 J	0.780 J
C-11 DS	0.59	Primary	<0.100 U	<0.250 U	0.360 J	0.390 J	<0.040 U	0.480 J	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.460 J	0.650 J
C-9 US	0.83	Primary	<0.100 U	<0.250 U	0.390 J	0.510 J	<0.040 U	0.81	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.450 J	0.870 J
C-9 DS	0.86	Primary	<0.100 U	<0.250 U	0.340 J	0.390 J	<0.040 U	0.57	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.460 J	0.700 J
C-8	1.00	Primary	<0.100 U	<0.250 U	0.380 J	0.470 J	<0.040 U	0.95	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.480 J	0.820 J
C-7	1.13	Primary	<0.100 U	<0.250 U	0.390 J	0.480 J	<0.040 U	1.05	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.470 J	0.890 J
C-6	1.20	Primary	<0.100 U	<0.250 U	0.410 J	0.410 J	0.050 J	0.69	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.490 J	0.670 J
C-5	1.31	Primary	<0.100 U	<0.250 U	0.380 J	0.410 J	<0.040 U	0.79	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.480 J	0.760 J
C-4.5	1.47	Primary	<0.100 U	<0.250 U	0.120 J	0.360 J	<0.040 U	0.53	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.420 J	0.610 J
SS-04.5	1.56	Primary	<0.100 U	<0.250 U	0.340 J	0.440 J	0.040 J	0.55	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.430 J	0.640 J
SS-04.5	1.65	Primary	<0.100 U	<0.250 U	0.330 J	0.410 J	<0.040 U	0.68	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.440 J	0.670 J
SS-05	1.82	Primary	<0.100 U	<0.250 U	0.350 J	0.500 J	0.060 J	0.83	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.450 J	0.680 J
SS-05A	2.66	Primary	<0.100 U	<0.250 U	0.370 J	0.480 J	0.040 J	2.07	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.470 J	0.830 J
SS-06A	3.00	Primary	<0.100 U	<0.250 U	0.370 J	0.490 J	0.050 J	1.43	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.480 J	0.740 J
C-12 TR	0.31	Tributary	<0.100 U	<0.250 U	0.51	0.540 J	<0.040 U	1.61	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.380 J	0.670 J
SAND CREEK	0.41	Tributary	<0.100 U	0.320 J	0.370 J	0.550 J	<0.040 U	1.83	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.360 J	1.32
C-11 TR	0.51	Tributary	<0.100 U	<0.250 U	0.55	0.610 J	<0.040 U	1.32	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.290 J	0.640 J
C-9 TR GG	0.85	Tributary	<0.100 U	<0.250 U	0.410 J	0.340 J	<0.040 U	1.52	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.52	0.630 J
C-8.5 TR	0.89	Tributary	<0.100 U	<0.250 U	0.75	1.090 J	0.160 J	2.24	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.57	1.130 J
C-7.5 TR	1.05	Tributary	<0.100 U	<0.250 U	0.68	0.900 J	0.38	2.93	<0.100 U	<0.250 U	<0.100 U	<0.250 U	1.19	1.83
C-5 TR	1.25	Tributary	<0.100 U	1.39	0.240 J	1.220 J	0.170 J	59.28	<0.100 U	<0.250 U	<0.100 U	0.330 J	0.63	4.90
MSD-B	1.58	Tributary	<0.100 U	0.950 J	1.38	2.00	0.180 J	8.36	<0.100 U	<0.250 U	<0.100 U	<0.250 U	2.56	5.29

				MINOR AND TRACE METALS										
Site Name	Distance	Stream	Se	Se, TR	Sn	Sn, TR	Sr	Sr, TR	Th	Th, TR	Ti	Ti, TR	Tl	Tl, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	1.75	NR	<0.100 U	NR	175.35	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-8.5 TR	0.89	Tributary	5.44	NR	<0.100 U	NR	186.14	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-8	1.00	Primary	18.97	NR	<0.100 U	NR	196.78	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-7.5 TR	1.05	Tributary	1.45	NR	<0.100 U	NR	177.94	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-6	1.20	Primary	<0.100 U	NR	<0.100 U	NR	276.91	NR	<0.100 U	NR	<0.100 U	NR	<0.100 U	NR
C-7.5 POND	1.01	Pond	0.400 J	0.680 J	<0.100 U	0.270 J	246.64	276.68	<0.100 U	6.95	<0.100 U	148.98	<0.100 U	<0.250 U
I-0	0.00	Primary	0.77	<0.250 U	<0.100 U	<0.250 U	209.02	216.09	<0.100 U	0.660 J	<0.100 U	4.93	<0.100 U	<0.250 U
C-12 US	0.24	Primary	13.62	<0.250 U	<0.100 U	<0.250 U	205.72	213.74	<0.100 U	0.600 J	<0.100 U	3.58	<0.100 U	<0.250 U
C-12 DS	0.39	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	207.70	220.80	<0.100 U	0.620 J	<0.100 U	3.77	<0.100 U	<0.250 U
C-11 US	0.48	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	207.34	216.53	<0.100 U	0.780 J	<0.100 U	8.21	<0.100 U	<0.250 U
C-11 DS	0.59	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	209.12	223.93	<0.100 U	0.650 J	<0.100 U	5.22	<0.100 U	<0.250 U
C-9 US	0.83	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	209.05	227.47	<0.100 U	0.870 J	<0.100 U	10.58	<0.100 U	<0.250 U
C-9 DS	0.86	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	210.99	223.29	<0.100 U	0.700 J	<0.100 U	6.75	<0.100 U	<0.250 U
C-8	1.00	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	211.09	221.39	<0.100 U	0.820 J	<0.100 U	9.94	<0.100 U	<0.250 U
C-7	1.13	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	209.37	224.63	<0.100 U	0.890 J	<0.100 U	11.67	<0.100 U	<0.250 U
C-6	1.20	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	210.63	223.09	<0.100 U	0.670 J	<0.100 U	5.35	<0.100 U	<0.250 U
C-5	1.31	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	209.58	223.21	<0.100 U	0.760 J	<0.100 U	7.90	<0.100 U	<0.250 U
C-4.5	1.47	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	212.91	218.50	<0.100 U	0.610 J	<0.100 U	3.60	<0.100 U	<0.250 U
SS-04.5	1.56	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	214.43	225.28	<0.100 U	0.640 J	<0.100 U	3.66	<0.100 U	<0.250 U
SS-04.5	1.65	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	214.32	225.87	<0.100 U	0.670 J	<0.100 U	4.34	<0.100 U	<0.250 U
SS-05	1.82	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	215.21	220.01	<0.100 U	0.680 J	<0.100 U	4.51	<0.100 U	<0.250 U
SS-05A	2.66	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	219.58	224.38	<0.100 U	0.830 J	<0.100 U	8.67	<0.100 U	<0.250 U
SS-06A	3.00	Primary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	221.46	230.21	<0.100 U	0.740 J	<0.100 U	5.04	<0.100 U	<0.250 U
C-12 TR	0.31	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	279.69	299.30	<0.100 U	0.670 J	<0.100 U	6.66	<0.100 U	<0.250 U
SAND CREEK	0.41	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	241.38	250.62	<0.100 U	1.32	<0.100 U	25.44	<0.100 U	<0.250 U
C-11 TR	0.51	Tributary	1.62	0.910 J	<0.100 U	<0.250 U	250.75	269.74	<0.100 U	0.640 J	<0.100 U	9.01	<0.100 U	<0.250 U
C-9 TR GG	0.85	Tributary	<0.100 U	<0.250 U	<0.100 U	<0.250 U	252.40	256.32	<0.100 U	0.630 J	<0.100 U	2.97	<0.100 U	<0.250 U
C-8.5 TR	0.89	Tributary	0.59	0.540 J	<0.100 U	<0.250 U	193.62	206.00	<0.100 U	1.130 J	<0.100 U	15.48	<0.100 U	<0.250 U
C-7.5 TR	1.05	Tributary	1.63	0.750 J	<0.100 U	<0.250 U	254.39	260.97	<0.100 U	1.83	<0.100 U	18.27	<0.100 U	<0.250 U
C-5 TR	1.25	Tributary	0.75	1.120 J	<0.100 U	0.850 J	233.19	267.64	<0.100 U	4.90	<0.100 U	119.39	<0.100 U	<0.250 U
MSD-B	1.58	Tributary	<0.100 U	1.150 J	<0.100 U	<0.250 U	368.88	382.50	<0.100 U	5.29	<0.100 U	53.78	<0.100 U	<0.250 U

			MINOR AND TRACE METALS					
Site Name	Distance	Stream	U	U, TR	W	W, TR	Zn	Zn, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
			Dissolved	TR	Dissolved	TR	Dissolved	TR
C-12 TR	0.31	Tributary	3.22	NR	0.360 J	NR	8.67	NR
C-8.5 TR	0.89	Tributary	2.06	NR	1.66	NR	67.03	NR
C-8	1.00	Primary	0.190 J	NR	1.64	NR	1.74	NR
C-7.5 TR	1.05	Tributary	4.44	NR	<0.100 U	NR	19.04	NR
C-6	1.20	Primary	<0.100 U	NR	2.08	NR	0.410 J	NR
C-7.5 POND	1.01	Pond	4.02	4.51	0.57	1.160 J	2.85	142.46
I-0	0.00	Primary	3.80	3.90	0.150 J	<0.250 U	1.50	2.30
C-12 US	0.24	Primary	4.02	4.02	0.150 J	<0.250 U	1.16	2.49
C-12 DS	0.39	Primary	4.12	4.34	0.160 J	<0.250 U	1.08	2.31
C-11 US	0.48	Primary	4.14	4.28	0.190 J	<0.250 U	1.38	3.12
C-11 DS	0.59	Primary	4.17	4.32	0.210 J	<0.250 U	2.72	4.64
C-9 US	0.83	Primary	4.18	4.39	0.180 J	<0.250 U	2.12	6.01
C-9 DS	0.86	Primary	4.24	4.27	0.180 J	<0.250 U	2.48	4.78
C-8	1.00	Primary	4.20	4.22	0.200 J	<0.250 U	4.06	18.17
C-7	1.13	Primary	4.17	4.24	0.200 J	0.270 J	3.84	13.03
C-6	1.20	Primary	4.16	4.25	0.210 J	<0.250 U	4.16	8.23
C-5	1.31	Primary	4.13	4.19	0.290 J	0.290 J	4.01	10.17
C-4.5	1.47	Primary	4.24	4.13	0.270 J	0.290 J	3.43	7.60
SS-04.5	1.56	Primary	4.19	4.29	0.270 J	0.300 J	4.04	7.85
SS-04.5	1.65	Primary	4.17	4.19	0.360 J	0.310 J	4.46	8.80
SS-05	1.82	Primary	4.20	4.09	0.290 J	0.320 J	4.96	9.27
SS-05A	2.66	Primary	4.39	4.24	0.320 J	0.360 J	6.98	17.15
SS-06A	3.00	Primary	4.38	4.32	0.310 J	0.320 J	12.87	18.78
C-12 TR	0.31	Tributary	7.77	8.16	0.380 J	0.490 J	2.19	9.13
SAND CREEK	0.41	Tributary	6.70	6.89	0.340 J	0.410 J	18.12	31.83
C-11 TR	0.51	Tributary	3.87	4.16	0.370 J	0.390 J	47.96	58.21
C-9 TR GG	0.85	Tributary	4.24	4.17	0.260 J	0.320 J	11.27	16.21
C-8.5 TR	0.89	Tributary	2.28	2.46	0.58	0.630 J	65.70	160.48
C-7.5 TR	1.05	Tributary	3.81	3.74	0.410 J	0.430 J	2.29	22.21
C-5 TR	1.25	Tributary	3.91	4.91	2.32	3.12	0.66	115.04
MSD-B	1.58	Tributary	3.67	3.78	0.360 J	0.800 J	89.79	177.88

						NAV-GPS Coordinates			FLOW		
Site Name	Distance	Stream	Type	Sample	GWIC	Lat	Long	DATE	Measured Flow		Calculated Flow
	(km)			ID	ID	Decimal Degrees			(cfs)	notes	(cfs)
BR TRACER SOLN	0.00	Tributary	Surface	200831	999030			9/21/11 9:00	1.15E-04	Very Good	1.15E-04
C-11 TR @ Culvert	0.31	Tributary	Surface	200825	262795	45.9909222	-112.5231056	9/21/11 13:15			
DI BLANK	QAQC	QAQC	QAQC	200830	999030			9/21/11 8:40	na		
C-5 TR Duplicate	1.25	Tributary	Surface	200840	262799			9/21/11 9:50	3.57E-01		3.57E-01

			PHYSICAL PARAMETERS								MAJOR CATIOS			
Site Name	Distance	Stream	pH	SC	TEMP		DO	pH	SC	Hardness	Ca	Ca, TR	Mg	Mg, TR
	(km)			(UMHOS)	(C)	(mv)	(mg/L)		(UMHOS)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BR TRACER SOLN	0.00	Tributary	NR	NR	NR	NR	NR	7.19	133,600		17.52	17.67	3.410 J	3.720 J
C-11 TR @ Culvert	0.31	Tributary	6.97	402.10	14.29	399.00	6.06	7.23	500.90	154.66	45.70	48.16	9.85	10.31
DI BLANK	QAQC	QAQC	5.50	10.00	10.00	NR	NR	5.86	9.10		<0.010 U	0.010 J	<0.020 U	<0.020 U
C-5 TR Duplicate	1.25	Tributary	NR	NR	NR	NR	NR	7.95	430.80	126.93	31.68	34.10	11.62	12.71

			MAJOR CATIONS								ANIONS		
Site Name	Distance	Stream	Na	Na, TR	K	K, TR	Fe	Fe, TR	Mn	Mn, TR	HCO3	CO3	Br
	(km)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	81170.00	79966.67	443.00	490.85	<5.000 U	<5.000 U	<1.000 U	<5.000 U	71.37		3.12E+08
C-11 TR @ Culvert	0.31	Tributary	19.02	18.98	4.28	4.58	0.11	0.50	0.03	0.03	147.60		110
DI BLANK	QAQC	QAQC	<0.020 U	0.100 J	<0.050 U	<0.050 U	<2.000 U	<5.000 U	<1.000 U	<2.500 U	7.34		<10.000 U
C-5 TR Duplicate	1.25	Tributary	23.68	24.73	5.01	6.58	0.13	4.75	0.08	0.32	149.18		124

			ANIONS		NON-METALS				
Site Name	Distance	Stream	Cl	SO4	SiO2	NO3-N	PO4	Carbon	Carbon
	(km)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
BR TRACER SOLN	0.00	Tributary	26,019	359,087	9.98	<1000 U	<2000 U	1.52	1.52
C-11 TR @ Culvert	0.31	Tributary	24.17	31.84	25.33	4.15	0.19	2.82	2.82
DI BLANK	QAQC	QAQC	<0.100 U	<0.500 U	<0.020 U	<0.010 U	<0.020 U	0.36	0.36
C-5 TR Duplicate	1.25	Tributary	17.42	34.79	4.53	<0.010 U	<0.020 U	5.40	5.15

			MINOR AND TRACEMETALS								
Site Name	Distance	Stream	Ag	Ag, TR	Al	Al, TR	As	As, TR	B	B, TR	Ba
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	NR	<5000 U
C-11 TR @ Culvert	0.31	Tributary	<0.100 U	<0.250 U	20.96	207.60	5.81	9.24	51.89	NR	42.29
DI BLANK	QAQC	QAQC	<0.100 U	<0.250 U	1.320 J	6.84	0.470 J	<0.250 U	<0.500 U	NR	<0.100 U
C-5 TR Duplicate	1.25	Tributary	<0.100 U	<0.250 U	1.110 J	1550.52	8.86	17.76	32.06	NR	42.47

			MINOR AND TRACE METALS							
Site Name	Distance	Stream	Ba, TR	Be	Be, TR	Br	Cd	Cd, TR	Ce	Ce, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	3.12E+08	<5000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	48.60	<0.100 U	<0.250 U	1.10E+02	<0.100 U	<0.250 U	<0.100 U	0.400 J
DI BLANK	QAQC	QAQC	<0.250 U	<0.100 U	<0.250 U	<10.000 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-5 TR Duplicate	1.25	Tributary	45.46	<0.100 U	<0.250 U	1.24E+02	<0.100 U	0.330 J	<0.100 U	1.97

			MINOR AND TRACE METALS							
Site Name	Distance	Stream	Co	Co, TR	Cr	Cr, TR	Cs	Cs, TR	Cu	Cu, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	0.130 J	<0.250 U	0.160 J	0.390 J	<0.100 U	<0.250 U	3.48	10.86
DI BLANK	QAQC	QAQC	<0.100 U	<0.250 U	0.150 J	<0.250 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-5 TR Duplicate	1.25	Tributary	<0.100 U	0.940 J	0.160 J	1.130 J	<0.100 U	0.610 J	0.44	60.03

			MINOR AND TRACE METALS									
Site Name	Distance	Stream		Ga,TR	La	La, TR	Li	Li, TR	Mo	Mo, TR	Nb	Nb, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<1000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	<0.100 U	<0.250 U	<0.100 U	0.400 J	4.49	8.64	5.36	5.49	<0.100 U	<0.250 U
DI BLANK	QAQC	QAQC	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.400 U	2.050 J	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-5 TR Duplicate	1.25	Tributary	<0.100 U	0.610 J	<0.100 U	86.14	9.69	11.97	5.85	0.320 J	<0.100 U	0.370 J

			MINOR AND TRACE METALS											
Site Name	Distance	Stream	Nd	Nd, TR	Ni	Ni, TR	Pb	Pb, TR	Pd	Pd, TR	Pr	Pr, TR	Rb	Rb, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	<0.100 U	0.280 J	0.500 J	0.640 J	<0.040 U	2.47	<0.100 U	<0.250 U	<0.100 U	<0.250 U	0.350 J	0.950 J
DI BLANK	QAQC	QAQC	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.040 U	<0.100 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U
C-5 TR Duplicate	1.25	Tributary	<0.100 U	1.49	0.200 J	1.240 J	0.140 J	60.42	<0.100 U	<0.250 U	<0.100 U	0.368 J	0.57	0.920 J

				MINOR AND TRACE METALS										
Site Name	Distance	Stream	Se	Se, TR	Sn	Sn, TR	Sr	Sr, TR	Th	Th, TR	Ti	Ti, TR	Tl	Tl, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	0.80	<0.250 U	<0.100 U	<0.250 U	256.89	267.99	<0.100 U	0.950 J	<0.100 U	15.27	<0.100 U	<0.250 U
DI BLANK	QAQC	QAQC	1.30	<0.250 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.100 U	1.70	<0.100 U	<0.250 U
C-5 TR Duplicate	1.25	Tributary	<0.100 U	<0.250 U	<0.100 U	3.96	239.02	272.36	<0.100 U	0.920 J	<0.100 U	126.95	<0.100 U	<0.250 U

			MINOR AND TRACE METALS					
Site Name	Distance	Stream	U	U, TR	W	W, TR	Zn	Zn, TR
	(km)		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
BR TRACER SOLN	0.00	Tributary	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U	<5000 U
C-11 TR @ Culvert	0.31	Tributary	3.53	3.73	<0.100 U	<0.250 U	40.24	54.23
DI BLANK	QAQC	QAQC	<0.100 U	<0.250 U	<0.100 U	<0.250 U	<0.200 U	<0.500 U
C-5 TR Duplicate	1.25	Tributary	3.86	4.81	2.21	3.22	0.50	124.70

APPENDIX D

DISCHARGE MEASUREMENT SUMMARY

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	I0.920.WAD
Start Date and Time	2011/09/21 14:18:09

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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	0.1%	0.4%
Velocity	0.6%	1.4%
Width	0.1%	0.1%
Method	1.4%	-
# Stations	1.1%	-
Overall	**2.2%**	**1.8%**

Summary

Averaging Int.	30	# Stations	47
Start Edge	REW	Total Width	30.400
Mean SNR	29.3 dB	Total Area	29.850
Mean Temp	51.82 °F	Mean Depth	0.982
Disch. Equation	Mid-Section	Mean Velocity	0.3475
		Total Discharge	**10.3721**

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	I0.920.WAD
Start Date and Time	2011/09/21 14:18:09

Site Details

Site Name	
Operator(s)	NJT

Measurement Results

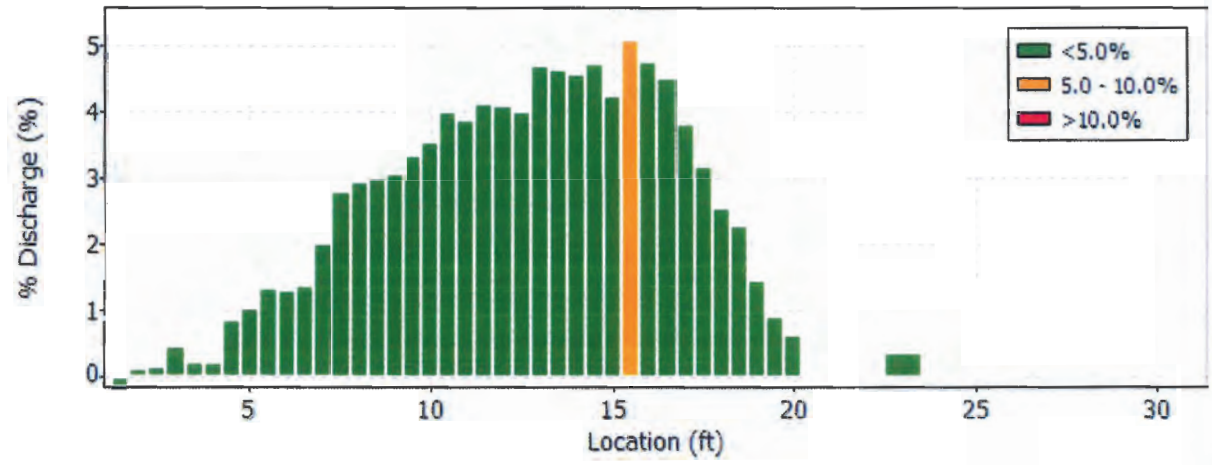
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:18	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*14:18*	*1.50*	*0.6*	*0.750*	*0.6*	*0.300*	*-0.0400*	*1.00*	*-0.0400*	*0.375*	*-0.0150*	*-0.1*
2	*14:19*	*2.00*	*0.6*	*0.800*	*0.6*	*0.320*	*0.0305*	*1.00*	*0.0305*	*0.400*	*0.0122*	*0.1*
3	*14:20*	*2.50*	*0.6*	*1.050*	*0.6*	*0.420*	*0.0292*	*1.00*	*0.0292*	*0.525*	*0.0153*	*0.1*
4	14:21	3.00	0.6	1.110	0.6	0.444	0.0837	1.00	0.0837	0.555	0.0464	0.4
5	*14:22*	*3.50*	*0.6*	*1.220*	*0.6*	*0.488*	*0.0348*	*1.00*	*0.0348*	*0.610*	*0.0212*	*0.2*
6	14:24	4.00	0.6	1.350	0.6	0.540	0.0341	1.00	0.0341	0.675	0.0230	0.2
7	14:25	4.50	0.6	1.350	0.6	0.540	0.1302	1.00	0.1302	0.675	0.0879	0.8
8	14:26	5.00	0.6	1.350	0.6	0.540	0.1588	1.00	0.1588	0.675	0.1072	1.0
9	14:27	5.50	0.6	1.350	0.6	0.540	0.2044	1.00	0.2044	0.675	0.1380	1.3
10	14:28	6.00	0.6	1.450	0.6	0.580	0.1870	1.00	0.1870	0.725	0.1356	1.3
11	14:29	6.50	0.6	1.450	0.6	0.580	0.1959	1.00	0.1959	0.725	0.1420	1.4
12	14:30	7.00	0.6	1.450	0.6	0.580	0.2867	1.00	0.2867	0.725	0.2079	2.0
13	14:31	7.50	0.6	1.450	0.6	0.580	0.4006	1.00	0.4006	0.725	0.2905	2.8
14	14:32	8.00	0.6	1.450	0.6	0.580	0.4199	1.00	0.4199	0.725	0.3045	2.9
15	14:33	8.50	0.6	1.450	0.6	0.580	0.4285	1.00	0.4285	0.725	0.3107	3.0
16	14:34	9.00	0.6	1.400	0.6	0.560	0.4551	1.00	0.4551	0.700	0.3185	3.1
17	14:35	9.50	0.6	1.400	0.6	0.560	0.4938	1.00	0.4938	0.700	0.3456	3.3
18	14:36	10.00	0.6	1.350	0.6	0.540	0.5443	1.00	0.5443	0.675	0.3674	3.5
19	14:37	10.50	0.6	1.350	0.6	0.540	0.6129	1.00	0.6129	0.675	0.4137	4.0
20	14:38	11.00	0.6	1.300	0.6	0.520	0.6198	1.00	0.6198	0.650	0.4028	3.9
21	14:39	11.50	0.6	1.300	0.6	0.520	0.6552	1.00	0.6552	0.650	0.4258	4.1
22	14:40	12.00	0.6	1.300	0.6	0.520	0.6516	1.00	0.6516	0.650	0.4235	4.1
23	14:41	12.50	0.6	1.320	0.6	0.528	0.6289	1.00	0.6289	0.660	0.4151	4.0
24	14:42	13.00	0.6	1.320	0.6	0.528	0.7365	1.00	0.7365	0.660	0.4861	4.7
25	14:43	13.50	0.6	1.300	0.6	0.520	0.7385	1.00	0.7385	0.650	0.4800	4.6
26	14:44	14.00	0.6	1.300	0.6	0.520	0.7277	1.00	0.7277	0.650	0.4730	4.6
27	14:44	14.50	0.6	1.300	0.6	0.520	0.7536	1.00	0.7536	0.650	0.4898	4.7
28	14:46	15.00	0.6	1.300	0.6	0.520	0.6781	1.00	0.6781	0.650	0.4408	4.2
29	14:47	15.50	0.6	1.300	0.6	0.520	0.8104	1.00	0.8104	0.650	0.5267	5.1
30	14:48	16.00	0.6	1.300	0.6	0.520	0.7566	1.00	0.7566	0.650	0.4917	4.7
31	14:50	16.50	0.6	1.240	0.6	0.496	0.7523	1.00	0.7523	0.620	0.4665	4.5
32	14:51	17.00	0.6	1.190	0.6	0.476	0.6634	1.00	0.6634	0.595	0.3947	3.8
33	14:52	17.50	0.6	1.200	0.6	0.480	0.5495	1.00	0.5495	0.600	0.3298	3.2
34	14:54	18.00	0.6	1.140	0.6	0.456	0.4639	1.00	0.4639	0.570	0.2645	2.5
35	14:55	18.50	0.6	1.190	0.6	0.476	0.3990	1.00	0.3990	0.595	0.2374	2.3
36	14:56	19.00	0.6	1.250	0.6	0.500	0.2408	1.00	0.2408	0.625	0.1505	1.5
37	*14:57*	*19.50*	*0.6*	*1.200*	*0.6*	*0.480*	*0.1558*	*1.00*	*0.1558*	*0.600*	*0.0935*	*0.9*
38	*14:59*	*20.00*	*0.6*	*1.150*	*0.6*	*0.460*	*0.1138*	*1.00*	*0.1138*	*0.575*	*0.0655*	*0.6*
39	*15:00*	*20.50*	*0.6*	*1.000*	*0.6*	*0.400*	*0.0013*	*1.00*	*0.0013*	*0.500*	*0.0007*	*0.0*
40	*15:01*	*21.00*	*0.6*	*0.900*	*0.6*	*0.360*	*0.0089*	*1.00*	*0.0089*	*0.675*	*0.0060*	*0.1*
41	*15:02*	*22.00*	*0.6*	*0.700*	*0.6*	*0.280*	*-0.0023*	*1.00*	*-0.0023*	*0.700*	*-0.0016*	*0.0*
42	*15:04*	*23.00*	*0.6*	*0.600*	*0.6*	*0.240*	*0.0646*	*1.00*	*0.0646*	*0.600*	*0.0388*	*0.4*
43	*15:05*	*24.00*	*0.6*	*0.620*	*0.6*	*0.248*	*0.0010*	*1.00*	*0.0010*	*0.620*	*0.0006*	*0.0*
44	*15:07*	*25.00*	*0.6*	*0.620*	*0.6*	*0.248*	*-0.0049*	*1.00*	*-0.0049*	*0.620*	*-0.0031*	*0.0*
45	*15:08*	*26.00*	*0.6*	*0.600*	*0.6*	*0.240*	*0.0003*	*1.00*	*0.0003*	*1.920*	*0.0006*	*0.0*
46	15:08	31.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

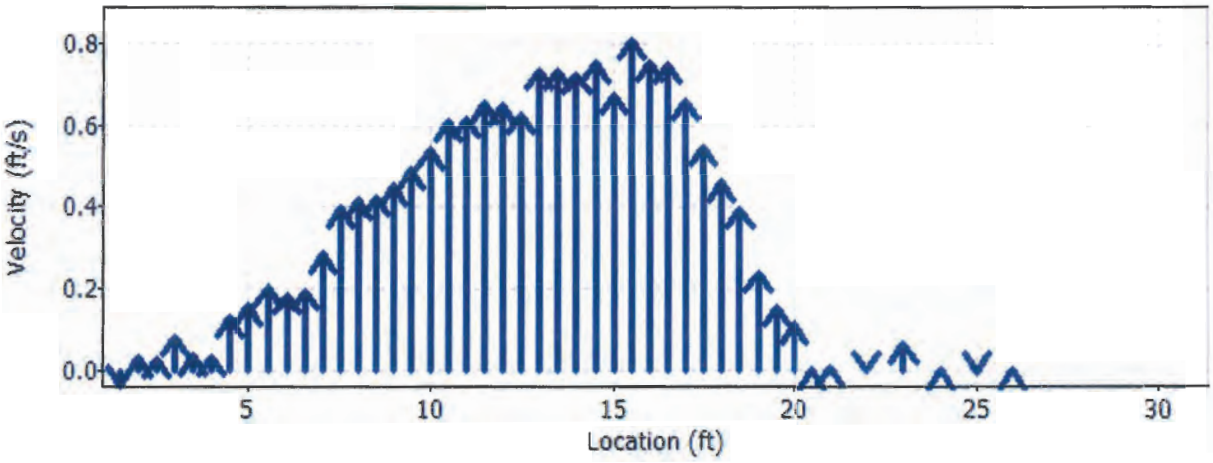
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

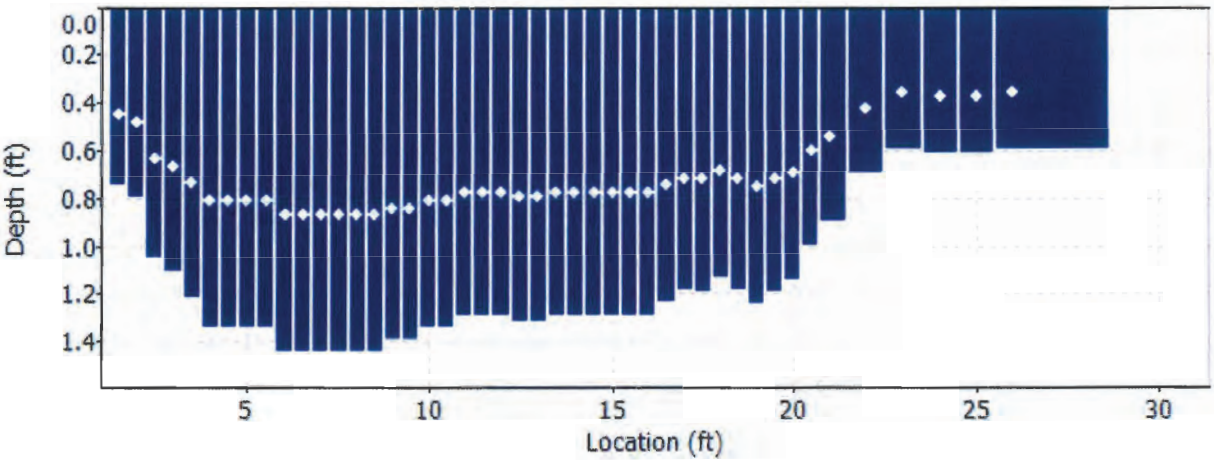
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	I0.920.WAD	Site Name	
Start Date and Time	2011/09/21 14:18:09	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	I0.920.WAD
Start Date and Time	2011/09/21 14:18:09

Site Details

Site Name	
Operator(s)	NJT

Quality Control

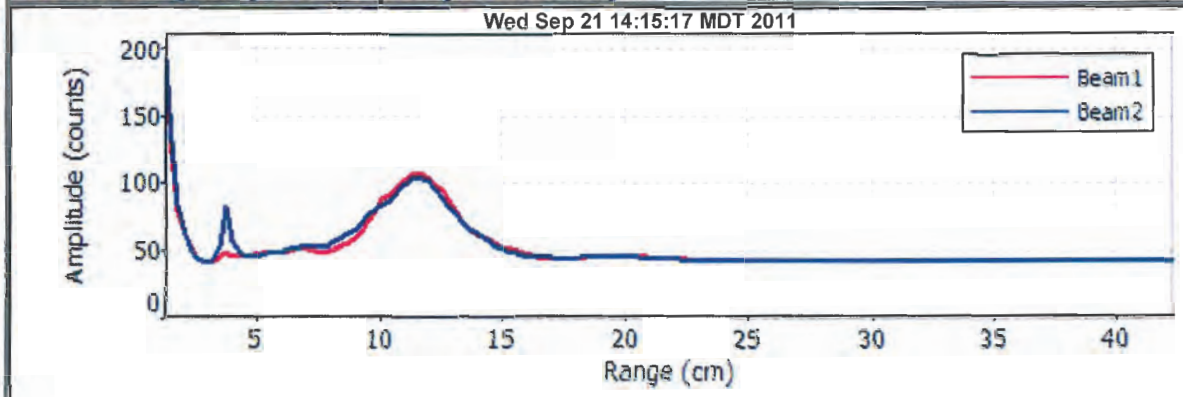
St	Loc	%Dep	Message
1	1.50	0.6	High angle: 167
		0.6	SNR (44.1) is different from typical SNR (29.3)
2	2.00	0.6	High SNR variation during measurement: 4.3,5.2
3	2.50	0.6	High angle: 41
		0.6	High SNR variation during measurement: 6.5,6.0
5	3.50	0.6	High angle: 33
37	19.50	0.6	High SNR variation during measurement: 9.0,10.3
		0.6	Boundary QC is Good; possible boundary interference
38	20.00	0.6	High SNR variation during measurement: 8.6,7.3
39	20.50	0.6	SNR (47.5) is different from typical SNR (29.3)
40	21.00	0.6	SNR (40.6) is different from typical SNR (29.3)
		0.6	High SNR variation during measurement: 7.7,6.9
41	22.00	0.6	SNR (56.5) is different from typical SNR (29.3)
		0.6	High SNR variation during measurement: 10.8,7.3
42	23.00	0.6	High angle: 42
		0.6	High SNR variation during measurement: 5.2,4.7
43	24.00	0.6	Boundary QC is Fair; possible boundary interference
44	25.00	0.6	SNR (61.3) is different from typical SNR (29.3)
		0.6	High SNR variation during measurement: 5.6,3.9
45	26.00	0.6	Low SNR: 1.7,48.1
		0.6	High differences in beam SNR: 1.7,48.1
		0.6	Boundary QC is Fair; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	I0.920.WAD	Site Name	
Start Date and Time	2011/09/21 14:18:09	Operator(s)	NJT

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 Sep 27 2012

File Information	
File Name	C12US.920.WAD
Start Date and Time	2011/09/21 15:38:22

Site Details	
Site Name	
Operator(s)	NJT

System Information	
Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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%	2.3%
Velocity	0.9%	3.7%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.0%	-
Overall	**3.1%**	**4.4%**

Summary

Averaging Int.	30	# Stations	25
Start Edge	REW	Total Width	30.400
Mean SNR	31.3 dB	Total Area	20.595
Mean Temp	52.20 °F	Mean Depth	0.677
Disch. Equation	Mid-Section	Mean Velocity	0.4916
		Total Discharge	**10.1238**

Measurement Results

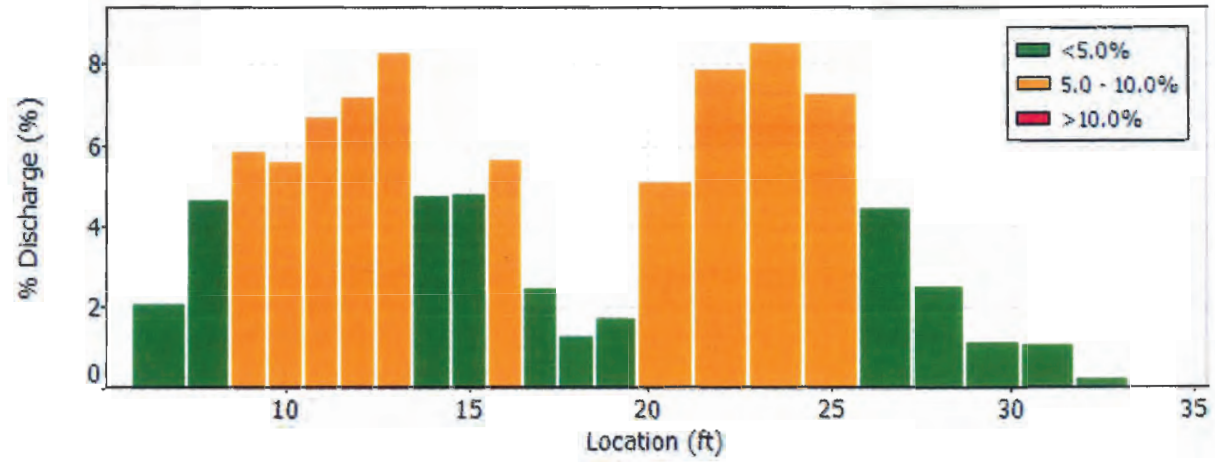
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:38	5.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	15:38	6.50	0.6	0.500	0.6	0.200	0.2822	1.00	0.2822	0.750	0.2116	2.1
2	15:39	8.00	0.6	0.920	0.6	0.368	0.4140	1.00	0.4140	1.150	0.4761	4.7
3	15:41	9.00	0.6	1.050	0.6	0.420	0.5663	1.00	0.5663	1.050	0.5945	5.9
4	15:42	10.00	0.6	1.100	0.6	0.440	0.5203	1.00	0.5203	1.100	0.5724	5.7
5	15:43	11.00	0.6	1.250	0.6	0.500	0.5463	1.00	0.5463	1.250	0.6828	6.7
6	15:44	12.00	0.6	1.250	0.6	0.500	0.5840	1.00	0.5840	1.250	0.7300	7.2
7	15:45	13.00	0.6	1.220	0.6	0.488	0.6877	1.00	0.6877	1.220	0.8390	8.3
8	15:46	14.00	0.6	1.220	0.6	0.488	0.3957	1.00	0.3957	1.220	0.4828	4.8
9	15:47	15.00	0.6	1.220	0.6	0.488	0.4016	1.00	0.4016	1.220	0.4900	4.8
10	15:48	16.00	0.6	1.300	0.6	0.520	0.4409	1.00	0.4409	1.300	0.5732	5.7
11	*15:49*	*17.00*	*0.6*	*1.100*	*0.6*	*0.440*	*0.2293*	*1.00*	*0.2293*	*1.100*	*0.2523*	*2.5*
12	*15:50*	*18.00*	*0.6*	*0.620*	*0.6*	*0.248*	*0.2175*	*1.00*	*0.2175*	*0.620*	*0.1349*	*1.3*
13	15:52	19.00	0.6	0.400	0.6	0.160	0.3553	1.00	0.3553	0.500	0.1776	1.8
14	15:53	20.50	0.6	0.600	0.6	0.240	0.5761	1.00	0.5761	0.900	0.5186	5.1
15	15:54	22.00	0.6	0.650	0.6	0.260	0.8238	1.00	0.8238	0.975	0.8031	7.9
16	15:55	23.50	0.6	0.650	0.6	0.260	0.8901	1.00	0.8901	0.975	0.8678	8.6
17	15:56	25.00	0.6	0.500	0.6	0.200	0.9902	1.00	0.9902	0.750	0.7426	7.3
18	*15:57*	*26.50*	*0.6*	*0.430*	*0.6*	*0.172*	*0.7047*	*1.00*	*0.7047*	*0.645*	*0.4547*	*4.5*
19	15:58	28.00	0.6	0.300	0.6	0.120	0.5791	1.00	0.5791	0.450	0.2605	2.6
20	15:59	29.50	0.6	0.330	0.6	0.132	0.2339	1.00	0.2339	0.495	0.1158	1.1
21	16:00	31.00	0.6	0.330	0.6	0.132	0.2320	1.00	0.2320	0.495	0.1148	1.1
22	*16:02*	*32.50*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0472*	*1.00*	*0.0472*	*0.600*	*0.0283*	*0.3*
23	*16:03*	*34.00*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0007*	*1.00*	*0.0007*	*0.580*	*0.0004*	*0.0*
24	16:03	35.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

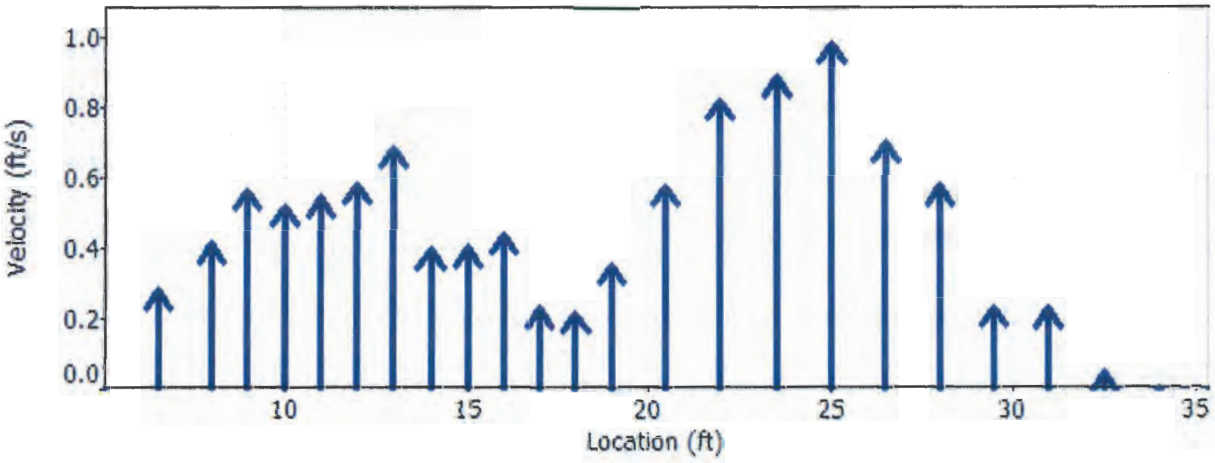
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

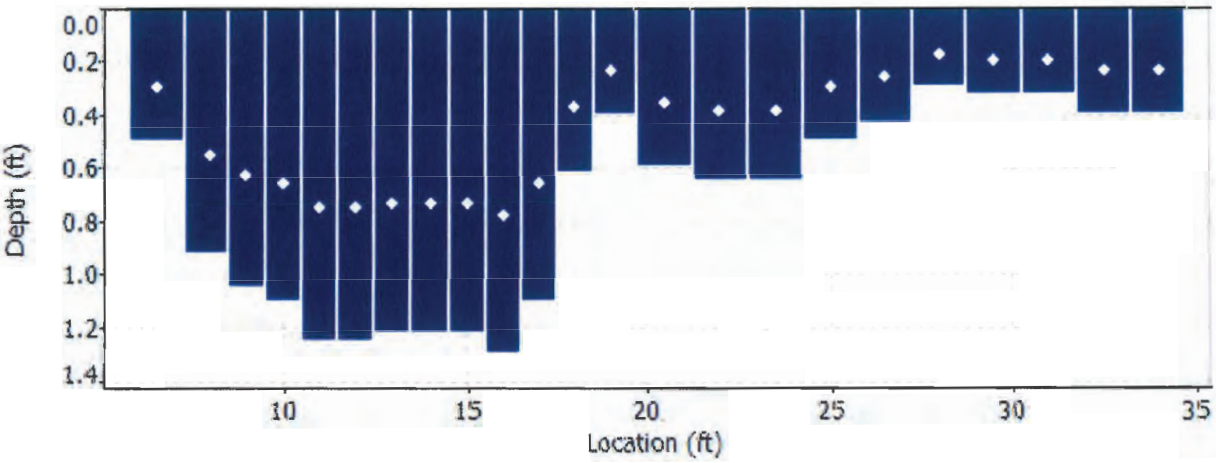
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12US.920.WAD	Site Name	
Start Date and Time	2011/09/21 15:38:22	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12US.920.WAD	Site Name	
Start Date and Time	2011/09/21 15:38:22	Operator(s)	NJT

Quality Control

St	Loc	%Dep	Message
11	17.00	0.6	High angle: -21
12	18.00	0.6	High angle: -31
		0.6	Boundary QC is Good; possible boundary interference
18	26.50	0.6	High angle: -23
22	32.50	0.6	Boundary QC is Fair; possible boundary interference
23	34.00	0.6	SNR (60.2) is different from typical SNR (31.3)

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

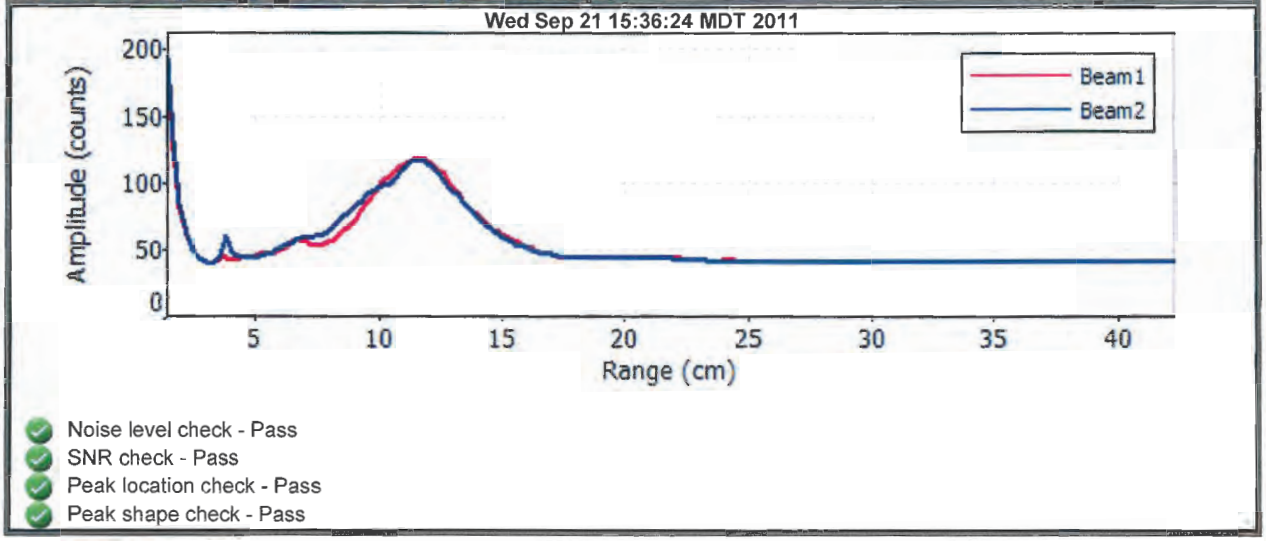
File Information

File Name	C12US.920.WAD
Start Date and Time	2011/09/21 15:38:22

Site Details

Site Name	
Operator(s)	NJT

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 Sep 27 2012

File Information

File Name	C12TRIB.921.WAD
Start Date and Time	2011/09/21 18:46:38

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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	0.7%	4.3%
Velocity	316.7%	93.3%
Width	0.4%	0.4%
Method	6.4%	-
# Stations	4.2%	-
Overall	**316.8%**	**93.4%**

Summary

Averaging Int.	30	# Stations	12
Start Edge	REW	Total Width	4.000
Mean SNR	41.6 dB	Total Area	3.130
Mean Temp	57.91 °F	Mean Depth	0.783
Disch. Equation	Mid-Section	Mean Velocity	-0.0095
		Total Discharge	**-0.0297**

Measurement Results

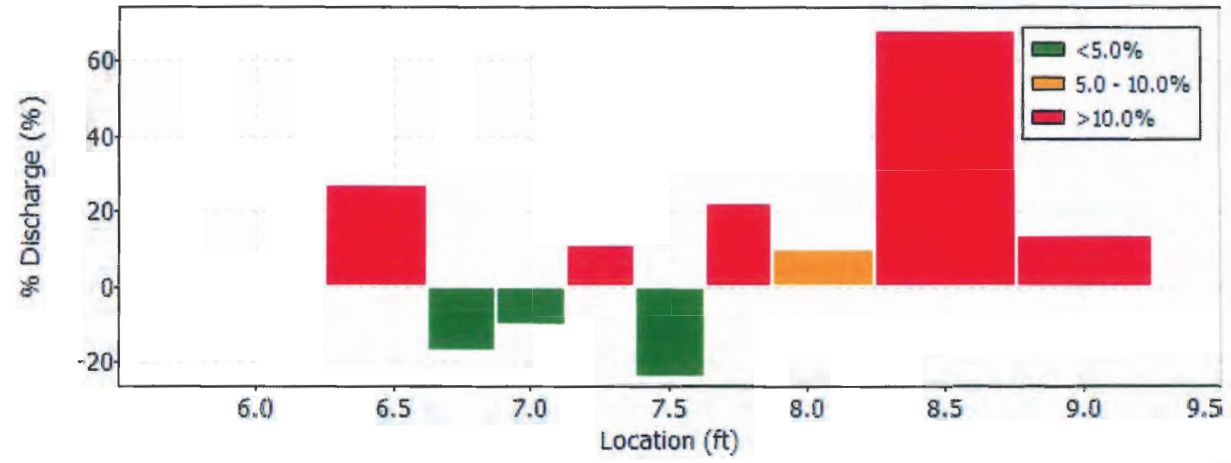
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	18:46	5.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	18:46	6.00	0.6	0.270	0.6	0.108	0.0010	1.00	0.0010	0.135	0.0001	-0.4
2	*18:48*	*6.50*	*0.6*	*0.700*	*0.6*	*0.280*	*-0.0308*	*1.00*	*-0.0308*	*0.263*	*-0.0081*	*27.2*
3	*19:00*	*6.75*	*0.6*	*0.810*	*0.6*	*0.324*	*0.0249*	*1.00*	*0.0249*	*0.203*	*0.0050*	*-17.0*
4	18:49	7.00	0.6	0.900	0.6	0.360	0.0135	1.00	0.0135	0.225	0.0030	-10.2
5	19:02	7.25	0.6	1.100	0.6	0.440	-0.0118	1.00	-0.0118	0.275	-0.0032	10.9
6	18:51	7.50	0.6	1.180	0.6	0.472	0.0243	1.00	0.0243	0.295	0.0072	-24.1
7	*19:03*	*7.75*	*0.6*	*1.200*	*0.6*	*0.480*	*-0.0220*	*1.00*	*-0.0220*	*0.300*	*-0.0066*	*22.2*
8	18:52	8.00	0.6	1.200	0.6	0.480	-0.0066	1.00	-0.0066	0.450	-0.0030	9.9
9	*18:56*	*8.50*	*0.6*	*1.150*	*0.6*	*0.460*	*-0.0351*	*1.00*	*-0.0351*	*0.575*	*-0.0202*	*67.9*
10	18:57	9.00	0.6	0.820	0.6	0.328	-0.0098	1.00	-0.0098	0.410	-0.0040	13.6
11	18:57	9.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

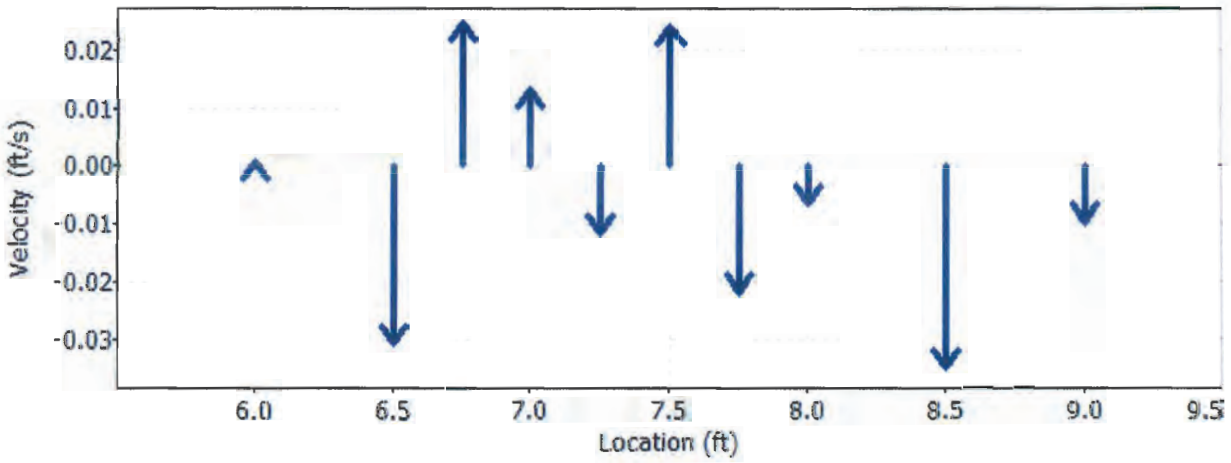
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

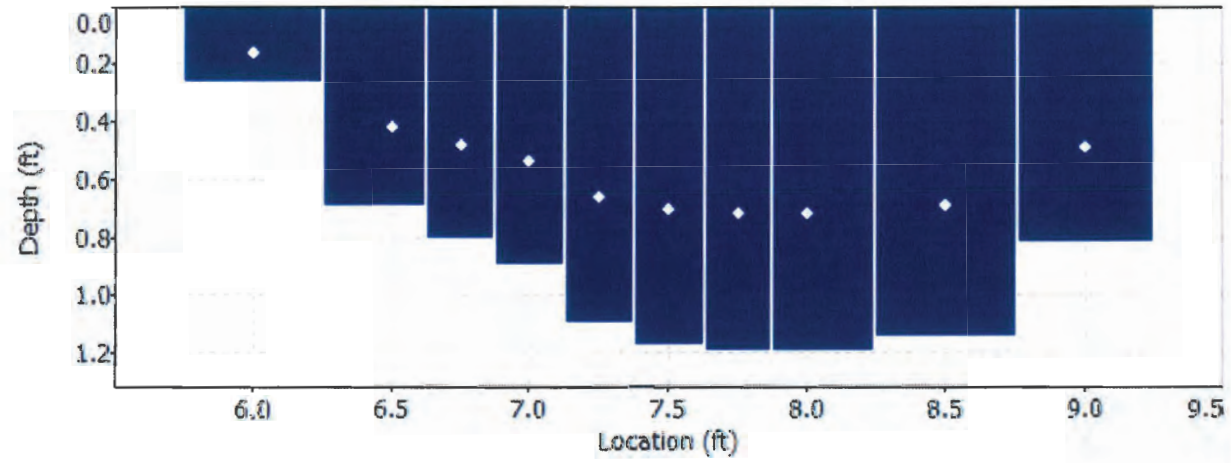
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 18:46:38	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 18:46:38	Operator(s)	ADD

Quality Control

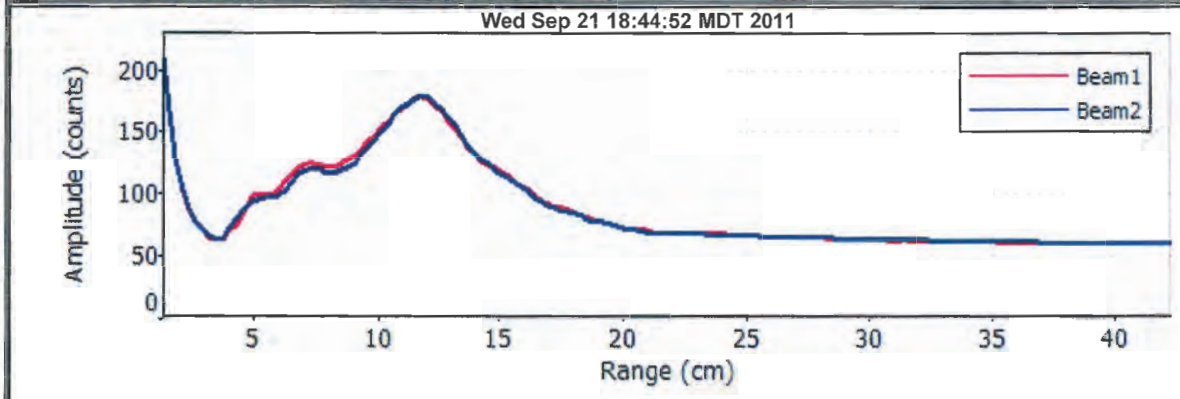
St	Loc	%Dep	Message
2	6.50	0.6	High angle: -102
		0.6	Low SNR: 4.3,2.5
		0.6	SNR (3.4) is different from typical SNR (41.6)
		0.6	High standard error: 0.359
3	6.75	0.6	High angle: 58
7	7.75	0.6	High angle: -170
9	8.50	0.6	High angle: -180

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 18:46:38	Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C12DS.921.WAD
Start Date and Time	2011/09/21 17:53:15

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	1.2%
Velocity	0.5%	1.9%
Width	0.1%	0.1%
Method	1.5%	-
# Stations	1.5%	-
Overall	**2.4%**	**2.5%**

Summary

Averaging Int.	30	# Stations	35
Start Edge	REW	Total Width	33.500
Mean SNR	29.1 dB	Total Area	24.144
Mean Temp	51.94 °F	Mean Depth	0.721
Disch. Equation	Mid-Section	Mean Velocity	0.4838
		Total Discharge	**11.6812**

Measurement Results

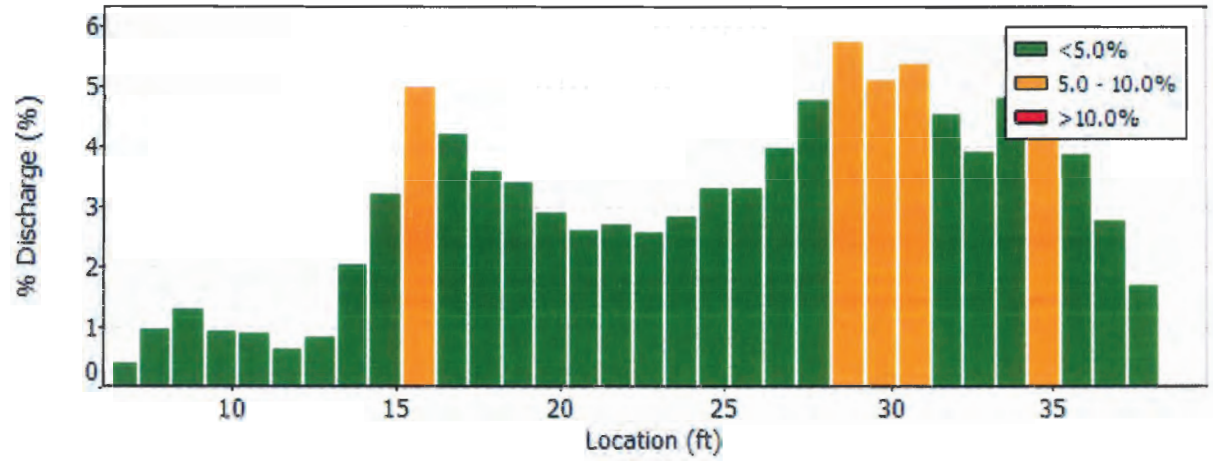
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	17:53	6.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*17:57*	*6.70*	*0.6*	*0.630*	*0.6*	*0.252*	*0.0948*	*1.00*	*0.0948*	*0.504*	*0.0478*	*0.4*
2	17:58	7.70	0.6	0.600	0.6	0.240	0.1932	1.00	0.1932	0.600	0.1160	1.0
3	17:59	8.70	0.6	0.650	0.6	0.260	0.2388	1.00	0.2388	0.650	0.1552	1.3
4	*18:01*	*9.70*	*0.6*	*0.640*	*0.6*	*0.256*	*0.1752*	*1.00*	*0.1752*	*0.640*	*0.1121*	*1.0*
5	18:02	10.70	0.6	0.580	0.6	0.232	0.1883	1.00	0.1883	0.580	0.1092	0.9
6	18:04	11.70	0.6	0.580	0.6	0.232	0.1316	1.00	0.1316	0.580	0.0763	0.7
7	18:05	12.70	0.6	0.520	0.6	0.208	0.1939	1.00	0.1939	0.520	0.1008	0.9
8	18:06	13.70	0.6	0.780	0.6	0.312	0.3064	1.00	0.3064	0.780	0.2390	2.0
9	18:07	14.70	0.6	0.840	0.6	0.336	0.4488	1.00	0.4488	0.840	0.3770	3.2
10	18:08	15.70	0.6	0.940	0.6	0.376	0.6220	1.00	0.6220	0.940	0.5847	5.0
11	18:09	16.70	0.6	0.840	0.6	0.336	0.5902	1.00	0.5902	0.840	0.4957	4.2
12	18:10	17.70	0.6	0.700	0.6	0.280	0.6050	1.00	0.6050	0.700	0.4236	3.6
13	18:11	18.70	0.6	0.590	0.6	0.236	0.6808	1.00	0.6808	0.590	0.4016	3.4
14	18:12	19.70	0.6	0.550	0.6	0.220	0.6188	1.00	0.6188	0.550	0.3402	2.9
15	18:13	20.70	0.6	0.500	0.6	0.200	0.6155	1.00	0.6155	0.500	0.3077	2.6
16	18:14	21.70	0.6	0.480	0.6	0.192	0.6634	1.00	0.6634	0.480	0.3184	2.7
17	18:15	22.70	0.6	0.550	0.6	0.220	0.5545	1.00	0.5545	0.550	0.3049	2.6
18	18:16	23.70	0.6	0.520	0.6	0.208	0.6404	1.00	0.6404	0.520	0.3330	2.9
19	18:17	24.70	0.6	0.580	0.6	0.232	0.6683	1.00	0.6683	0.580	0.3877	3.3
20	18:18	25.70	0.6	0.710	0.6	0.284	0.5469	1.00	0.5469	0.710	0.3883	3.3
21	18:19	26.70	0.6	0.760	0.6	0.304	0.6155	1.00	0.6155	0.760	0.4677	4.0
22	18:20	27.70	0.6	0.800	0.6	0.320	0.7008	1.00	0.7008	0.800	0.5605	4.8
23	18:21	28.70	0.6	0.880	0.6	0.352	0.7674	1.00	0.7674	0.880	0.6752	5.8
24	18:22	29.70	0.6	0.910	0.6	0.364	0.6578	1.00	0.6578	0.910	0.5987	5.1
25	18:28	30.70	0.6	1.090	0.6	0.436	0.5801	1.00	0.5801	1.090	0.6322	5.4
26	18:26	31.70	0.6	1.300	0.6	0.520	0.4091	1.00	0.4091	1.300	0.5318	4.6
27	18:29	32.70	0.6	1.240	0.6	0.496	0.3711	1.00	0.3711	1.240	0.4602	3.9
28	18:30	33.70	0.6	1.010	0.6	0.404	0.5581	1.00	0.5581	1.010	0.5636	4.8
29	18:31	34.70	0.6	0.990	0.6	0.396	0.5902	1.00	0.5902	0.990	0.5844	5.0
30	18:32	35.70	0.6	0.890	0.6	0.356	0.5128	1.00	0.5128	0.890	0.4564	3.9
31	18:33	36.70	0.6	0.700	0.6	0.280	0.4685	1.00	0.4685	0.700	0.3280	2.8
32	18:34	37.70	0.6	0.550	0.6	0.220	0.3691	1.00	0.3691	0.550	0.2030	1.7
33	*18:36*	*38.70*	*0.6*	*0.390*	*0.6*	*0.156*	*0.0007*	*1.00*	*0.0007*	*0.371*	*0.0002*	*0.0*
34	18:36	39.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

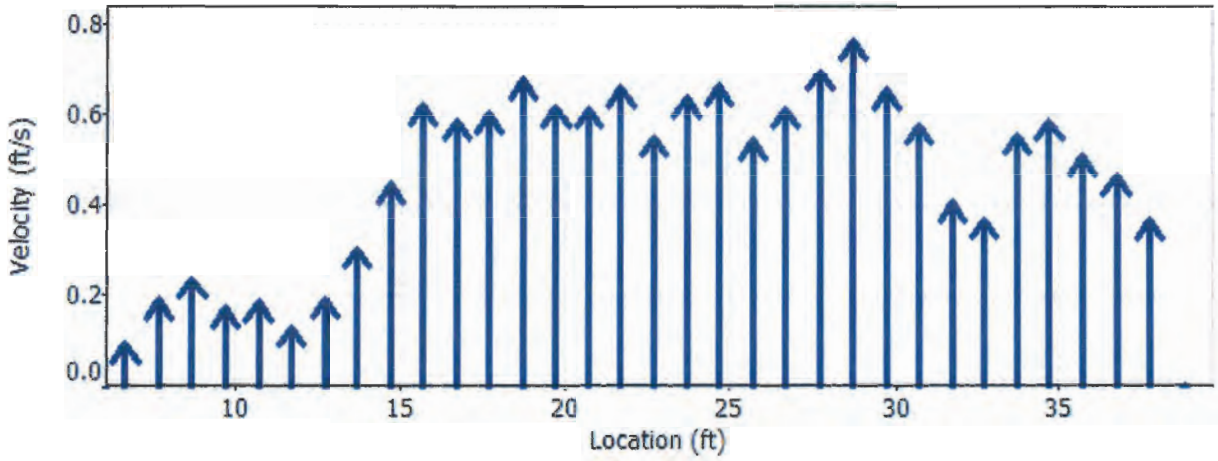
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

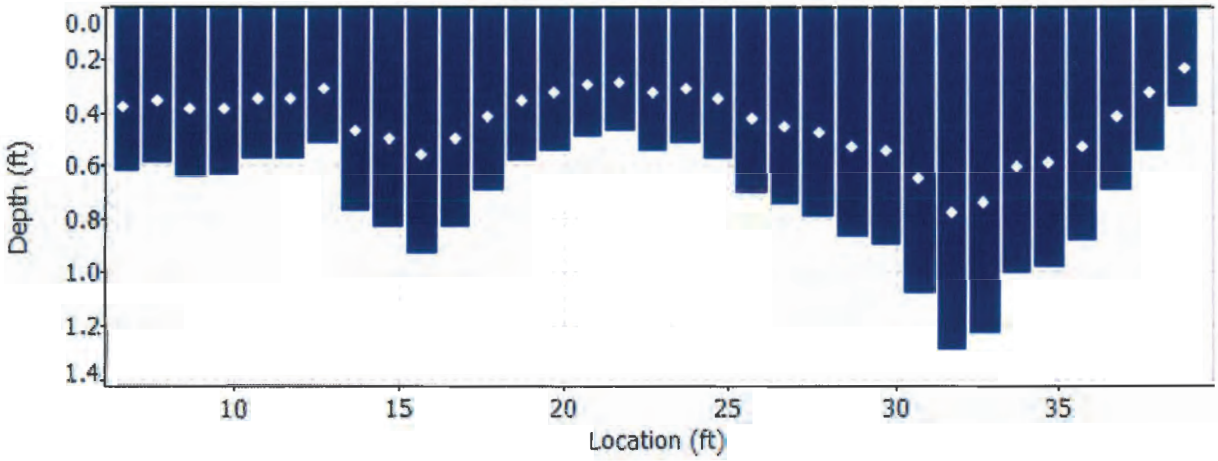
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 17:53:15	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 17:53:15	Operator(s)	ADD

Quality Control

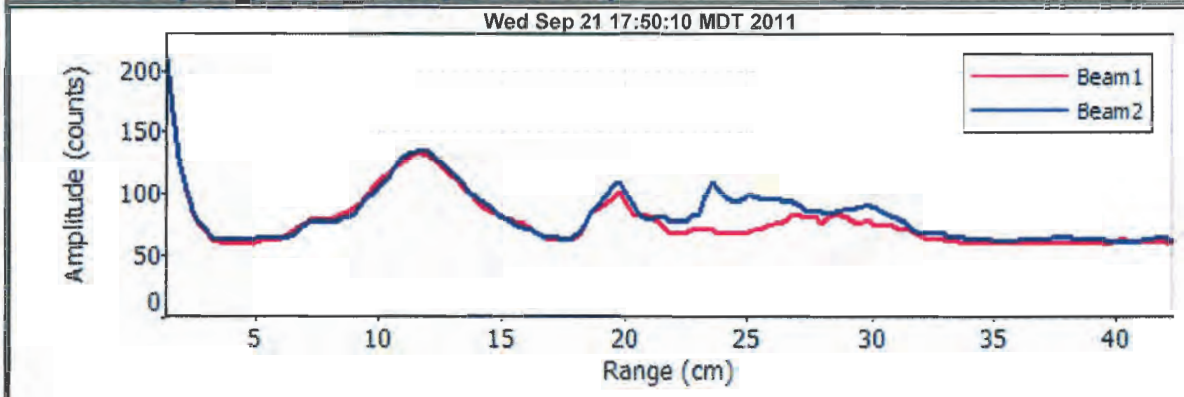
St	Loc	%Dep	Message
1	6.70	0.6	Boundary QC is Fair; possible boundary interference
4	9.70	0.6	High angle: 20
33	38.70	0.6	High differences in beam SNR: 17.6,27.9
		0.6	Boundary QC is Poor; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 17:53:15	Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C11US.921.WAD
Start Date and Time	2011/09/21 16:55:51

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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	0.1%	0.6%
Velocity	0.7%	2.6%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	1.5%	-
Overall	**2.5%**	**2.9%**

Summary

Averaging Int.	30	# Stations	35
Start Edge	REW	Total Width	33.500
Mean SNR	31.2 dB	Total Area	48.945
Mean Temp	52.77 °F	Mean Depth	1.461
Disch. Equation	Mid-Section	Mean Velocity	0.2385
		Total Discharge	**11.6718**

Measurement Results

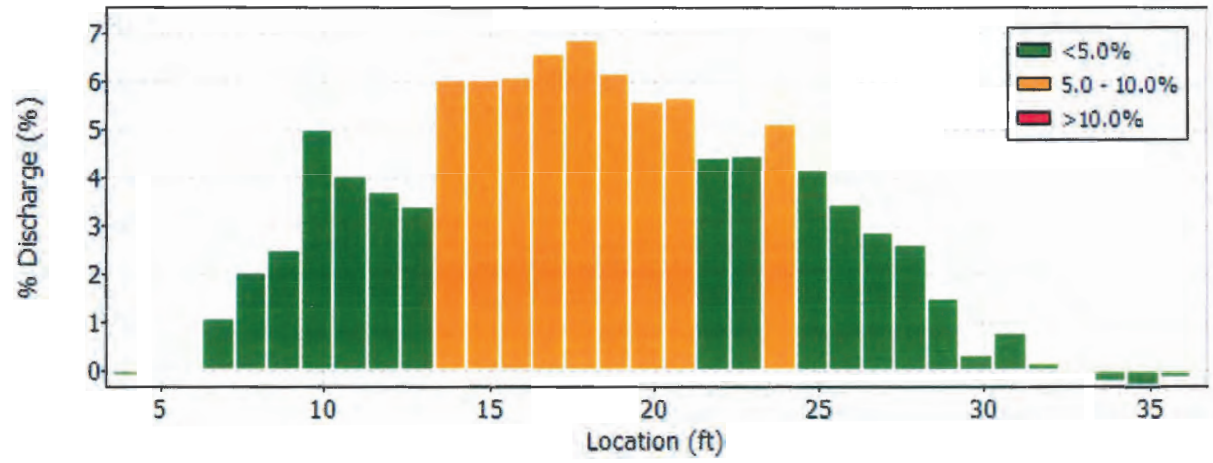
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:55	3.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*16:55*	*3.80*	*0.6*	*0.900*	*0.6*	*0.360*	*-0.0210*	*1.00*	*-0.0210*	*0.675*	*-0.0142*	*-0.1*
2	*16:57*	*4.80*	*0.6*	*1.350*	*0.6*	*0.540*	*-0.0036*	*1.00*	*-0.0036*	*1.350*	*-0.0049*	*0.0*
3	*16:58*	*5.80*	*0.6*	*1.430*	*0.6*	*0.572*	*0.0036*	*1.00*	*0.0036*	*1.430*	*0.0052*	*0.0*
4	17:00	6.80	0.6	1.610	0.6	0.644	0.0804	1.00	0.0804	1.610	0.1294	1.1
5	17:02	7.80	0.6	1.680	0.6	0.672	0.1424	1.00	0.1424	1.680	0.2392	2.0
6	17:03	8.80	0.6	1.800	0.6	0.720	0.1634	1.00	0.1634	1.800	0.2941	2.5
7	17:04	9.80	0.6	1.830	0.6	0.732	0.3182	1.00	0.3182	1.830	0.5824	5.0
8	17:06	10.80	0.6	1.860	0.6	0.744	0.2523	1.00	0.2523	1.860	0.4692	4.0
9	17:07	11.80	0.6	1.830	0.6	0.732	0.2359	1.00	0.2359	1.830	0.4317	3.7
10	17:08	12.80	0.6	1.710	0.6	0.684	0.2323	1.00	0.2323	1.710	0.3972	3.4
11	17:09	13.80	0.6	1.670	0.6	0.668	0.4206	1.00	0.4206	1.670	0.7024	6.0
12	17:10	14.80	0.6	1.680	0.6	0.672	0.4196	1.00	0.4196	1.680	0.7050	6.0
13	17:11	15.80	0.6	1.610	0.6	0.644	0.4393	1.00	0.4393	1.610	0.7072	6.1
14	17:13	16.80	0.6	1.500	0.6	0.600	0.5121	1.00	0.5121	1.500	0.7682	6.6
15	17:16	17.80	0.6	1.500	0.6	0.600	0.5338	1.00	0.5338	1.500	0.8007	6.9
16	17:17	18.80	0.6	1.520	0.6	0.608	0.4715	1.00	0.4715	1.520	0.7166	6.1
17	17:18	19.80	0.6	1.500	0.6	0.600	0.4341	1.00	0.4341	1.500	0.6511	5.6
18	17:19	20.80	0.6	1.390	0.6	0.556	0.4734	1.00	0.4734	1.390	0.6581	5.6
19	17:20	21.80	0.6	1.300	0.6	0.520	0.3963	1.00	0.3963	1.300	0.5152	4.4
20	17:21	22.80	0.6	1.320	0.6	0.528	0.3957	1.00	0.3957	1.320	0.5222	4.5
21	17:23	23.80	0.6	1.420	0.6	0.568	0.4213	1.00	0.4213	1.420	0.5982	5.1
22	17:26	24.80	0.6	1.500	0.6	0.600	0.3245	1.00	0.3245	1.500	0.4867	4.2
23	17:27	25.80	0.6	1.670	0.6	0.668	0.2408	1.00	0.2408	1.670	0.4021	3.4
24	17:28	26.80	0.6	1.650	0.6	0.660	0.2044	1.00	0.2044	1.650	0.3372	2.9
25	17:29	27.80	0.6	1.620	0.6	0.648	0.1880	1.00	0.1880	1.620	0.3046	2.6
26	17:31	28.80	0.6	1.660	0.6	0.664	0.1066	1.00	0.1066	1.660	0.1770	1.5
27	*17:32*	*29.80*	*0.6*	*1.670*	*0.6*	*0.668*	*0.0246*	*1.00*	*0.0246*	*1.670*	*0.0411*	*0.4*
28	17:33	30.80	0.6	1.600	0.6	0.640	0.0587	1.00	0.0587	1.600	0.0940	0.8
29	17:34	31.80	0.6	1.430	0.6	0.572	0.0148	1.00	0.0148	1.430	0.0211	0.2
30	*17:35*	*32.80*	*0.6*	*1.300*	*0.6*	*0.520*	*0.0098*	*1.00*	*0.0098*	*1.300*	*0.0128*	*0.1*
31	*17:36*	*33.80*	*0.6*	*1.130*	*0.6*	*0.452*	*-0.0226*	*1.00*	*-0.0226*	*1.130*	*-0.0256*	*-0.2*
32	*17:38*	*34.80*	*0.6*	*0.900*	*0.6*	*0.360*	*-0.0400*	*1.00*	*-0.0400*	*0.900*	*-0.0360*	*-0.3*
33	*17:40*	*35.80*	*0.6*	*0.630*	*0.6*	*0.252*	*-0.0279*	*1.00*	*-0.0279*	*0.630*	*-0.0176*	*-0.2*
34	17:40	36.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

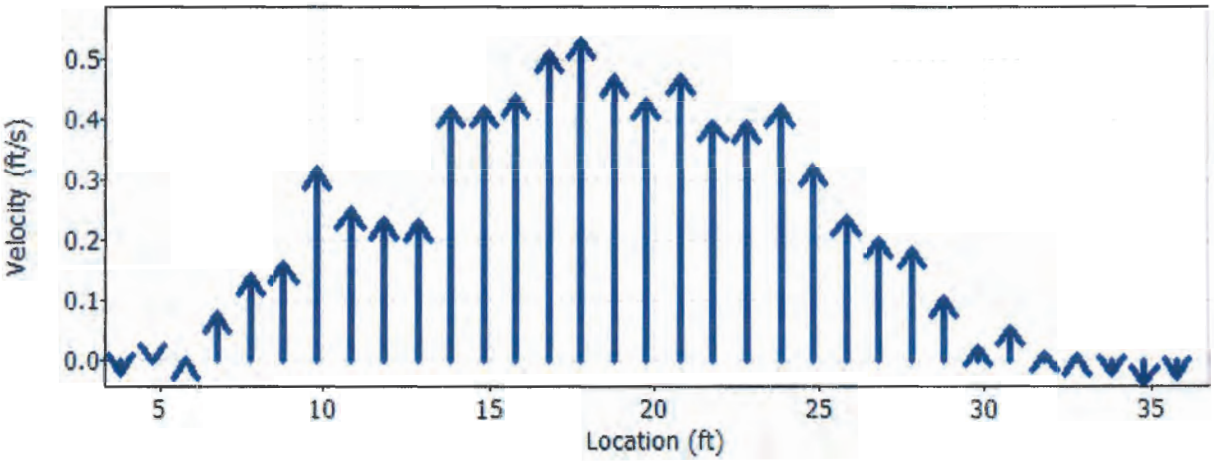
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

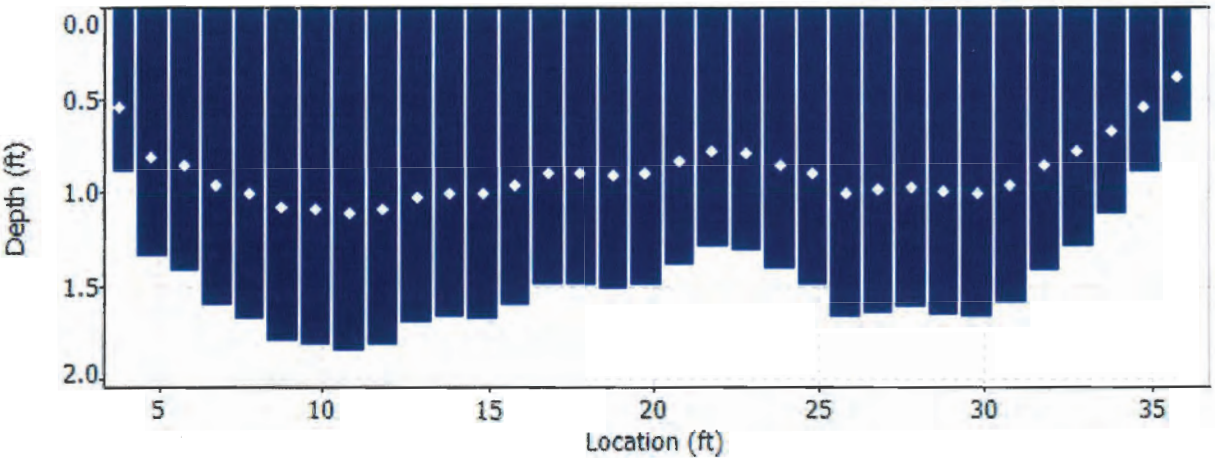
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C11US.921.WAD	Site Name	
Start Date and Time	2011/09/21 16:55:51	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C11US.921.WAD
Start Date and Time	2011/09/21 16:55:51

Site Details

Site Name	
Operator(s)	ADD

Quality Control

St	Loc	%Dep	Message
1	3.80	0.6	High angle: 180
		0.6	SNR (48.5) is different from typical SNR (31.2)
2	4.80	0.6	SNR (44.1) is different from typical SNR (31.2)
3	5.80	0.6	SNR (42.4) is different from typical SNR (31.2)
27	29.80	0.6	High angle: 26
		0.6	High SNR variation during measurement: 5.2,5.2
30	32.80	0.6	SNR (44.2) is different from typical SNR (31.2)
		0.6	High SNR variation during measurement: 5.6,6.0
31	33.80	0.6	High angle: 139
		0.6	SNR (43.4) is different from typical SNR (31.2)
32	34.80	0.6	High angle: 158
		0.6	SNR (45.5) is different from typical SNR (31.2)
33	35.80	0.6	High angle: -148
		0.6	SNR (43.0) is different from typical SNR (31.2)
		0.6	Boundary QC is Good; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

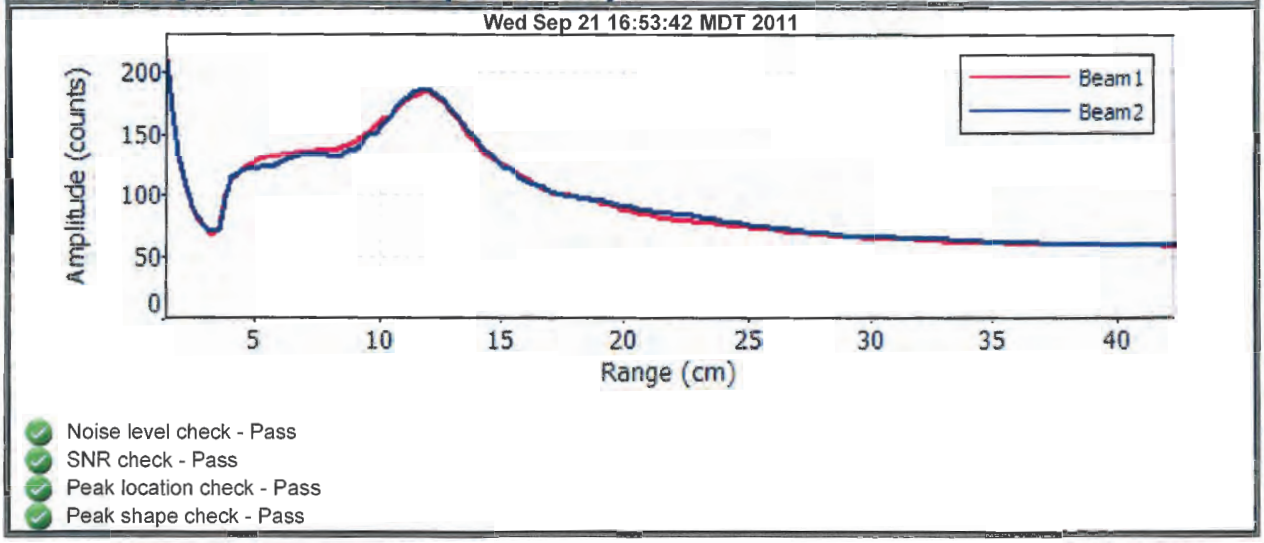
File Information

File Name	C11US.921.WAD
Start Date and Time	2011/09/21 16:55:51

Site Details

Site Name	
Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C11TRIB.921.WAD
Start Date and Time	2011/09/21 16:01:04

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	6.4%
Velocity	144.5%	17.0%
Width	0.2%	0.2%
Method	3.5%	-
# Stations	2.4%	-
Overall	**144.6%**	**18.2%**

Summary

Averaging Int.	30	# Stations	21
Start Edge	REW	Total Width	7.400
Mean SNR	34.0 dB	Total Area	6.210
Mean Temp	58.66 °F	Mean Depth	0.839
Disch. Equation	Mid-Section	Mean Velocity	0.0291
		Total Discharge	**0.1808**

Measurement Results

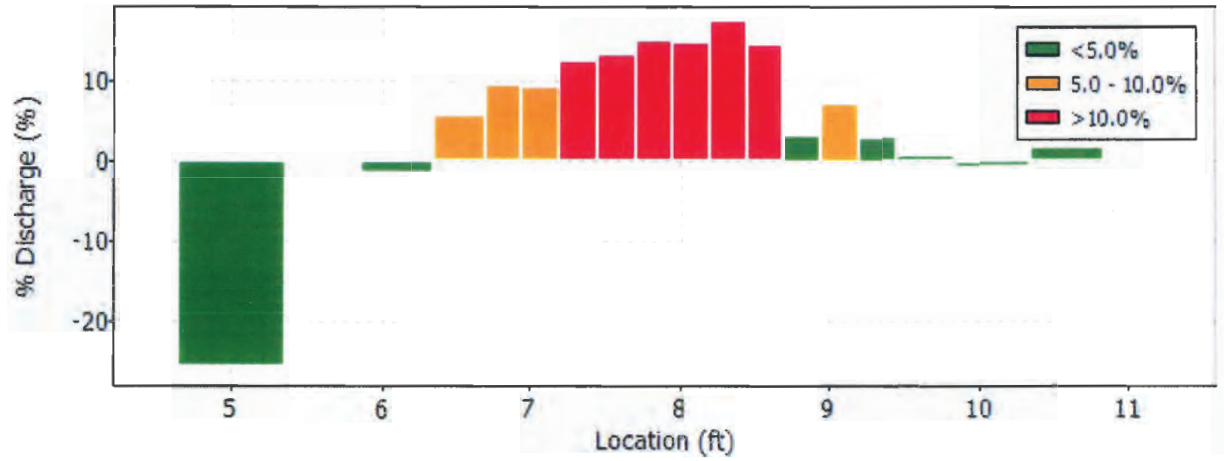
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:01	4.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*16:02*	*5.10*	*0.6*	*0.430*	*0.6*	*0.172*	*-0.1539*	*1.00*	*-0.1539*	*0.301*	*-0.0463*	*-25.6*
2	*16:04*	*5.60*	*0.6*	*0.340*	*0.6*	*0.136*	*-0.0020*	*1.00*	*-0.0020*	*0.170*	*-0.0003*	*-0.2*
3	*16:06*	*6.10*	*0.6*	*0.830*	*0.6*	*0.332*	*-0.0062*	*1.00*	*-0.0062*	*0.415*	*-0.0026*	*-1.4*
4	*16:07*	*6.60*	*0.6*	*1.210*	*0.6*	*0.484*	*0.0246*	*1.00*	*0.0246*	*0.423*	*0.0104*	*5.8*
5	*16:27*	*6.80*	*0.6*	*1.230*	*0.6*	*0.492*	*0.0554*	*1.00*	*0.0554*	*0.307*	*0.0170*	*9.4*
6	*16:09*	*7.10*	*0.6*	*1.180*	*0.6*	*0.472*	*0.0571*	*1.00*	*0.0571*	*0.295*	*0.0168*	*9.3*
7	16:29	7.30	0.6	1.210	0.6	0.484	0.0748	1.00	0.0748	0.302	0.0226	12.5
8	16:11	7.60	0.6	1.250	0.6	0.500	0.0771	1.00	0.0771	0.313	0.0241	13.3
9	16:33	7.80	0.6	1.260	0.6	0.504	0.0860	1.00	0.0860	0.315	0.0271	15.0
10	16:13	8.10	0.6	1.320	0.6	0.528	0.0810	1.00	0.0810	0.330	0.0267	14.8
11	16:35	8.30	0.6	1.350	0.6	0.540	0.0942	1.00	0.0942	0.338	0.0318	17.6
12	16:15	8.60	0.6	1.350	0.6	0.540	0.0778	1.00	0.0778	0.338	0.0262	14.5
13	16:36	8.80	0.6	1.320	0.6	0.528	0.0180	1.00	0.0180	0.330	0.0060	3.3
14	*16:16*	*9.10*	*0.6*	*1.290*	*0.6*	*0.516*	*0.0400*	*1.00*	*0.0400*	*0.323*	*0.0129*	*7.1*
15	*16:37*	*9.30*	*0.6*	*1.000*	*0.6*	*0.400*	*0.0213*	*1.00*	*0.0213*	*0.250*	*0.0053*	*2.9*
16	16:18	9.60	0.6	1.000	0.6	0.400	0.0030	1.00	0.0030	0.400	0.0012	0.7
17	16:20	10.10	0.6	1.080	0.6	0.432	-0.0023	1.00	-0.0023	0.540	-0.0012	-0.7
18	16:21	10.60	0.6	0.860	0.6	0.344	0.0072	1.00	0.0072	0.430	0.0031	1.7
19	*16:22*	*11.10*	*0.6*	*0.180*	*0.6*	*0.072*	*-0.0003*	*1.00*	*-0.0003*	*0.090*	*0.0000*	*0.0*
20	16:22	11.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

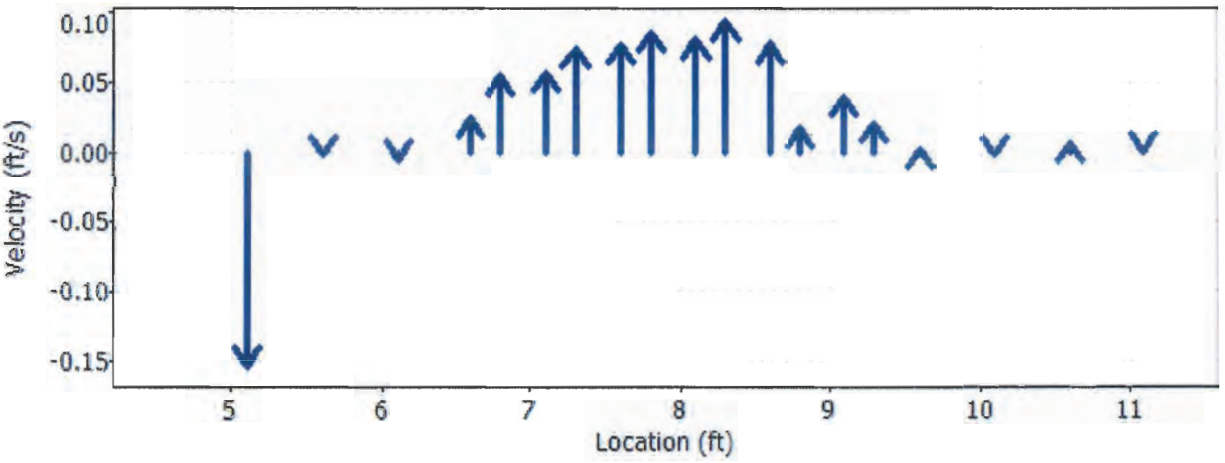
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

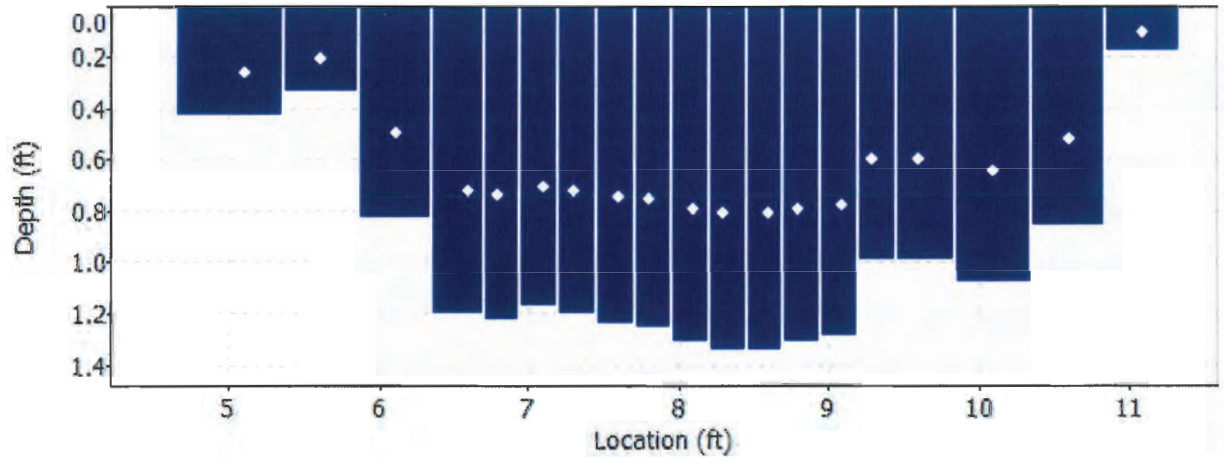
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C11TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 16:01:04	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C11TRIB.921.WAD
Start Date and Time	2011/09/21 16:01:04

Site Details

Site Name	
Operator(s)	ADD

Quality Control

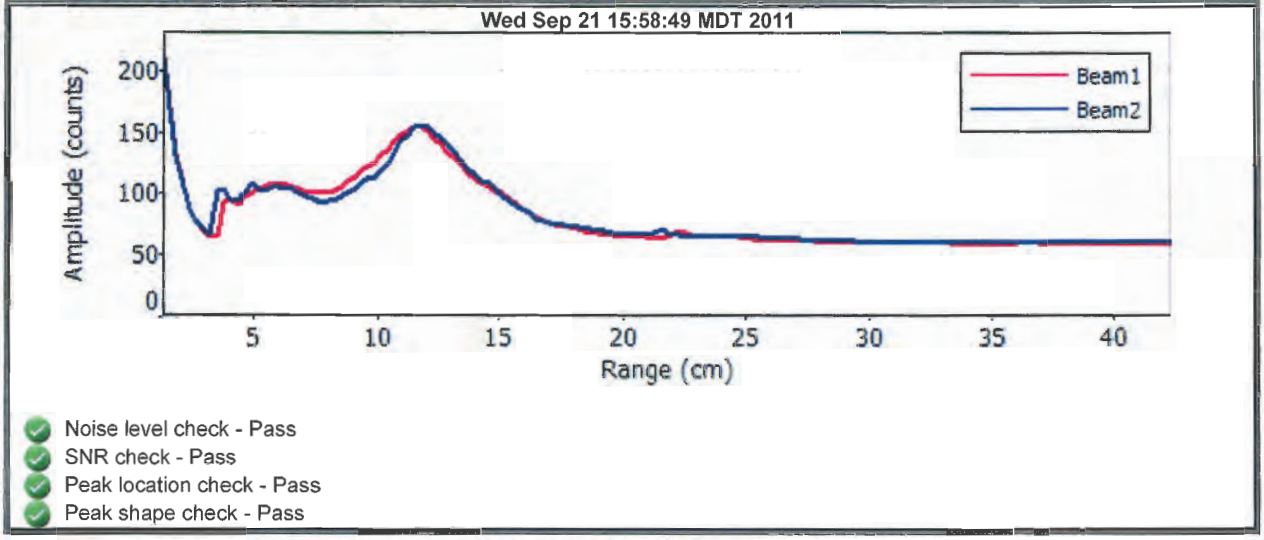
St	Loc	%Dep	Message
1	5.10	0.6	High angle: -179
		0.6	Low SNR: 9.8,0.0
		0.6	SNR (4.9) is different from typical SNR (34.0)
		0.6	High SNR variation during measurement: 6.9,0.4
		0.6	High standard error: 0.868
2	5.60	0.6	High number of spikes: 4
3	6.10	0.6	SNR (46.2) is different from typical SNR (34.0)
4	6.60	0.6	High angle: -27
5	6.80	0.6	High angle: -29
6	7.10	0.6	High angle: -33
14	9.10	0.6	High angle: -23
15	9.30	0.6	High angle: 25
19	11.10	0.6	High SNR variation during measurement: 2.6,7.3
		0.6	Boundary QC is Fair; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C11TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 16:01:04	Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C11DS.921.WAD
Start Date and Time	2011/09/21 14:55:22

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	1.8%
Velocity	0.9%	3.6%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	1.7%	-
Overall	**2.7%**	**4.1%**

Summary

Averaging Int.	30	# Stations	31
Start Edge	REW	Total Width	24.500
Mean SNR	32.4 dB	Total Area	16.942
Mean Temp	53.04 °F	Mean Depth	0.691
Disch. Equation	Mid-Section	Mean Velocity	0.7633
		Total Discharge	**12.9308**

Measurement Results

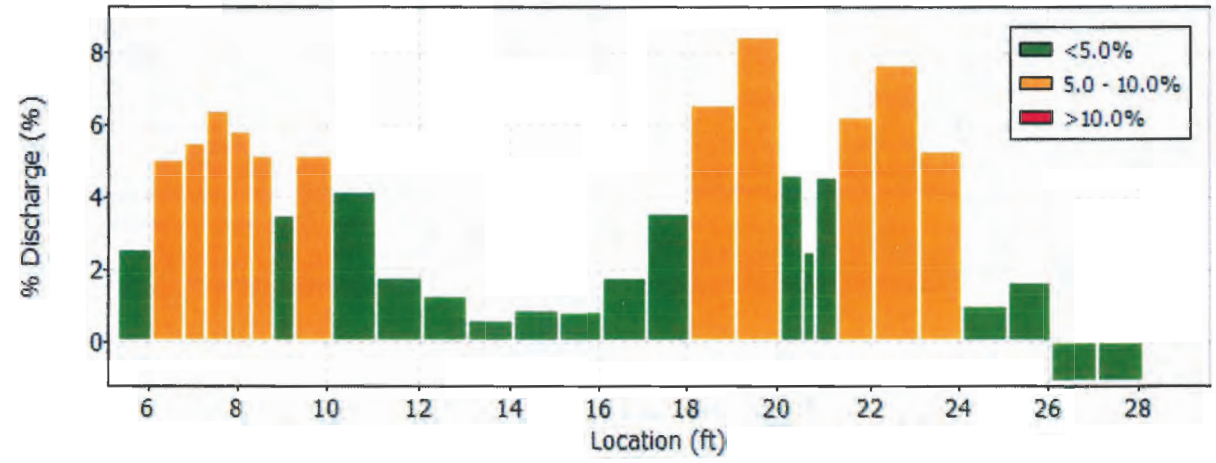
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:55	5.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:57	5.60	0.6	0.490	0.6	0.196	0.8976	1.00	0.8976	0.368	0.3300	2.6
2	14:59	6.60	0.6	0.650	0.6	0.260	1.4350	1.00	1.4350	0.455	0.6528	5.0
3	15:43	7.00	0.6	0.790	0.6	0.316	1.7930	1.00	1.7930	0.395	0.7083	5.5
4	15:03	7.60	0.6	0.860	0.6	0.344	1.9150	1.00	1.9150	0.430	0.8234	6.4
5	15:45	8.00	0.6	0.870	0.6	0.348	1.7303	1.00	1.7303	0.435	0.7528	5.8
6	15:04	8.60	0.6	0.880	0.6	0.352	1.5177	1.00	1.5177	0.440	0.6677	5.2
7	15:46	9.00	0.6	0.820	0.6	0.328	1.0991	1.00	1.0991	0.410	0.4506	3.5
8	15:05	9.60	0.6	0.690	0.6	0.276	1.2087	1.00	1.2087	0.552	0.6672	5.2
9	15:06	10.60	0.6	0.530	0.6	0.212	1.0197	1.00	1.0197	0.530	0.5403	4.2
10	15:14	11.60	0.6	0.220	0.6	0.088	1.0423	1.00	1.0423	0.220	0.2295	1.8
11	15:15	12.60	0.6	0.220	0.6	0.088	0.7503	1.00	0.7503	0.220	0.1652	1.3
12	*15:18*	*13.60*	*0.6*	*0.320*	*0.6*	*0.128*	*0.2365*	*1.00*	*0.2365*	*0.320*	*0.0757*	*0.6*
13	15:20	14.60	0.6	0.250	0.6	0.100	0.4587	1.00	0.4587	0.250	0.1147	0.9
14	15:23	15.60	0.6	0.370	0.6	0.148	0.2838	1.00	0.2838	0.370	0.1050	0.8
15	15:25	16.60	0.6	0.530	0.6	0.212	0.4249	1.00	0.4249	0.530	0.2251	1.7
16	15:27	17.60	0.6	0.760	0.6	0.304	0.6070	1.00	0.6070	0.760	0.4612	3.6
17	15:28	18.60	0.6	0.860	0.6	0.344	0.9846	1.00	0.9846	0.860	0.8466	6.5
18	15:29	19.60	0.6	1.030	0.6	0.412	1.1148	1.00	1.1148	0.978	1.0907	8.4
19	15:49	20.50	0.6	1.080	0.6	0.432	1.0994	1.00	1.0994	0.540	0.5937	4.6
20	15:31	20.60	0.6	1.080	0.6	0.432	1.2044	1.00	1.2044	0.270	0.3252	2.5
21	15:50	21.00	0.6	1.030	0.6	0.412	1.1335	1.00	1.1335	0.515	0.5837	4.5
22	15:32	21.60	0.6	0.980	0.6	0.392	1.0262	1.00	1.0262	0.784	0.8046	6.2
23	15:33	22.60	0.6	0.980	0.6	0.392	1.0098	1.00	1.0098	0.980	0.9896	7.7
24	15:34	23.60	0.6	1.000	0.6	0.400	0.6791	1.00	0.6791	1.000	0.6791	5.3
25	15:36	24.60	0.6	0.720	0.6	0.288	0.1736	1.00	0.1736	0.720	0.1250	1.0
26	*15:37*	*25.60*	*0.6*	*0.820*	*0.6*	*0.328*	*0.2648*	*1.00*	*0.2648*	*0.820*	*0.2171*	*1.7*
27	*15:38*	*26.60*	*0.6*	*1.040*	*0.6*	*0.416*	*-0.1417*	*1.00*	*-0.1417*	*1.040*	*-0.1474*	*-1.1*
28	*15:39*	*27.60*	*0.6*	*0.950*	*0.6*	*0.380*	*-0.1539*	*1.00*	*-0.1539*	*0.950*	*-0.1462*	*-1.1*
29	*15:40*	*28.60*	*0.6*	*0.800*	*0.6*	*0.320*	*-0.0003*	*1.00*	*-0.0003*	*0.800*	*-0.0003*	*0.0*
30	15:40	29.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

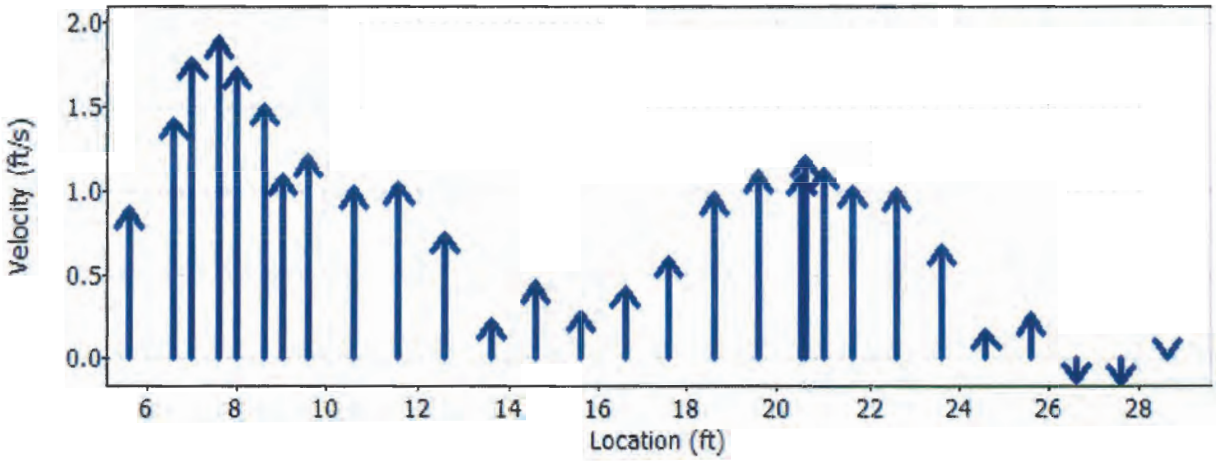
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

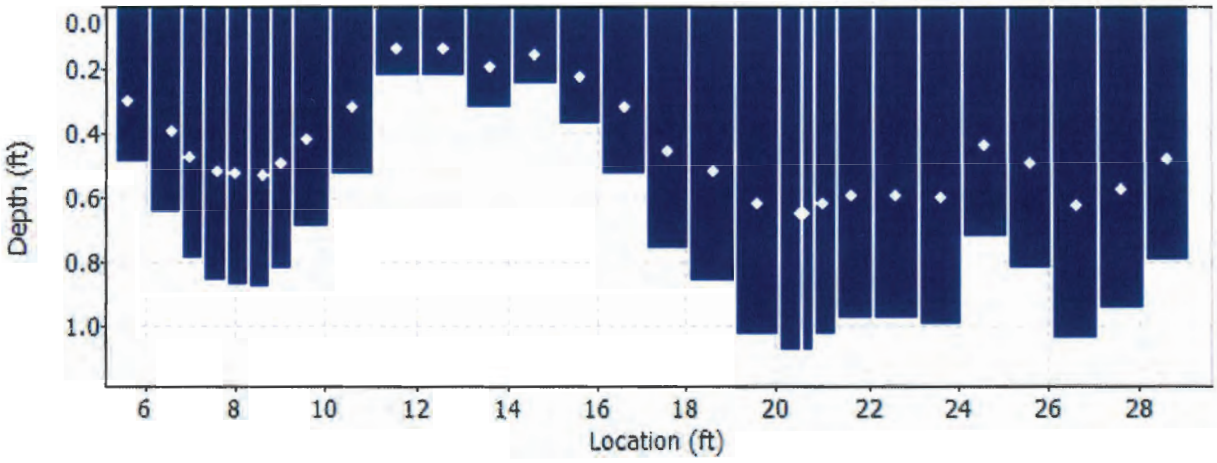
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C11DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 14:55:22	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C11DS.921.WAD
Start Date and Time	2011/09/21 14:55:22

Site Details

Site Name	
Operator(s)	ADD

Quality Control

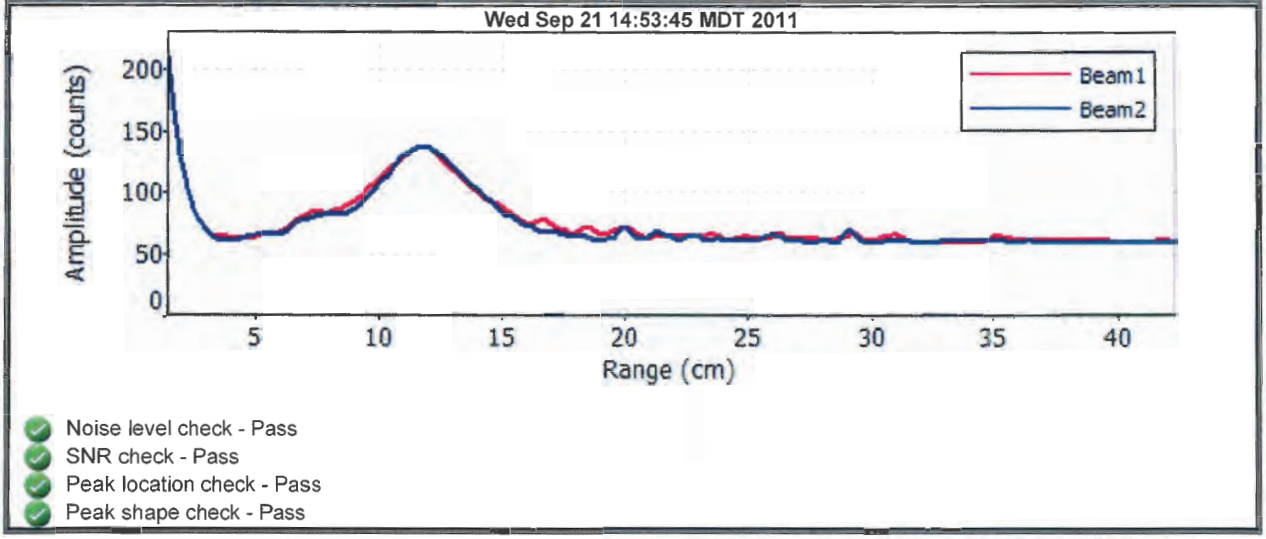
St	Loc	%Dep	Message
12	13.60	0.6	High angle: -27
26	25.60	0.6	High SNR variation during measurement: 7.3,7.3
27	26.60	0.6	High angle: -149
28	27.60	0.6	High angle: -155
29	28.60	0.6	High differences in beam SNR: 70.0,44.7
		0.6	SNR (57.4) is different from typical SNR (32.4)

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C11DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 14:55:22	Operator(s)	ADD

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 Sep 27 2012

File Information	
File Name	C9US.920.WAD
Start Date and Time	2011/09/21 16:24:08

Site Details	
Site Name	
Operator(s)	NJT

System Information	
Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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%	2.8%
Velocity	0.8%	5.0%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.3%	-
Overall	**3.2%**	**5.8%**

Summary

Averaging Int.	30	# Stations	22
Start Edge	REW	Total Width	39.600
Mean SNR	27.4 dB	Total Area	26.000
Mean Temp	53.91 °F	Mean Depth	0.657
Disch. Equation	Mid-Section	Mean Velocity	0.4776
		Total Discharge	**12.4177**

Measurement Results

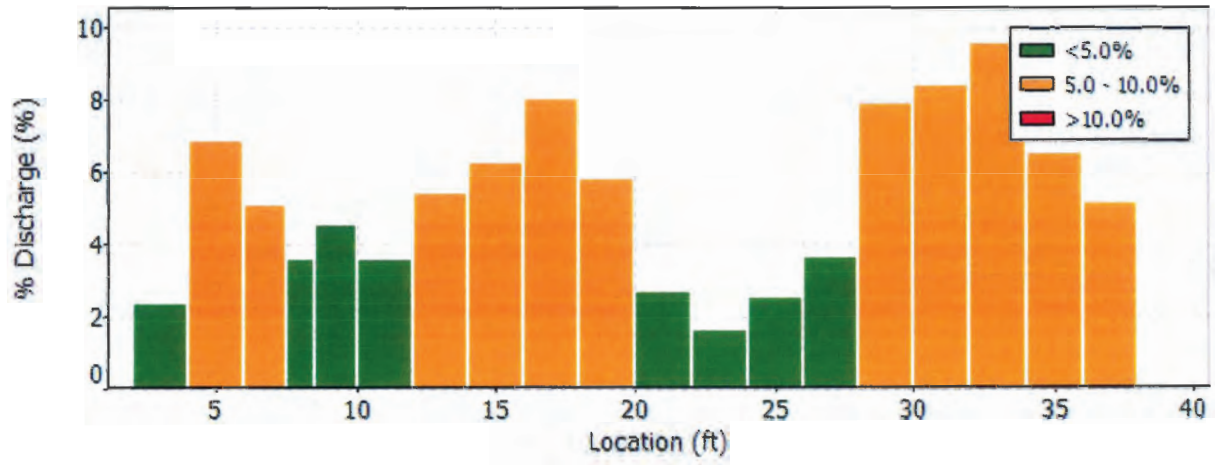
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:24	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*16:24*	*3.00*	*0.6*	*0.460*	*0.6*	*0.184*	*0.3173*	*1.00*	*0.3173*	*0.920*	*0.2919*	*2.4*
2	16:25	5.00	0.6	0.620	0.6	0.248	0.6873	1.00	0.6873	1.240	0.8524	6.9
3	16:26	7.00	0.6	0.700	0.6	0.280	0.6030	1.00	0.6030	1.050	0.6333	5.1
4	16:27	8.00	0.6	0.670	0.6	0.268	0.6667	1.00	0.6667	0.670	0.4466	3.6
5	16:28	9.00	0.6	0.700	0.6	0.280	0.5387	1.00	0.5387	1.050	0.5658	4.6
6	16:30	11.00	0.6	0.550	0.6	0.220	0.4091	1.00	0.4091	1.100	0.4499	3.6
7	16:31	13.00	0.6	0.670	0.6	0.268	0.5030	1.00	0.5030	1.340	0.6739	5.4
8	16:32	15.00	0.6	0.670	0.6	0.268	0.5801	1.00	0.5801	1.340	0.7772	6.3
9	16:33	17.00	0.6	0.670	0.6	0.268	0.7490	1.00	0.7490	1.340	1.0036	8.1
10	16:36	19.00	0.6	0.630	0.6	0.252	0.5768	1.00	0.5768	1.260	0.7266	5.9
11	16:37	21.00	0.6	0.820	0.6	0.328	0.2064	1.00	0.2064	1.640	0.3384	2.7
12	16:38	23.00	0.6	0.520	0.6	0.208	0.1952	1.00	0.1952	1.040	0.2030	1.6
13	*16:40*	*25.00*	*0.6*	*0.600*	*0.6*	*0.240*	*0.2628*	*1.00*	*0.2628*	*1.200*	*0.3154*	*2.5*
14	*16:41*	*27.00*	*0.6*	*0.680*	*0.6*	*0.272*	*0.3337*	*1.00*	*0.3337*	*1.360*	*0.4539*	*3.7*
15	16:42	29.00	0.6	0.970	0.6	0.388	0.5092	1.00	0.5092	1.940	0.9880	8.0
16	16:43	31.00	0.6	1.050	0.6	0.420	0.4984	1.00	0.4984	2.100	1.0464	8.4
17	16:44	33.00	0.6	0.900	0.6	0.360	0.6644	1.00	0.6644	1.800	1.1958	9.6
18	16:45	35.00	0.6	0.800	0.6	0.320	0.5066	1.00	0.5066	1.600	0.8104	6.5
19	16:47	37.00	0.6	0.600	0.6	0.240	0.5348	1.00	0.5348	1.200	0.6418	5.2
20	*16:48*	*39.00*	*0.6*	*0.450*	*0.6*	*0.180*	*0.0043*	*1.00*	*0.0043*	*0.810*	*0.0035*	*0.0*
21	16:48	40.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

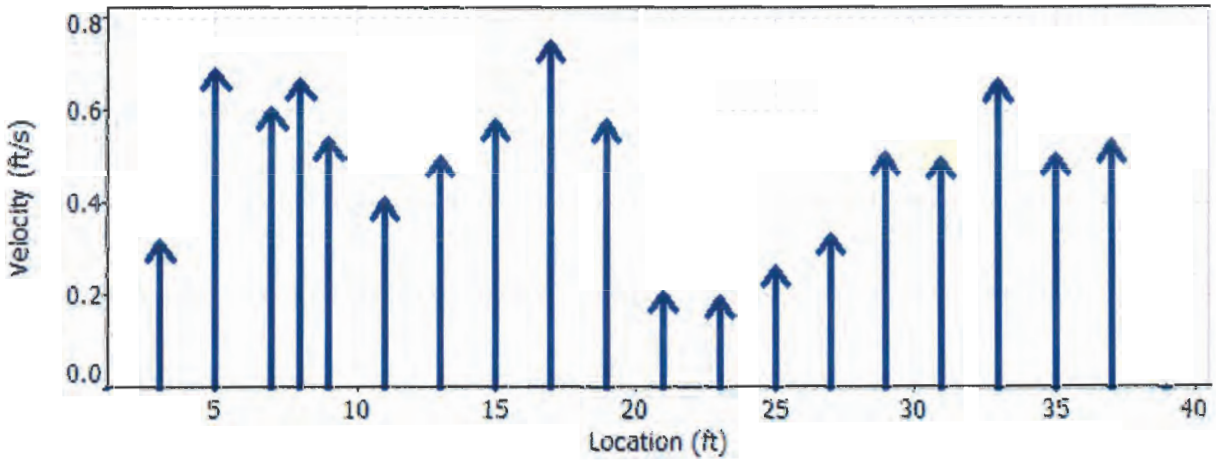
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

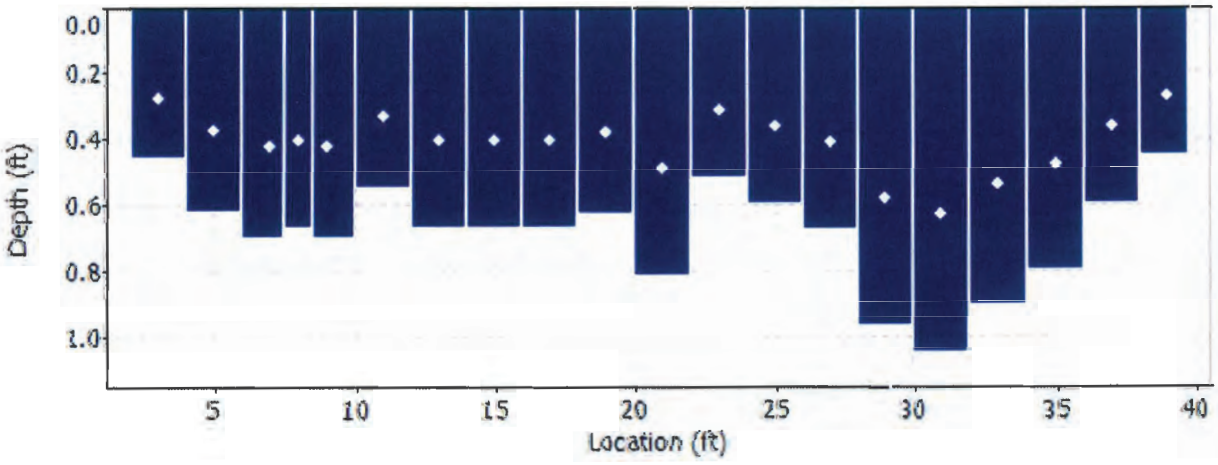
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C9US.920.WAD	Site Name	
Start Date and Time	2011/09/21 16:24:08	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C9US.920.WAD
Start Date and Time	2011/09/21 16:24:08

Site Details

Site Name	
Operator(s)	NJT

Quality Control

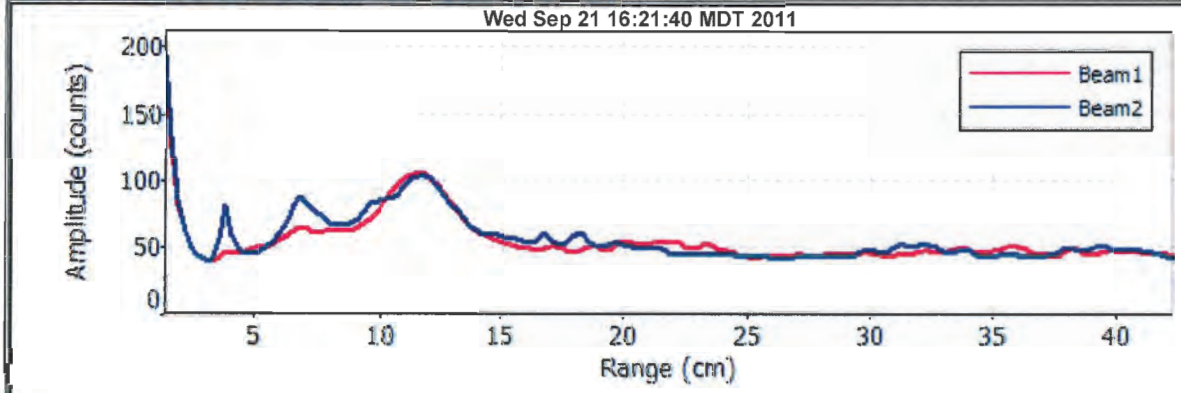
St	Loc	%Dep	Message
1	3.00	0.6	High standard error: 0.031
13	25.00	0.6	High angle: -26
14	27.00	0.6	High angle: -23
20	39.00	0.6	SNR (57.0) is different from typical SNR (27.4)

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C9US.920.WAD	Site Name	
Start Date and Time	2011/09/21 16:24:08	Operator(s)	NJT

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 Sep 27 2012

File Information

File Name	C9TRIB.921.WAD
Start Date and Time	2011/09/21 08:53:00

Site Details

Site Name	
Operator(s)	ADD

System Information

Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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	3.1%	21.8%
Velocity	14.0%	200.6%
Width	1.0%	1.0%
Method	15.4%	-
# Stations	5.1%	-
Overall	**21.7%**	**201.8%**

Summary

Averaging Int.	30	# Stations	10
Start Edge	REW	Total Width	4.400
Mean SNR	38.3 dB	Total Area	2.609
Mean Temp	37.02 °F	Mean Depth	0.593
Disch. Equation	Mid-Section	Mean Velocity	-0.0021
		Total Discharge	**-0.0054**

Measurement Results

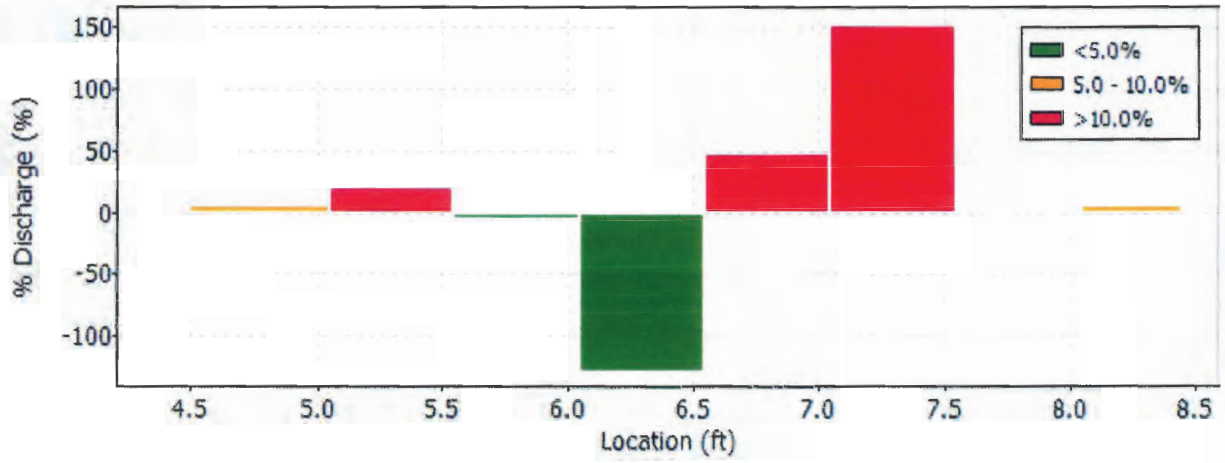
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	08:52	4.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*08:56*	*4.80*	*0.6*	*0.400*	*0.6*	*0.160*	*-0.0013*	*1.00*	*-0.0013*	*0.220*	*-0.0003*	*5.3*
2	*08:59*	*5.30*	*0.6*	*0.840*	*0.6*	*0.336*	*-0.0026*	*1.00*	*-0.0026*	*0.420*	*-0.0011*	*20.3*
3	09:04	5.80	0.6	0.920	0.6	0.368	0.0007	1.00	0.0007	0.460	0.0003	-5.6
4	09:02	6.30	0.6	0.920	0.6	0.368	0.0151	1.00	0.0151	0.460	0.0069	-128.0
5	09:06	6.80	0.6	0.790	0.6	0.316	-0.0066	1.00	-0.0066	0.395	-0.0026	47.8
6	*09:07*	*7.30*	*0.6*	*0.620*	*0.6*	*0.248*	*-0.0266*	*1.00*	*-0.0266*	*0.310*	*-0.0082*	*151.9*
7	*09:10*	*7.80*	*0.6*	*0.520*	*0.6*	*0.208*	*-0.0007*	*1.00*	*-0.0007*	*0.260*	*-0.0002*	*3.1*
8	*09:11*	*8.30*	*0.6*	*0.210*	*0.6*	*0.084*	*-0.0033*	*1.00*	*-0.0033*	*0.084*	*-0.0003*	*5.1*
9	09:11	8.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

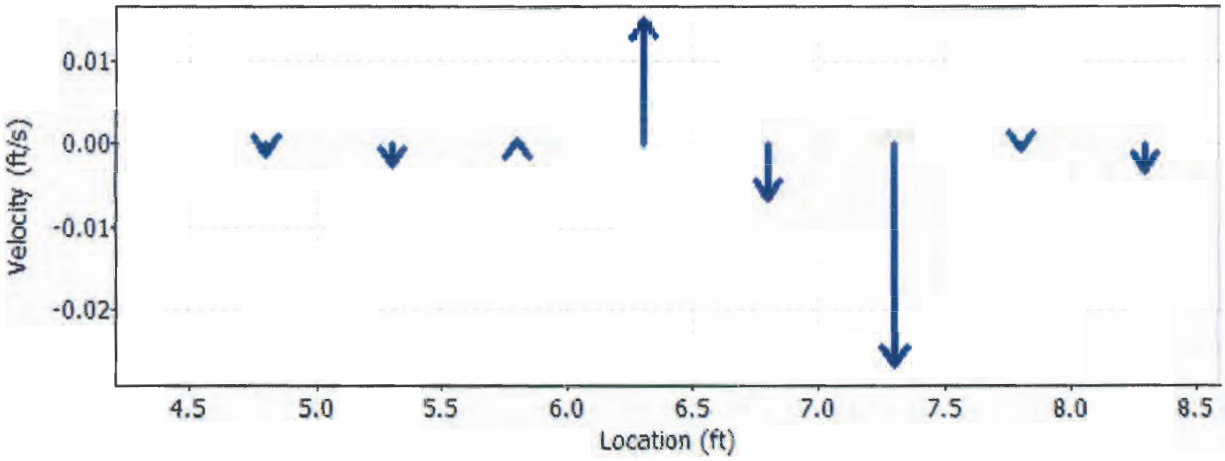
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

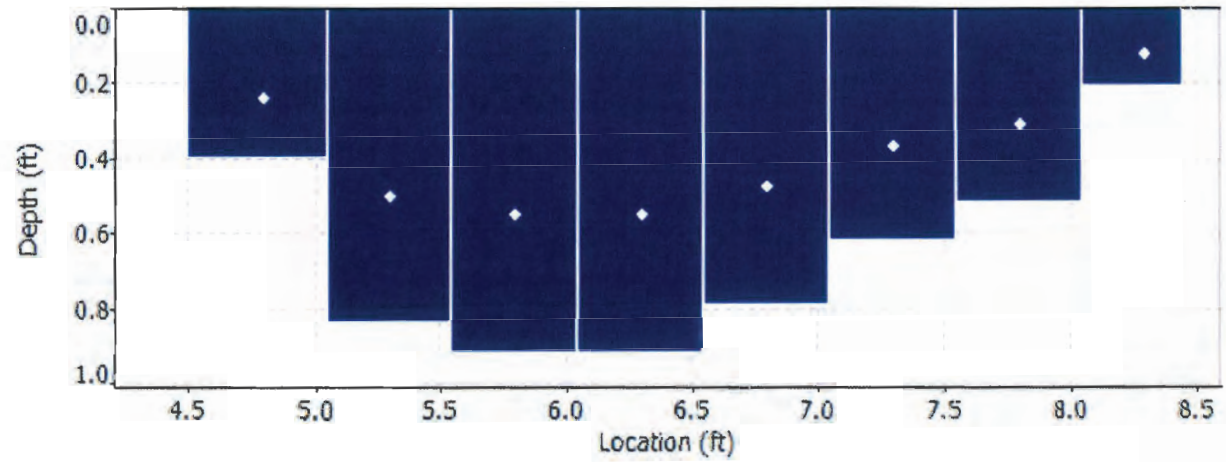
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C9TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 08:53:00	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C9TRIB.921.WAD
Start Date and Time	2011/09/21 08:53:00

Site Details

Site Name	
Operator(s)	ADD

Quality Control

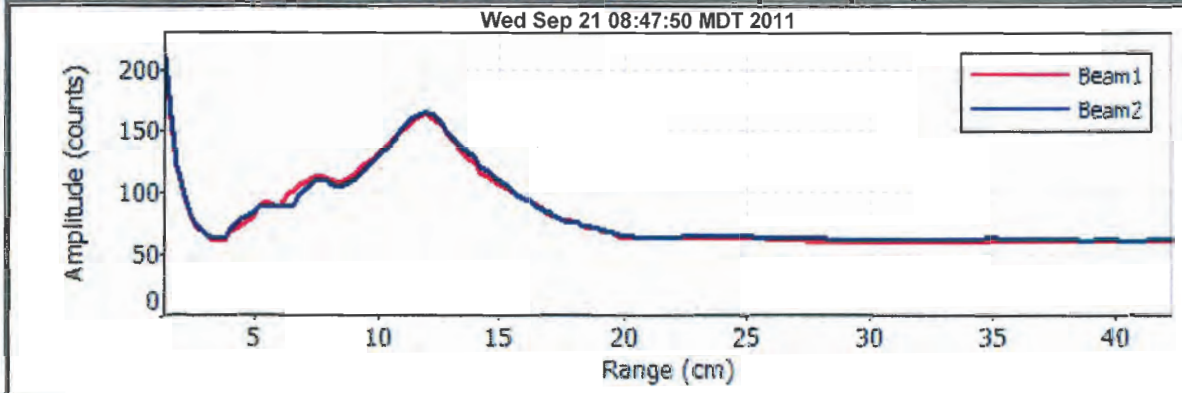
St	Loc	%Dep	Message
1	4.80	0.6	High differences in beam SNR: 25.7,43.8
2	5.30	0.6	High differences in beam SNR: 29.6,42.1
6	7.30	0.6	High angle: -158
7	7.80	0.6	Boundary QC is Fair; possible boundary interference
8	8.30	0.6	High differences in beam SNR: 33.5,44.7
		0.6	Boundary QC is Good; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C9TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 08:53:00	Operator(s)	ADD

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 Sep 27 2012

File Information		Site Details	
File Name	S-905 C10-01.WAD	Site Name	
Start Date and Time	2011/09/21 14:02:13	Operator(s)	ADD

System Information	
Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	0.9%
Velocity	0.7%	3.3%
Width	0.1%	0.1%
Method	2.0%	-
# Stations	2.2%	-
Overall	**3.2%**	**3.5%**

Summary			
Averaging Int.	30	# Stations	23
Start Edge	REW	Total Width	22.400
Mean SNR	29.1 dB	Total Area	13.173
Mean Temp	52.44 °F	Mean Depth	0.588
Disch. Equation	Mid-Section	Mean Velocity	0.9355
		Total Discharge	**12.3241**

Measurement Results

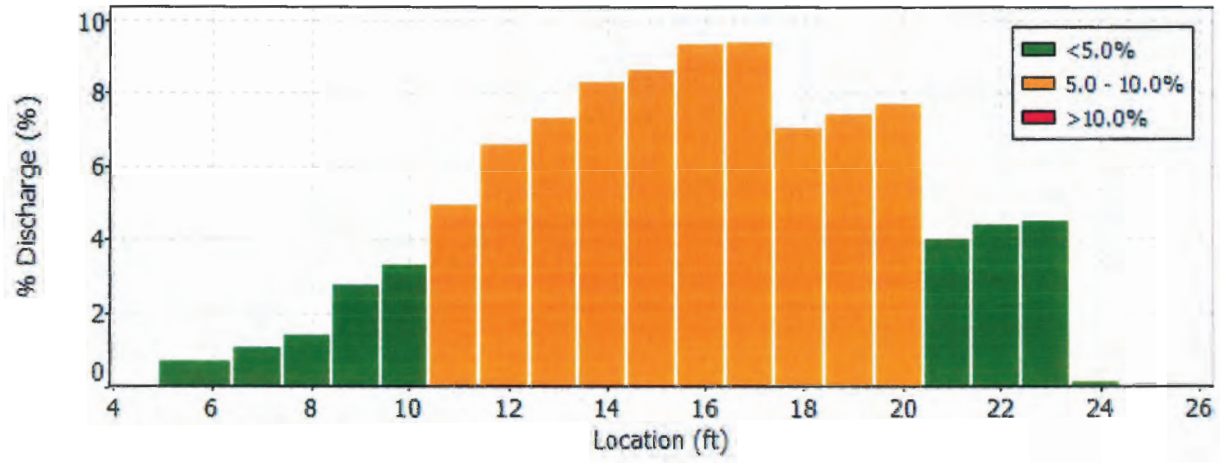
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:02	3.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:02	5.90	0.6	0.120	0.6	0.048	0.5167	1.00	0.5167	0.180	0.0931	0.8
2	14:03	6.90	0.6	0.240	0.6	0.096	0.5804	1.00	0.5804	0.240	0.1394	1.1
3	14:04	7.90	0.6	0.310	0.6	0.124	0.5751	1.00	0.5751	0.310	0.1783	1.4
4	14:06	8.90	0.6	0.430	0.6	0.172	0.8048	1.00	0.8048	0.430	0.3462	2.8
5	14:07	9.90	0.6	0.550	0.6	0.220	0.7490	1.00	0.7490	0.550	0.4119	3.3
6	14:08	10.90	0.6	0.630	0.6	0.252	0.9833	1.00	0.9833	0.630	0.6194	5.0
7	14:09	11.90	0.6	0.670	0.6	0.268	1.2228	1.00	1.2228	0.670	0.8192	6.6
8	14:10	12.90	0.6	0.700	0.6	0.280	1.2982	1.00	1.2982	0.700	0.9089	7.4
9	14:11	13.90	0.6	0.700	0.6	0.280	1.4646	1.00	1.4646	0.700	1.0254	8.3
10	14:13	14.90	0.6	0.730	0.6	0.292	1.4659	1.00	1.4659	0.730	1.0701	8.7
11	14:14	15.90	0.6	0.730	0.6	0.292	1.5814	1.00	1.5814	0.730	1.1544	9.4
12	14:15	16.90	0.6	0.780	0.6	0.312	1.4918	1.00	1.4918	0.780	1.1634	9.4
13	14:17	17.90	0.6	0.720	0.6	0.288	1.2106	1.00	1.2106	0.720	0.8718	7.1
14	14:18	18.90	0.6	0.740	0.6	0.296	1.2454	1.00	1.2454	0.740	0.9218	7.5
15	14:19	19.90	0.6	0.770	0.6	0.308	1.2385	1.00	1.2385	0.770	0.9537	7.7
16	14:30	20.90	0.6	0.820	0.6	0.328	0.6099	1.00	0.6099	0.820	0.5001	4.1
17	*14:33*	*21.90*	*0.6*	*0.880*	*0.6*	*0.352*	*0.6273*	*1.00*	*0.6273*	*0.880*	*0.5520*	*4.5*
18	14:34	22.90	0.6	0.880	0.6	0.352	0.6355	1.00	0.6355	0.880	0.5592	4.5
19	*14:36*	*23.90*	*0.6*	*0.790*	*0.6*	*0.316*	*0.0269*	*1.00*	*0.0269*	*0.790*	*0.0213*	*0.2*
20	*14:37*	*24.90*	*0.6*	*0.650*	*0.6*	*0.260*	*0.0207*	*1.00*	*0.0207*	*0.650*	*0.0134*	*0.1*
21	*14:38*	*25.90*	*0.6*	*0.390*	*0.6*	*0.156*	*0.0049*	*1.00*	*0.0049*	*0.273*	*0.0013*	*0.0*
22	14:38	26.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

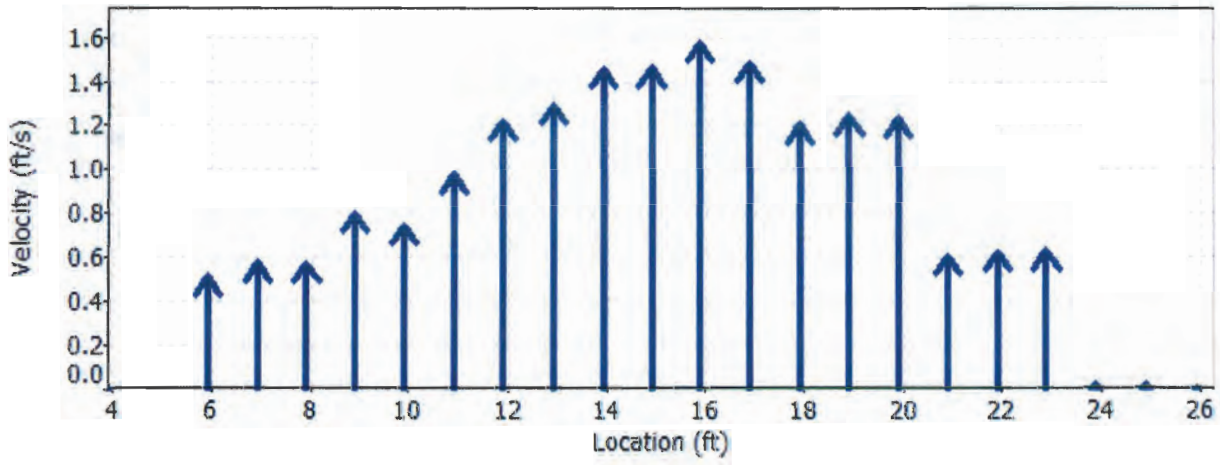
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

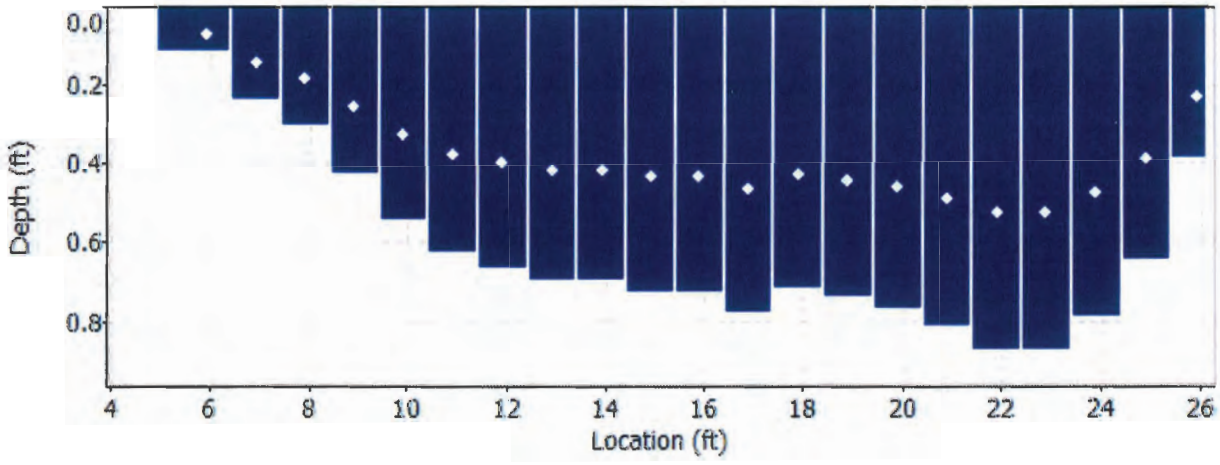
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C10.921.WAD	Site Name	
Start Date and Time	2011/09/21 14:02:13	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C10.921.WAD
Start Date and Time	2011/09/21 14:02:13

Site Details

Site Name	
Operator(s)	ADD

Quality Control

St	Loc	%Dep	Message
17	21.90	0.6	High standard error: 0.033
19	23.90	0.6	High angle: -60
20	24.90	0.6	High angle: -47
		0.6	SNR (43.2) is different from typical SNR (29.1)
		0.6	High SNR variation during measurement: 7.3,7.7
21	25.90	0.6	Boundary QC is Fair; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

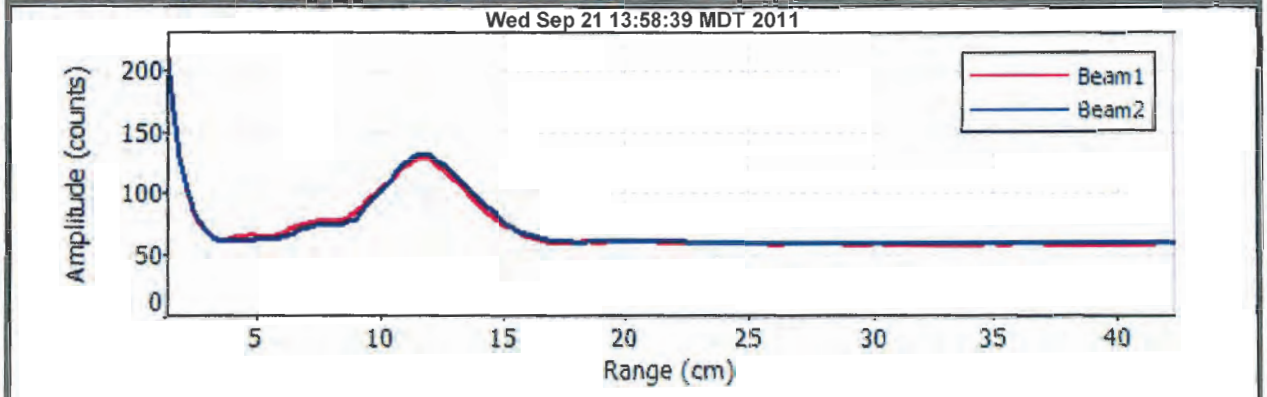
File Information

File Name	C10.921.WAD
Start Date and Time	2011/09/21 14:02:13

Site Details

Site Name	
Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C8.920.WAD
Start Date and Time	2011/09/21 13:24:40

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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	0.1%	0.8%
Velocity	0.9%	1.4%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	1.9%	-
Overall	**2.8%**	**1.9%**

Summary

Averaging Int.	30	# Stations	27
Start Edge	REW	Total Width	14.900
Mean SNR	26.8 dB	Total Area	20.964
Mean Temp	52.66 °F	Mean Depth	1.407
Disch. Equation	Mid-Section	Mean Velocity	0.5302
		Total Discharge	**11.1156**

Measurement Results

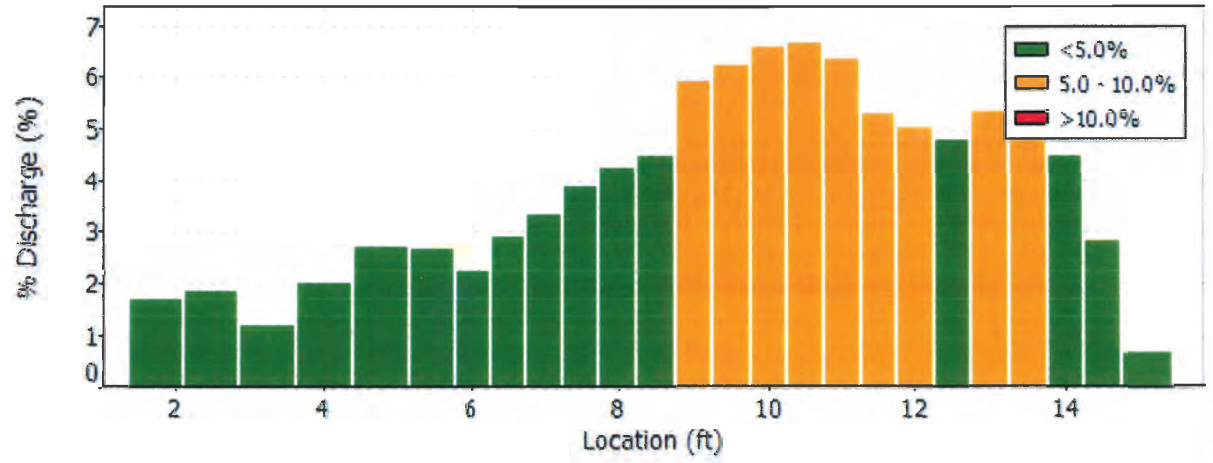
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:24	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:24	1.75	0.6	0.650	0.6	0.260	0.3921	1.00	0.3921	0.487	0.1911	1.7
2	13:26	2.50	0.6	0.790	0.6	0.316	0.3517	1.00	0.3517	0.593	0.2084	1.9
3	13:27	3.25	0.6	0.900	0.6	0.360	0.2018	1.00	0.2018	0.675	0.1362	1.2
4	13:28	4.00	0.6	1.040	0.6	0.416	0.2910	1.00	0.2910	0.780	0.2270	2.0
5	13:30	4.75	0.6	1.050	0.6	0.420	0.3871	1.00	0.3871	0.787	0.3048	2.7
6	13:31	5.50	0.6	1.330	0.6	0.532	0.3622	1.00	0.3622	0.831	0.3011	2.7
7	13:32	6.00	0.6	1.410	0.6	0.564	0.3563	1.00	0.3563	0.705	0.2512	2.3
8	13:34	6.50	0.6	1.430	0.6	0.572	0.4544	1.00	0.4544	0.715	0.3249	2.9
9	13:35	7.00	0.6	1.610	0.6	0.644	0.4656	1.00	0.4656	0.805	0.3747	3.4
10	13:36	7.50	0.6	1.690	0.6	0.676	0.5144	1.00	0.5144	0.845	0.4347	3.9
11	13:37	8.00	0.6	1.750	0.6	0.700	0.5440	1.00	0.5440	0.875	0.4760	4.3
12	13:38	8.50	0.6	1.650	0.6	0.660	0.6096	1.00	0.6096	0.825	0.5029	4.5
13	13:39	9.00	0.6	1.890	0.6	0.756	0.7044	1.00	0.7044	0.945	0.6657	6.0
14	13:41	9.50	0.6	1.850	0.6	0.740	0.7549	1.00	0.7549	0.925	0.6983	6.3
15	13:42	10.00	0.6	1.840	0.6	0.736	0.8018	1.00	0.8018	0.920	0.7376	6.6
16	13:43	10.50	0.6	1.840	0.6	0.736	0.8123	1.00	0.8123	0.920	0.7473	6.7
17	13:44	11.00	0.6	1.850	0.6	0.740	0.7707	1.00	0.7707	0.925	0.7129	6.4
18	13:46	11.50	0.6	1.880	0.6	0.752	0.6352	1.00	0.6352	0.940	0.5970	5.4
19	13:47	12.00	0.6	1.900	0.6	0.760	0.5955	1.00	0.5955	0.950	0.5657	5.1
20	13:48	12.50	0.6	1.910	0.6	0.764	0.5620	1.00	0.5620	0.955	0.5367	4.8
21	13:49	13.00	0.6	1.930	0.6	0.772	0.6204	1.00	0.6204	0.965	0.5987	5.4
22	13:50	13.50	0.6	2.000	0.6	0.800	0.6263	1.00	0.6263	1.000	0.6263	5.6
23	*13:52*	*14.00*	*0.6*	*1.700*	*0.6*	*0.680*	*0.5919*	*1.00*	*0.5919*	*0.850*	*0.5031*	*4.5*
24	*13:54*	*14.50*	*0.6*	*1.600*	*0.6*	*0.640*	*0.3980*	*1.00*	*0.3980*	*0.800*	*0.3184*	*2.9*
25	*13:55*	*15.00*	*0.6*	*1.350*	*0.6*	*0.540*	*0.0791*	*1.00*	*0.0791*	*0.945*	*0.0747*	*0.7*
26	13:55	15.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

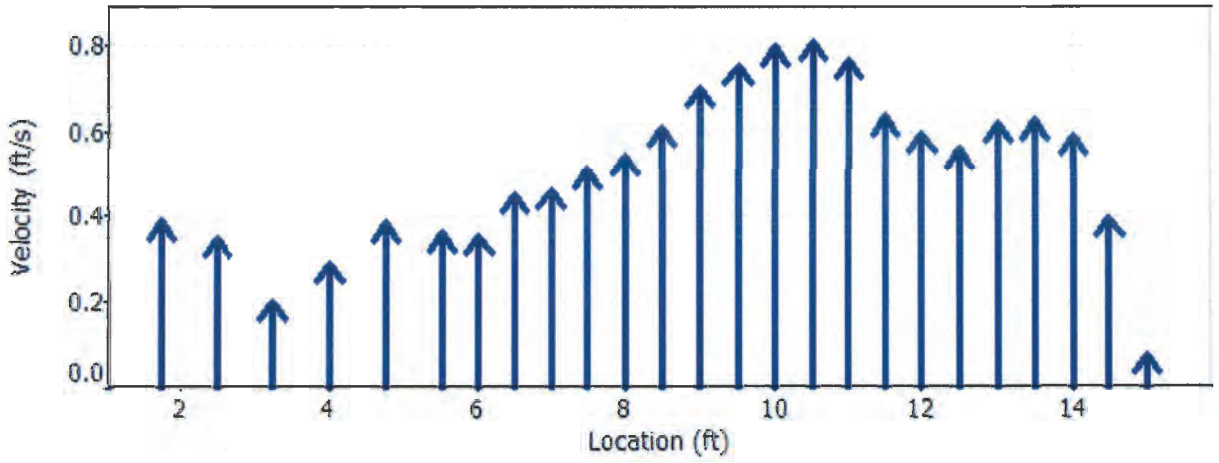
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

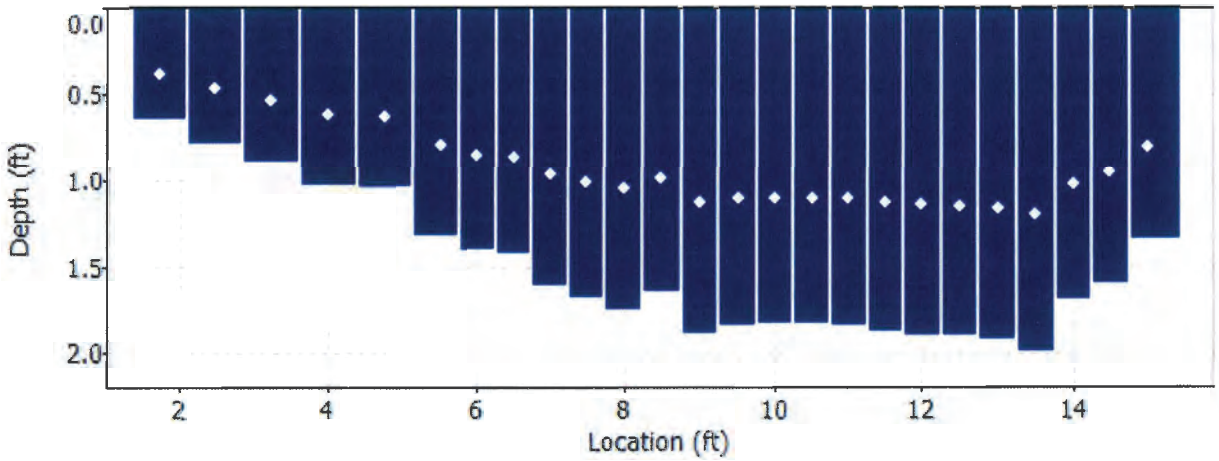
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C8.920.WAD	Site Name	
Start Date and Time	2011/09/21 13:24:40	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C8.920.WAD	Site Name	
Start Date and Time	2011/09/21 13:24:40	Operator(s)	NJT

Quality Control

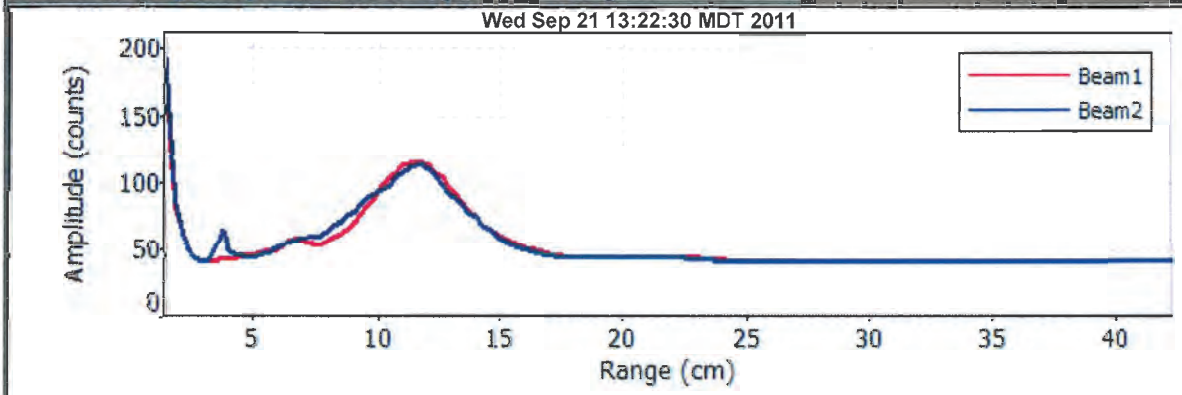
St	Loc	%Dep	Message
23	14.00	0.6	High angle: -27
		0.6	High standard error: 0.031
24	14.50	0.6	High standard error: 0.030
25	15.00	0.6	High angle: -23
		0.6	Boundary QC is Poor; possible boundary interference

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C8.920.WAD	Site Name	
Start Date and Time	2011/09/21 13:24:40	Operator(s)	NJT

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 Sep 27 2012

File Information

File Name	C7NEW.920.WAD
Start Date and Time	2011/09/21 12:25:44

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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	0.1%	1.0%
Velocity	0.9%	2.4%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.0%	-
Overall	**3.0%**	**2.8%**

Summary

Averaging Int.	30	# Stations	25
Start Edge	REW	Total Width	16.800
Mean SNR	30.7 dB	Total Area	18.312
Mean Temp	51.13 °F	Mean Depth	1.090
Disch. Equation	Mid-Section	Mean Velocity	0.6398
		Total Discharge	**11.7164**

Measurement Results

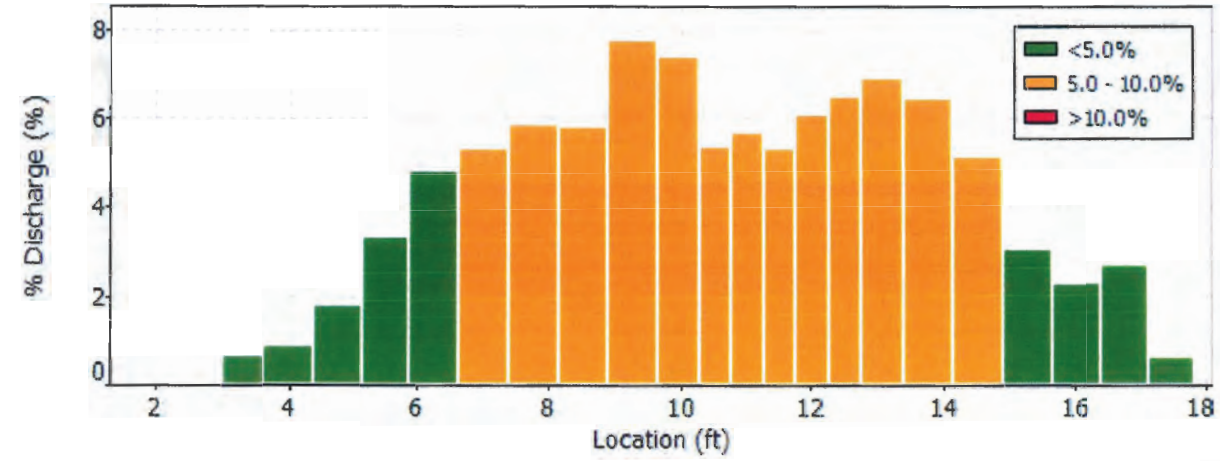
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:25	1.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:25*	*2.80*	*0.6*	*0.400*	*0.6*	*0.160*	*-0.0013*	*1.00*	*-0.0013*	*0.390*	*-0.0005*	*0.0*
2	12:27	3.25	0.6	0.450	0.6	0.180	0.3058	1.00	0.3058	0.270	0.0826	0.7
3	12:28	4.00	0.6	0.750	0.6	0.300	0.1936	1.00	0.1936	0.563	0.1089	0.9
4	*12:30*	*4.75*	*0.6*	*0.880*	*0.6*	*0.352*	*0.3189*	*1.00*	*0.3189*	*0.660*	*0.2105*	*1.8*
5	*12:31*	*5.50*	*0.6*	*1.020*	*0.6*	*0.408*	*0.5125*	*1.00*	*0.5125*	*0.765*	*0.3920*	*3.3*
6	12:32	6.25	0.6	1.150	0.6	0.460	0.6575	1.00	0.6575	0.862	0.5670	4.8
7	12:33	7.00	0.6	1.200	0.6	0.480	0.6909	1.00	0.6909	0.900	0.6219	5.3
8	*12:34*	*7.75*	*0.6*	*1.270*	*0.6*	*0.508*	*0.7208*	*1.00*	*0.7208*	*0.953*	*0.6866*	*5.9*
9	*12:36*	*8.50*	*0.6*	*1.320*	*0.6*	*0.528*	*0.6880*	*1.00*	*0.6880*	*0.990*	*0.6811*	*5.8*
10	*12:37*	*9.25*	*0.6*	*1.590*	*0.6*	*0.636*	*0.7631*	*1.00*	*0.7631*	*1.192*	*0.9100*	*7.8*
11	12:38	10.00	0.6	1.800	0.6	0.720	0.7723	1.00	0.7723	1.125	0.8688	7.4
12	*12:40*	*10.50*	*0.6*	*1.860*	*0.6*	*0.744*	*0.6778*	*1.00*	*0.6778*	*0.930*	*0.6303*	*5.4*
13	*12:44*	*11.00*	*0.6*	*1.930*	*0.6*	*0.772*	*0.6890*	*1.00*	*0.6890*	*0.965*	*0.6649*	*5.7*
14	*12:47*	*11.50*	*0.6*	*1.980*	*0.6*	*0.792*	*0.6322*	*1.00*	*0.6322*	*0.990*	*0.6259*	*5.3*
15	*12:52*	*12.00*	*0.6*	*1.900*	*0.6*	*0.760*	*0.7536*	*1.00*	*0.7536*	*0.950*	*0.7159*	*6.1*
16	12:55	12.50	0.6	1.750	0.6	0.700	0.8684	1.00	0.8684	0.875	0.7599	6.5
17	12:57	13.00	0.6	1.400	0.6	0.560	0.9239	1.00	0.9239	0.875	0.8084	6.9
18	12:58	13.75	0.6	1.250	0.6	0.500	0.8041	1.00	0.8041	0.938	0.7539	6.4
19	*13:03*	*14.50*	*0.6*	*1.100*	*0.6*	*0.440*	*0.7333*	*1.00*	*0.7333*	*0.825*	*0.6050*	*5.2*
20	*13:07*	*15.25*	*0.6*	*0.920*	*0.6*	*0.368*	*0.5190*	*1.00*	*0.5190*	*0.690*	*0.3581*	*3.1*
21	13:10	16.00	0.6	0.710	0.6	0.284	0.5135	1.00	0.5135	0.532	0.2734	2.3
22	*13:12*	*16.75*	*0.6*	*0.800*	*0.6*	*0.320*	*0.5285*	*1.00*	*0.5285*	*0.600*	*0.3171*	*2.7*
23	*13:13*	*17.50*	*0.6*	*0.700*	*0.6*	*0.280*	*0.1585*	*1.00*	*0.1585*	*0.473*	*0.0749*	*0.6*
24	13:13	18.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

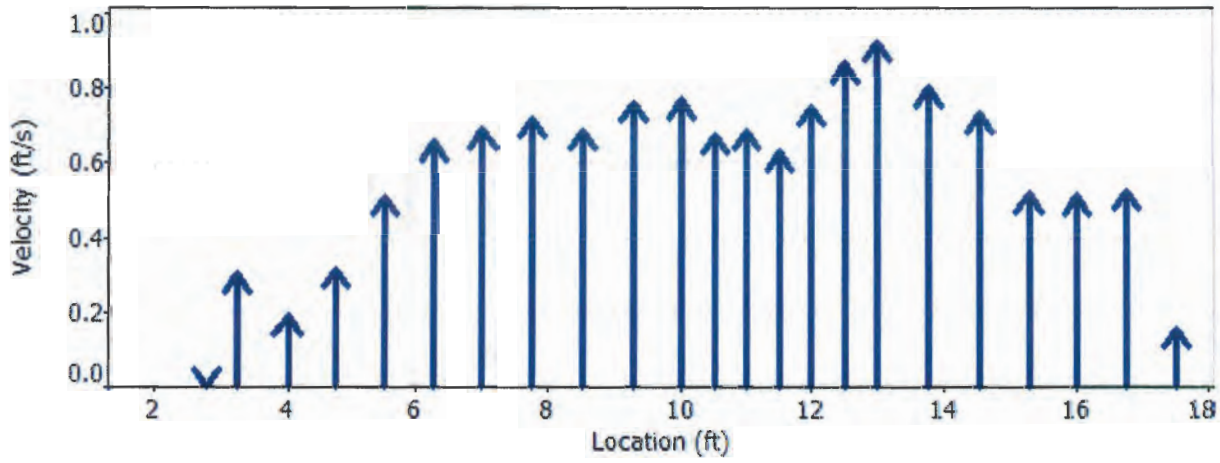
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

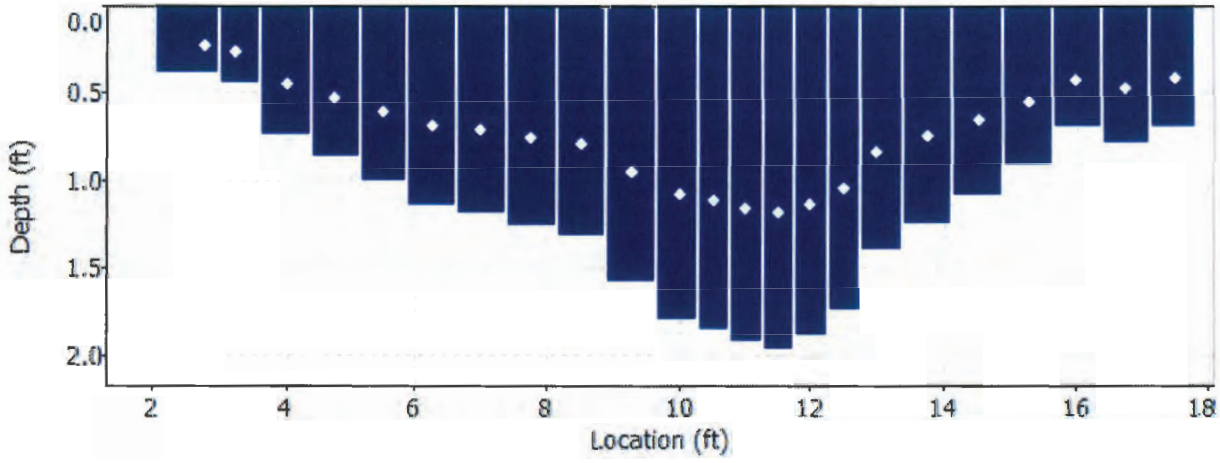
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C7NEW.920.WAD	Site Name	
Start Date and Time	2011/09/21 12:25:44	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C7NEW.920.WAD	Site Name	
Start Date and Time	2011/09/21 12:25:44	Operator(s)	NJT

Quality Control

St	Loc	%Dep	Message
1	2.80	0.6	SNR (55.4) is different from typical SNR (30.7)
4	4.75	0.6	High angle: -27
5	5.50	0.6	High angle: -22
8	7.75	0.6	High angle: -22
9	8.50	0.6	High angle: -26
10	9.25	0.6	High angle: -21
12	10.50	0.6	High angle: -21
13	11.00	0.6	High angle: -26
14	11.50	0.6	High angle: -31
15	12.00	0.6	High angle: -25
19	14.50	0.6	High angle: -23
20	15.25	0.6	High angle: -28
		0.6	High standard error: 0.031
22	16.75	0.6	High angle: -37
23	17.50	0.6	High angle: -45

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information	
File Name	C6.921.WAD
Start Date and Time	2011/09/21 10:54:39

Site Details	
Site Name	
Operator(s)	ADD

System Information	
Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	0.9%
Velocity	0.6%	2.3%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	1.7%	-
Overall	**2.6%**	**2.6%**

Summary			
Averaging Int.	30	# Stations	30
Start Edge	REW	Total Width	14.850
Mean SNR	33.6 dB	Total Area	10.423
Mean Temp	49.20 °F	Mean Depth	0.702
Disch. Equation	Mid-Section	Mean Velocity	1.2386
		Total Discharge	**12.9092**

Measurement Results

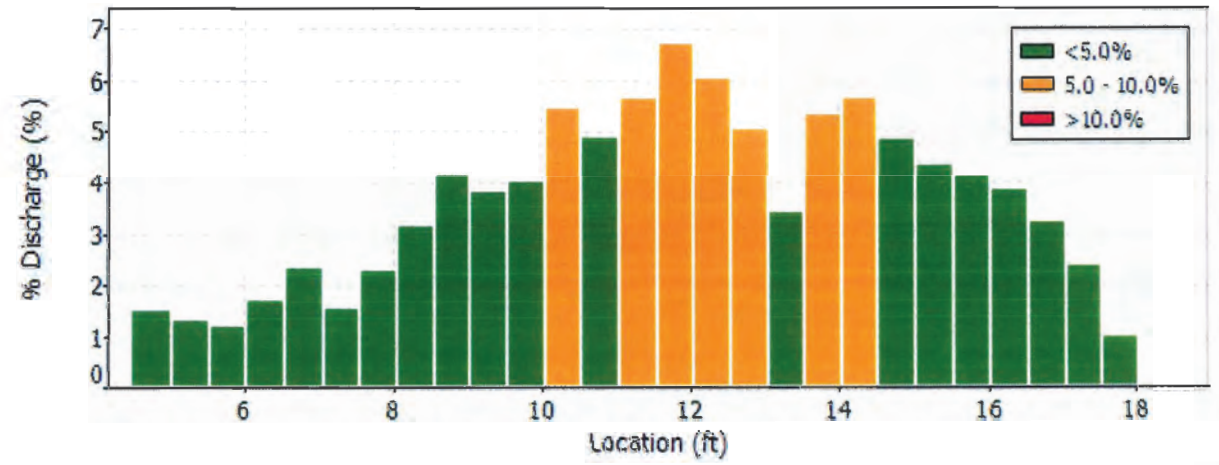
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:54	4.15	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	11:32	4.80	0.6	0.800	0.6	0.320	0.4367	1.00	0.4367	0.460	0.2008	1.6
2	11:38	5.30	0.6	0.800	0.6	0.320	0.4321	1.00	0.4321	0.400	0.1728	1.3
3	11:39	5.80	0.6	0.780	0.6	0.312	0.4134	1.00	0.4134	0.390	0.1612	1.2
4	11:40	6.30	0.6	0.800	0.6	0.320	0.5581	1.00	0.5581	0.400	0.2232	1.7
5	11:42	6.80	0.6	0.790	0.6	0.316	0.7733	1.00	0.7733	0.395	0.3055	2.4
6	11:45	7.30	0.6	0.810	0.6	0.324	0.5082	1.00	0.5082	0.405	0.2058	1.6
7	11:51	7.80	0.6	0.700	0.6	0.280	0.8547	1.00	0.8547	0.350	0.2992	2.3
8	11:52	8.30	0.6	0.780	0.6	0.312	1.0535	1.00	1.0535	0.390	0.4108	3.2
9	11:53	8.80	0.6	0.790	0.6	0.316	1.3760	1.00	1.3760	0.395	0.5435	4.2
10	11:54	9.30	0.6	0.830	0.6	0.332	1.1926	1.00	1.1926	0.415	0.4950	3.8
11	11:56	9.80	0.6	0.940	0.6	0.376	1.1148	1.00	1.1148	0.470	0.5239	4.1
12	11:57	10.30	0.6	0.920	0.6	0.368	1.5417	1.00	1.5417	0.460	0.7091	5.5
13	11:58	10.80	0.6	0.820	0.6	0.328	1.5509	1.00	1.5509	0.410	0.6358	4.9
14	11:59	11.30	0.6	0.890	0.6	0.356	1.6512	1.00	1.6512	0.445	0.7349	5.7
15	12:00	11.80	0.6	0.900	0.6	0.360	1.9357	1.00	1.9357	0.450	0.8710	6.7
16	12:01	12.30	0.6	0.850	0.6	0.340	1.8497	1.00	1.8497	0.425	0.7862	6.1
17	12:02	12.80	0.6	0.820	0.6	0.328	1.6047	1.00	1.6047	0.410	0.6578	5.1
18	12:03	13.30	0.6	0.760	0.6	0.304	1.1768	1.00	1.1768	0.380	0.4471	3.5
19	12:04	13.80	0.6	0.750	0.6	0.300	1.8527	1.00	1.8527	0.375	0.6948	5.4
20	12:05	14.30	0.6	0.720	0.6	0.288	2.0348	1.00	2.0348	0.360	0.7327	5.7
21	12:06	14.80	0.6	0.650	0.6	0.260	1.9472	1.00	1.9472	0.325	0.6328	4.9
22	12:07	15.30	0.6	0.620	0.6	0.248	1.8278	1.00	1.8278	0.310	0.5667	4.4
23	12:08	15.80	0.6	0.610	0.6	0.244	1.7664	1.00	1.7664	0.305	0.5387	4.2
24	12:09	16.30	0.6	0.580	0.6	0.232	1.7247	1.00	1.7247	0.290	0.5002	3.9
25	12:10	16.80	0.6	0.540	0.6	0.216	1.5551	1.00	1.5551	0.270	0.4199	3.3
26	12:11	17.30	0.6	0.520	0.6	0.208	1.1837	1.00	1.1837	0.260	0.3078	2.4
27	12:12	17.80	0.6	0.500	0.6	0.200	0.5292	1.00	0.5292	0.250	0.1323	1.0
28	*12:13*	*18.30*	*0.6*	*0.380*	*0.6*	*0.152*	*-0.0007*	*1.00*	*-0.0007*	*0.228*	*-0.0001*	*0.0*
29	12:13	19.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

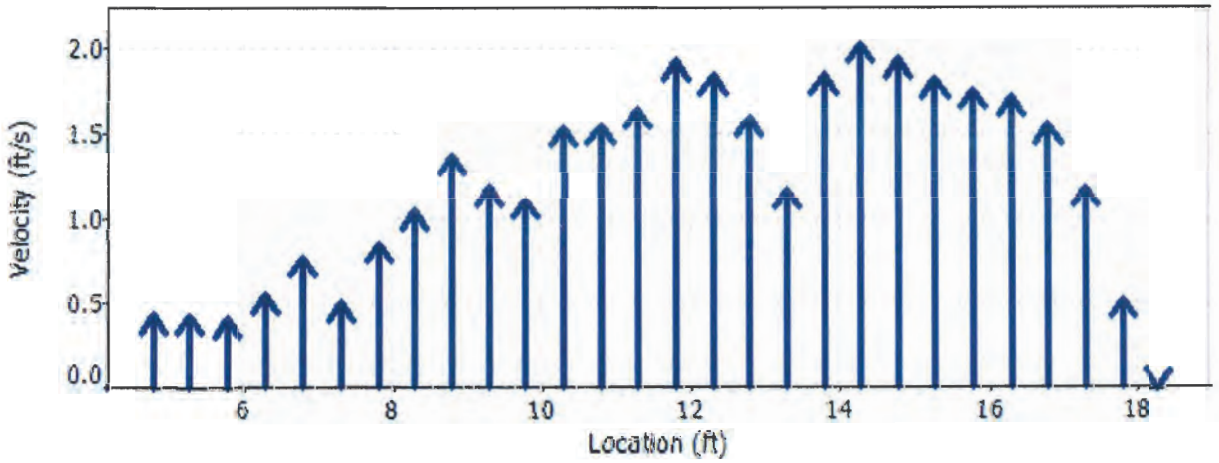
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

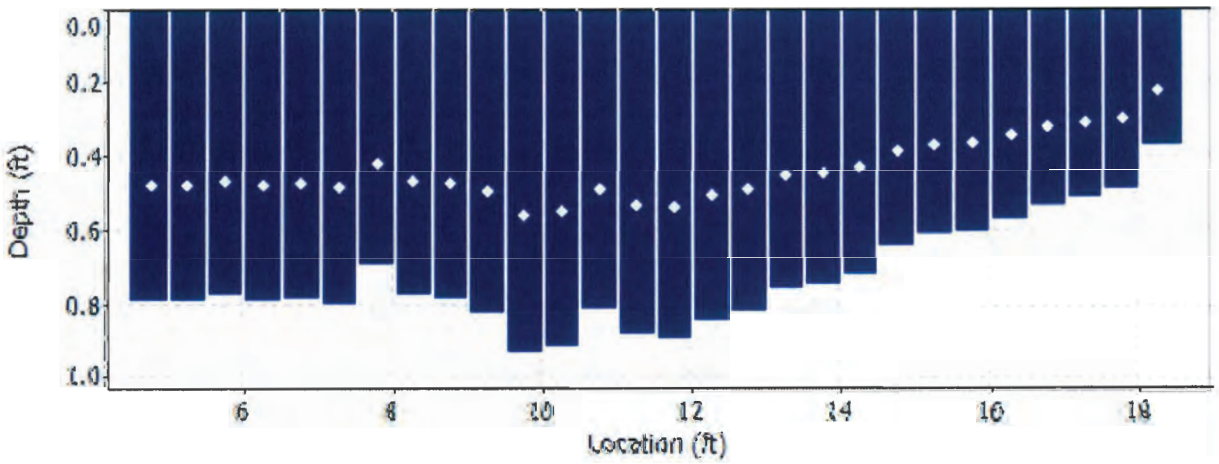
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C6.921.WAD	Site Name	
Start Date and Time	2011/09/21 10:54:39	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C6.921.WAD	Site Name	
Start Date and Time	2011/09/21 10:54:39	Operator(s)	ADD

Quality Control

St	Loc	%Dep	Message
28	18.30	0.6	SNR (61.9) is different from typical SNR (33.6)
		0.6	High SNR variation during measurement: 6.9,6.5

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

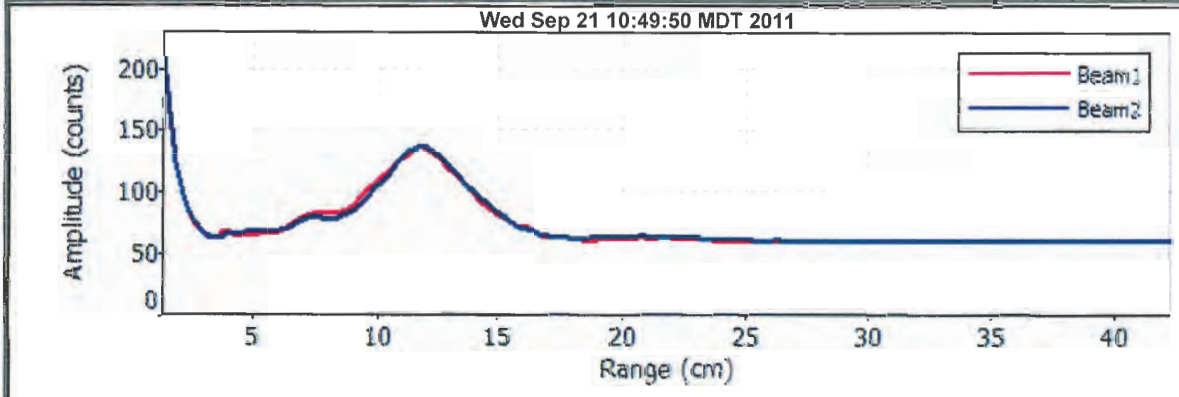
File Information

File Name	C6.921.WAD
Start Date and Time	2011/09/21 10:54:39

Site Details

Site Name	
Operator(s)	ADD

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 Sep 27 2012

File Information	
File Name	C5TRIB.921.WAD
Start Date and Time	2011/09/21 12:50:24

Site Details	
Site Name	
Operator(s)	ADD

System Information	
Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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%	0.9%
Velocity	2.2%	14.5%
Width	0.2%	0.2%
Method	3.4%	-
# Stations	2.0%	-
Overall	**4.7%**	**14.5%**

Summary

Averaging Int.	30	# Stations	26
Start Edge	REW	Total Width	11.700
Mean SNR	36.4 dB	Total Area	10.578
Mean Temp	55.71 °F	Mean Depth	0.904
Disch. Equation	Mid-Section	Mean Velocity	0.0338
		Total Discharge	**0.3574**

Measurement Results

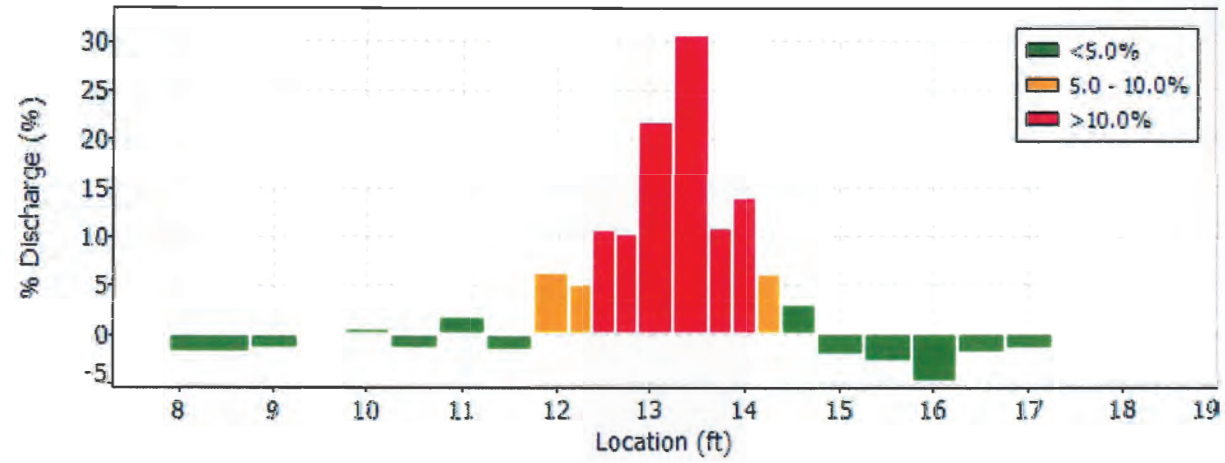
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:50	7.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:50*	*8.50*	*0.6*	*0.390*	*0.6*	*0.156*	*-0.0210*	*1.00*	*-0.0210*	*0.332*	*-0.0070*	*-1.9*
2	*12:52*	*9.00*	*0.6*	*0.530*	*0.6*	*0.212*	*-0.0197*	*1.00*	*-0.0197*	*0.265*	*-0.0052*	*-1.5*
3	12:54	9.50	0.6	0.700	0.6	0.280	0.0020	1.00	0.0020	0.350	0.0007	0.2
4	12:55	10.00	0.6	0.950	0.6	0.380	0.0049	1.00	0.0049	0.475	0.0023	0.7
5	*12:56*	*10.50*	*0.6*	*1.150*	*0.6*	*0.460*	*-0.0092*	*1.00*	*-0.0092*	*0.575*	*-0.0053*	*-1.5*
6	12:58	11.00	0.6	1.350	0.6	0.540	0.0095	1.00	0.0095	0.675	0.0064	1.8
7	13:00	11.50	0.6	1.430	0.6	0.572	-0.0082	1.00	-0.0082	0.715	-0.0059	-1.6
8	*13:02*	*12.00*	*0.6*	*1.420*	*0.6*	*0.568*	*0.0420*	*1.00*	*0.0420*	*0.532*	*0.0224*	*6.3*
9	*13:23*	*12.25*	*0.6*	*1.420*	*0.6*	*0.568*	*0.0512*	*1.00*	*0.0512*	*0.355*	*0.0182*	*5.1*
10	*13:03*	*12.50*	*0.6*	*1.430*	*0.6*	*0.572*	*0.1060*	*1.00*	*0.1060*	*0.358*	*0.0379*	*10.6*
11	*13:25*	*12.75*	*0.6*	*1.450*	*0.6*	*0.580*	*0.1017*	*1.00*	*0.1017*	*0.363*	*0.0369*	*10.3*
12	*13:04*	*13.00*	*0.6*	*1.470*	*0.6*	*0.588*	*0.1404*	*1.00*	*0.1404*	*0.551*	*0.0774*	*21.7*
13	*13:05*	*13.50*	*0.6*	*1.520*	*0.6*	*0.608*	*0.1913*	*1.00*	*0.1913*	*0.570*	*0.1090*	*30.5*
14	13:28	13.75	0.6	1.480	0.6	0.592	0.1050	1.00	0.1050	0.370	0.0388	10.9
15	*13:07*	*14.00*	*0.6*	*1.450*	*0.6*	*0.580*	*0.1378*	*1.00*	*0.1378*	*0.363*	*0.0500*	*14.0*
16	*13:30*	*14.25*	*0.6*	*1.390*	*0.6*	*0.556*	*0.0620*	*1.00*	*0.0620*	*0.348*	*0.0215*	*6.0*
17	*13:08*	*14.50*	*0.6*	*1.380*	*0.6*	*0.552*	*0.0213*	*1.00*	*0.0213*	*0.517*	*0.0110*	*3.1*
18	13:11	15.00	0.6	1.220	0.6	0.488	-0.0141	1.00	-0.0141	0.610	-0.0086	-2.4
19	*13:12*	*15.50*	*0.6*	*1.100*	*0.6*	*0.440*	*-0.0187*	*1.00*	*-0.0187*	*0.550*	*-0.0103*	*-2.9*
20	*13:14*	*16.00*	*0.6*	*1.010*	*0.6*	*0.404*	*-0.0354*	*1.00*	*-0.0354*	*0.505*	*-0.0179*	*-5.0*
21	*13:15*	*16.50*	*0.6*	*0.750*	*0.6*	*0.300*	*-0.0210*	*1.00*	*-0.0210*	*0.375*	*-0.0079*	*-2.2*
22	*13:16*	*17.00*	*0.6*	*0.590*	*0.6*	*0.236*	*-0.0213*	*1.00*	*-0.0213*	*0.295*	*-0.0063*	*-1.8*
23	*13:18*	*17.50*	*0.6*	*0.520*	*0.6*	*0.208*	*-0.0033*	*1.00*	*-0.0033*	*0.260*	*-0.0009*	*-0.2*
24	*13:19*	*18.00*	*0.6*	*0.360*	*0.6*	*0.144*	*-0.0003*	*1.00*	*-0.0003*	*0.270*	*-0.0001*	*0.0*
25	13:19	19.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

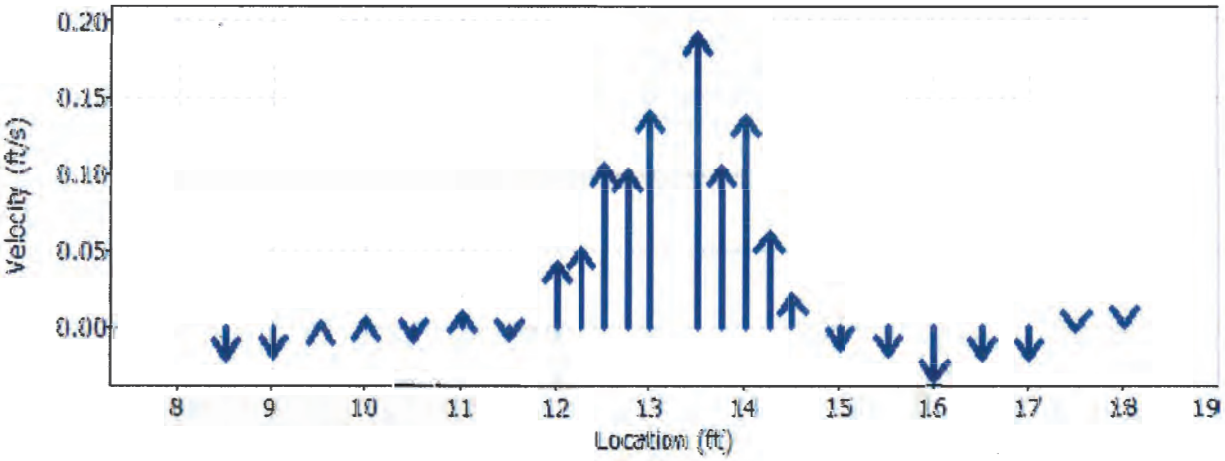
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

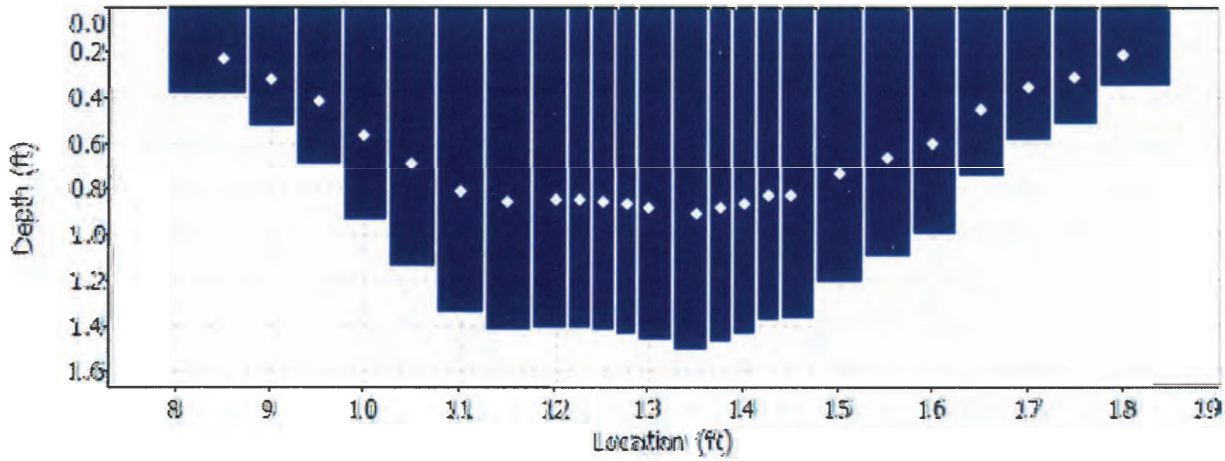
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C5TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 12:50:24	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C5TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 12:50:24	Operator(s)	ADD

Quality Control

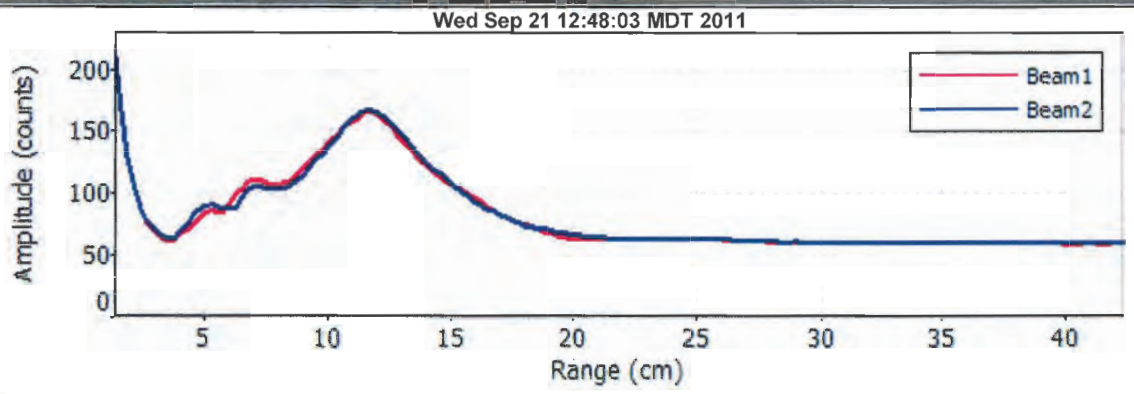
St	Loc	%Dep	Message
1	8.50	0.6	High angle: -150
2	9.00	0.6	Boundary QC is Good; possible boundary interference
5	10.50	0.6	High SNR variation during measurement: 5.6,6.5
8	12.00	0.6	High SNR variation during measurement: 6.0,5.6
9	12.25	0.6	High SNR variation during measurement: 7.7,6.5
10	12.50	0.6	SNR (26.2) is different from typical SNR (36.4)
11	12.75	0.6	SNR (26.2) is different from typical SNR (36.4)
12	13.00	0.6	SNR (24.9) is different from typical SNR (36.4)
13	13.50	0.6	SNR (24.9) is different from typical SNR (36.4)
15	14.00	0.6	SNR (24.7) is different from typical SNR (36.4)
16	14.25	0.6	High SNR variation during measurement: 5.2,5.2
17	14.50	0.6	High angle: 23
19	15.50	0.6	SNR (47.0) is different from typical SNR (36.4)
20	16.00	0.6	High angle: -151
		0.6	SNR (50.5) is different from typical SNR (36.4)
21	16.50	0.6	High angle: -179
		0.6	SNR (50.1) is different from typical SNR (36.4)
22	17.00	0.6	High angle: 171
		0.6	High SNR variation during measurement: 5.2,3.0
23	17.50	0.6	High SNR variation during measurement: 11.2,10.3
24	18.00	0.6	High differences in beam SNR: 29.2,39.9

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C5TRIB.921.WAD	Site Name	
Start Date and Time	2011/09/21 12:50:24	Operator(s)	ADD

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 Sep 27 2012

File Information	
File Name	C5DS.921.WAD
Start Date and Time	2011/09/21 10:00:28

Site Details	
Site Name	
Operator(s)	ADD

System Information	
Sensor Type	FlowTracker
Serial #	P3532
CPU Firmware Version	3.7
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	0.1%	1.2%
Velocity	0.8%	4.7%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	2.0%	-
Overall	**3.0%**	**5.0%**

Summary

Averaging Int.	30	# Stations	25
Start Edge	REW	Total Width	17.700
Mean SNR	31.4 dB	Total Area	19.440
Mean Temp	46.46 °F	Mean Depth	1.098
Disch. Equation	Mid-Section	Mean Velocity	0.6512
		Total Discharge	**12.6594**

Measurement Results

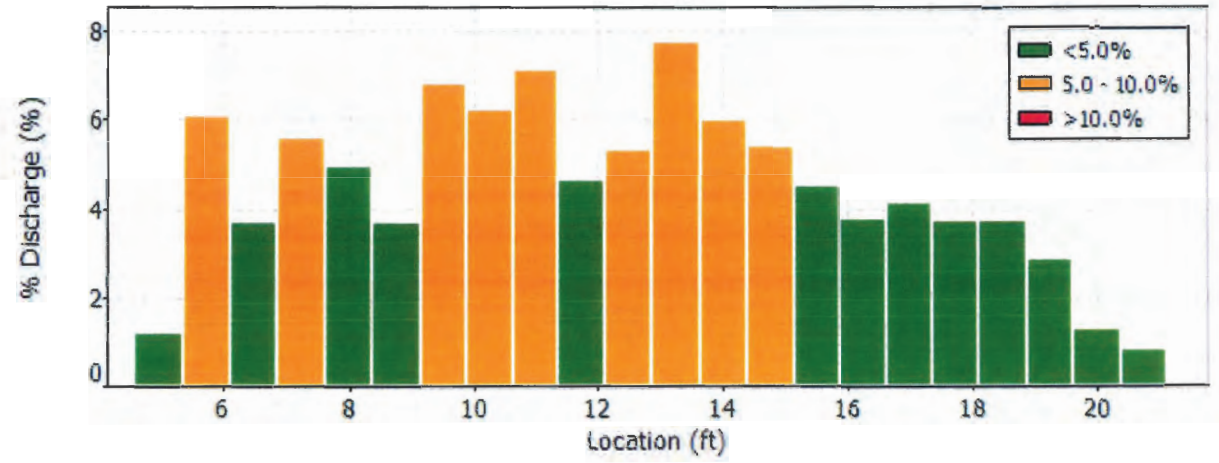
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:00	4.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*10:00*	*5.00*	*0.6*	*1.050*	*0.6*	*0.420*	*0.1831*	*1.00*	*0.1831*	*0.866*	*0.1586*	*1.3*
2	10:02	5.75	0.6	1.450	0.6	0.580	0.7087	1.00	0.7087	1.088	0.7707	6.1
3	*10:04*	*6.50*	*0.6*	*1.360*	*0.6*	*0.544*	*0.4610*	*1.00*	*0.4610*	*1.020*	*0.4701*	*3.7*
4	10:05	7.25	0.6	1.420	0.6	0.568	0.6690	1.00	0.6690	1.065	0.7124	5.6
5	*10:10*	*8.00*	*0.6*	*1.360*	*0.6*	*0.544*	*0.6204*	*1.00*	*0.6204*	*1.020*	*0.6328*	*5.0*
6	10:11	8.75	0.6	1.350	0.6	0.540	0.4665	1.00	0.4665	1.013	0.4724	3.7
7	10:12	9.50	0.6	1.290	0.6	0.516	0.8947	1.00	0.8947	0.968	0.8656	6.8
8	10:13	10.25	0.6	1.240	0.6	0.496	0.8478	1.00	0.8478	0.930	0.7885	6.2
9	10:14	11.00	0.6	1.240	0.6	0.496	0.9715	1.00	0.9715	0.930	0.9036	7.1
10	*10:19*	*11.75*	*0.6*	*1.280*	*0.6*	*0.512*	*0.6168*	*1.00*	*0.6168*	*0.960*	*0.5921*	*4.7*
11	10:20	12.50	0.6	1.220	0.6	0.488	0.7385	1.00	0.7385	0.915	0.6758	5.3
12	10:21	13.25	0.6	1.200	0.6	0.480	1.0945	1.00	1.0945	0.900	0.9851	7.8
13	10:23	14.00	0.6	1.190	0.6	0.476	0.8517	1.00	0.8517	0.892	0.7601	6.0
14	10:25	14.75	0.6	1.180	0.6	0.472	0.7736	1.00	0.7736	0.885	0.6847	5.4
15	10:26	15.50	0.6	1.150	0.6	0.460	0.6657	1.00	0.6657	0.862	0.5741	4.5
16	10:27	16.25	0.6	1.150	0.6	0.460	0.5614	1.00	0.5614	0.862	0.4841	3.8
17	10:28	17.00	0.6	1.100	0.6	0.440	0.6411	1.00	0.6411	0.825	0.5289	4.2
18	10:29	17.75	0.6	1.010	0.6	0.404	0.6250	1.00	0.6250	0.757	0.4734	3.7
19	10:31	18.50	0.6	0.920	0.6	0.368	0.6900	1.00	0.6900	0.690	0.4760	3.8
20	10:32	19.25	0.6	0.940	0.6	0.376	0.5256	1.00	0.5256	0.705	0.3705	2.9
21	10:34	20.00	0.6	0.880	0.6	0.352	0.2572	1.00	0.2572	0.660	0.1697	1.3
22	10:35	20.75	0.6	0.730	0.6	0.292	0.2008	1.00	0.2008	0.547	0.1099	0.9
23	*10:36*	*21.50*	*0.6*	*0.150*	*0.6*	*0.060*	*-0.0007*	*1.00*	*-0.0007*	*0.079*	*-0.0001*	*0.0*
24	10:36	21.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

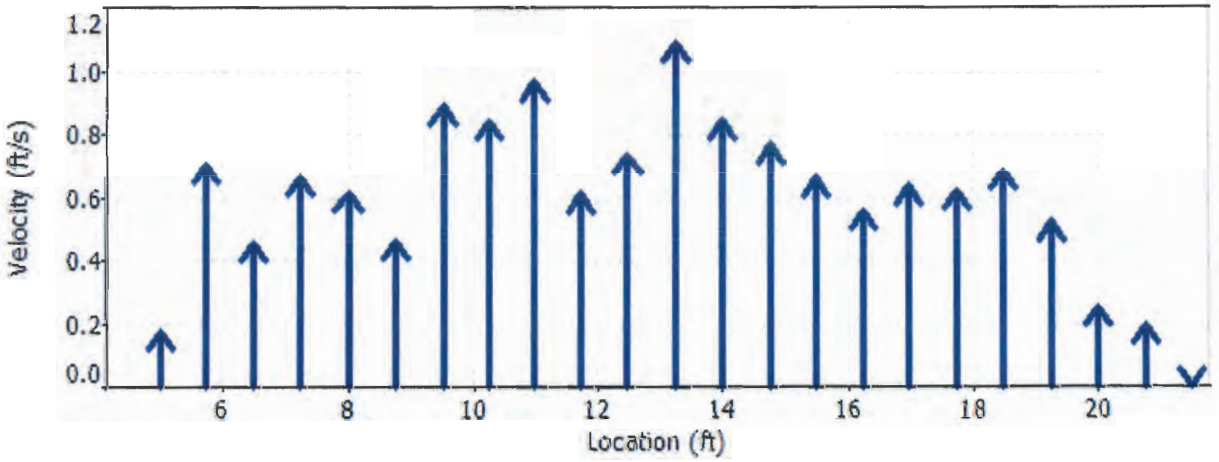
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

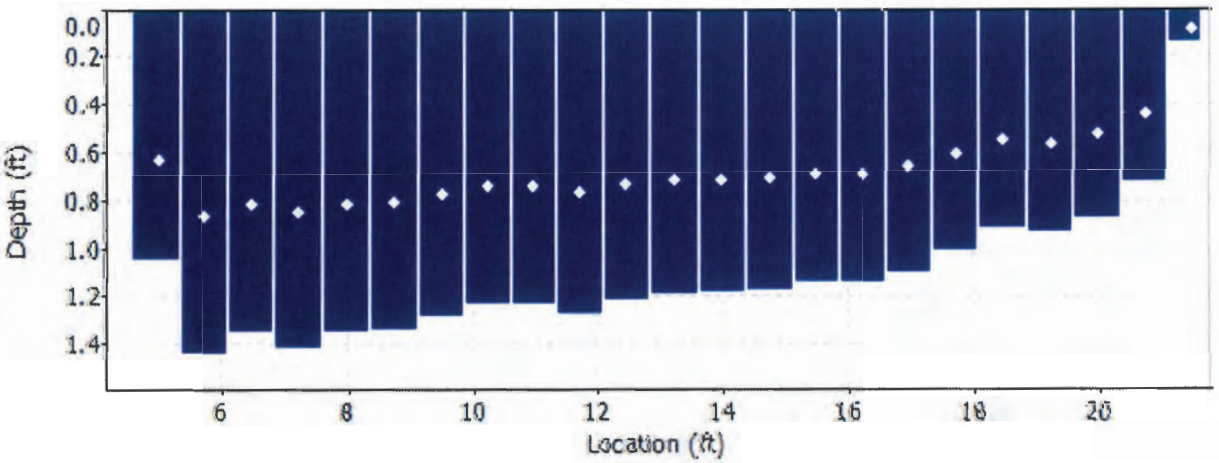
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C5DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 10:00:28	Operator(s)	ADD







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C5DS.921.WAD	Site Name	
Start Date and Time	2011/09/21 10:00:28	Operator(s)	ADD

Quality Control

St	Loc	%Dep	Message
1	5.00	0.6	SNR (42.6) is different from typical SNR (31.4)
3	6.50	0.6	High standard error: 0.032
5	8.00	0.6	High standard error: 0.031
10	11.75	0.6	High standard error: 0.032
23	21.50	0.6	SNR (58.7) is different from typical SNR (31.4)
		0.6	High SNR variation during measurement: 5.2,6.0

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

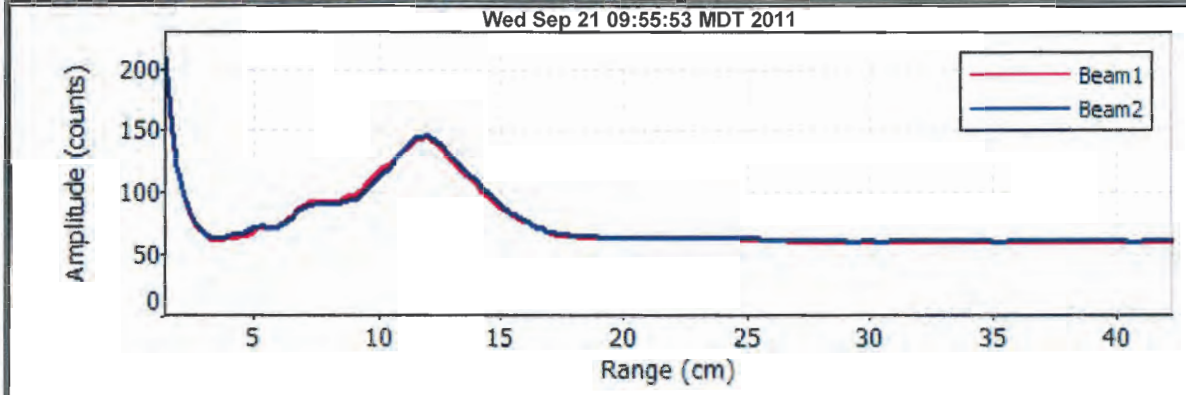
File Information

File Name	C5DS.921.WAD
Start Date and Time	2011/09/21 10:00:28

Site Details

Site Name	
Operator(s)	ADD

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 Sep 27 2012

File Information

File Name	C4P5.920.WAD
Start Date and Time	2011/09/21 09:26:11

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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%	0.8%
Velocity	0.9%	3.0%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	1.7%	-
Overall	**2.7%**	**3.3%**

Summary

Averaging Int.	30	# Stations	30
Start Edge	REW	Total Width	22.600
Mean SNR	30.6 dB	Total Area	20.117
Mean Temp	45.94 °F	Mean Depth	0.890
Disch. Equation	Mid-Section	Mean Velocity	0.5554
		Total Discharge	**11.1720**

Measurement Results

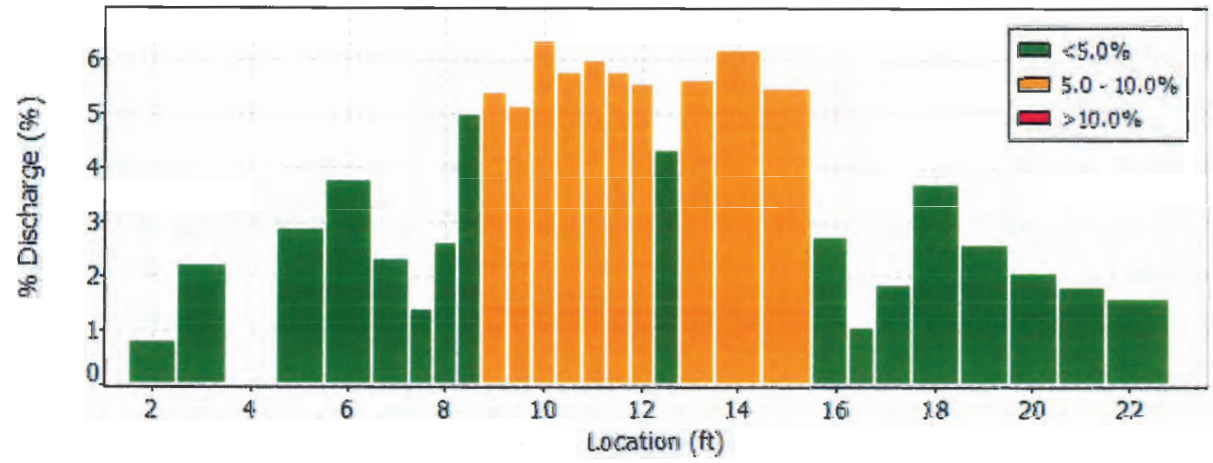
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:26	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*09:26*	*2.00*	*0.6*	*0.720*	*0.6*	*0.288*	*0.1250*	*1.00*	*0.1250*	*0.720*	*0.0900*	*0.8*
2	09:27	3.00	0.6	1.000	0.6	0.400	0.2461	1.00	0.2461	1.000	0.2461	2.2
3	*09:28*	*4.00*	*0.6*	*1.100*	*0.6*	*0.440*	*-0.0052*	*1.00*	*-0.0052*	*1.100*	*-0.0058*	*-0.1*
4	09:31	5.00	0.6	1.020	0.6	0.408	0.3169	1.00	0.3169	1.020	0.3233	2.9
5	09:32	6.00	0.6	1.120	0.6	0.448	0.3753	1.00	0.3753	1.120	0.4204	3.8
6	*09:33*	*7.00*	*0.6*	*1.050*	*0.6*	*0.420*	*0.3291*	*1.00*	*0.3291*	*0.787*	*0.2591*	*2.3*
7	10:11	7.50	0.6	1.140	0.6	0.456	0.2730	1.00	0.2730	0.570	0.1556	1.4
8	*09:37*	*8.00*	*0.6*	*1.320*	*0.6*	*0.528*	*0.4432*	*1.00*	*0.4432*	*0.660*	*0.2925*	*2.6*
9	09:40	8.50	0.6	1.400	0.6	0.560	0.7963	1.00	0.7963	0.700	0.5574	5.0
10	09:41	9.00	0.6	1.430	0.6	0.572	0.8448	1.00	0.8448	0.715	0.6041	5.4
11	09:43	9.50	0.6	1.410	0.6	0.564	0.8173	1.00	0.8173	0.705	0.5762	5.2
12	09:45	10.00	0.6	1.420	0.6	0.568	0.9980	1.00	0.9980	0.710	0.7086	6.3
13	09:46	10.50	0.6	1.350	0.6	0.540	0.9528	1.00	0.9528	0.675	0.6431	5.8
14	09:47	11.00	0.6	1.350	0.6	0.540	0.9934	1.00	0.9934	0.675	0.6706	6.0
15	09:49	11.50	0.6	1.310	0.6	0.524	0.9843	1.00	0.9843	0.655	0.6447	5.8
16	09:50	12.00	0.6	1.300	0.6	0.520	0.9567	1.00	0.9567	0.650	0.6218	5.6
17	*09:51*	*12.50*	*0.6*	*1.250*	*0.6*	*0.500*	*0.7772*	*1.00*	*0.7772*	*0.625*	*0.4858*	*4.3*
18	*09:52*	*13.00*	*0.6*	*1.250*	*0.6*	*0.500*	*0.6699*	*1.00*	*0.6699*	*0.938*	*0.6281*	*5.6*
19	09:54	14.00	0.6	1.050	0.6	0.420	0.6565	1.00	0.6565	1.050	0.6892	6.2
20	09:55	15.00	0.6	0.900	0.6	0.360	0.6804	1.00	0.6804	0.900	0.6124	5.5
21	09:57	16.00	0.6	0.875	0.6	0.350	0.4646	1.00	0.4646	0.656	0.3049	2.7
22	10:14	16.50	0.6	0.820	0.6	0.328	0.2940	1.00	0.2940	0.410	0.1205	1.1
23	*09:59*	*17.00*	*0.6*	*0.760*	*0.6*	*0.304*	*0.3612*	*1.00*	*0.3612*	*0.570*	*0.2059*	*1.8*
24	10:00	18.00	0.6	0.640	0.6	0.256	0.6460	1.00	0.6460	0.640	0.4135	3.7
25	10:02	19.00	0.6	0.500	0.6	0.200	0.5820	1.00	0.5820	0.500	0.2910	2.6
26	10:03	20.00	0.6	0.400	0.6	0.160	0.5817	1.00	0.5817	0.400	0.2326	2.1
27	10:04	21.00	0.6	0.420	0.6	0.168	0.4856	1.00	0.4856	0.420	0.2039	1.8
28	10:05	22.00	0.6	0.420	0.6	0.168	0.3235	1.00	0.3235	0.546	0.1766	1.6
29	10:05	23.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

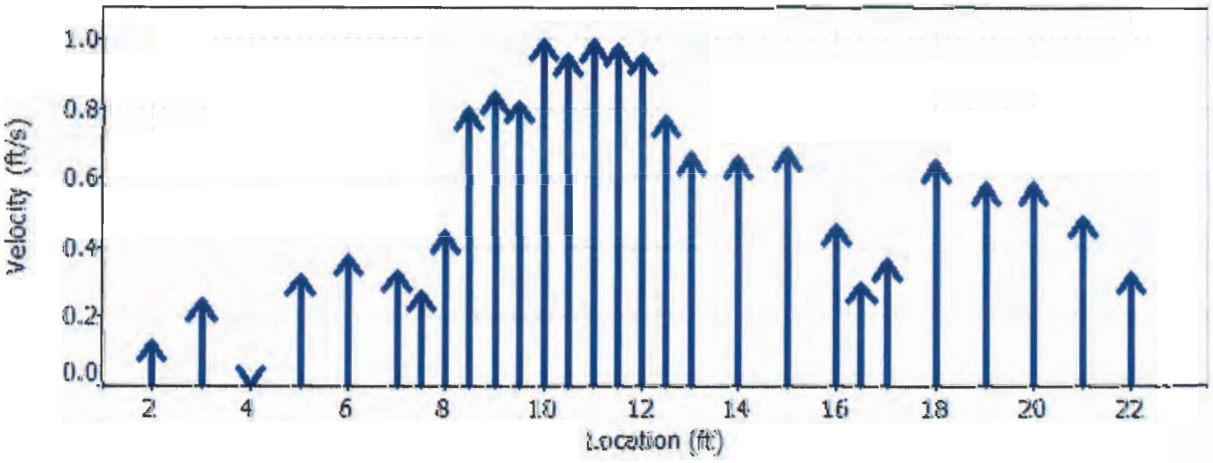
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

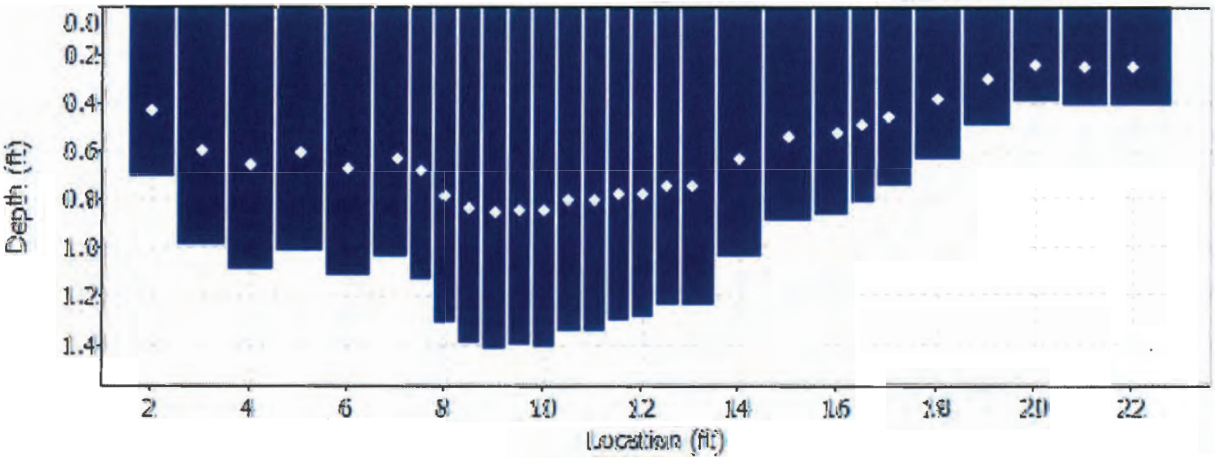
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C4P5.920.WAD	Site Name	
Start Date and Time	2011/09/21 09:26:11	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C4P5.920.WAD	Site Name	
Start Date and Time	2011/09/21 09:26:11	Operator(s)	NJT

Quality Control

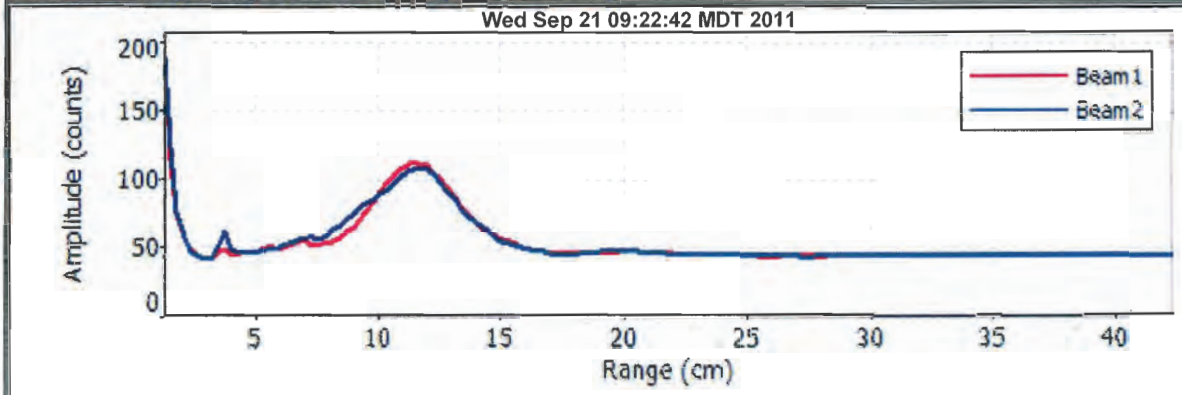
St	Loc	%Dep	Message
1	2.00	0.6	High SNR variation during measurement: 5.2,5.2
3	4.00	0.6	SNR (47.9) is different from typical SNR (30.6)
		0.6	High SNR variation during measurement: 11.2,9.5
6	7.00	0.6	High standard error: 0.032
8	8.00	0.6	High standard error: 0.045
17	12.50	0.6	High angle: -22
18	13.00	0.6	High angle: -25
23	17.00	0.6	High standard error: 0.039

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C4P5.920.WAD	Site Name	
Start Date and Time	2011/09/21 09:26:11	Operator(s)	NJT

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 Sep 27 2012

File Information

File Name	SS04.920.WAD
Start Date and Time	2011/09/21 10:30:21

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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	0.1%	1.1%
Velocity	0.9%	2.0%
Width	0.1%	0.1%
Method	2.0%	-
# Stations	2.3%	-
Overall	**3.3%**	**2.5%**

Summary

Averaging Int.	30	# Stations	22
Start Edge	REW	Total Width	20.200
Mean SNR	29.6 dB	Total Area	31.350
Mean Temp	47.17 °F	Mean Depth	1.552
Disch. Equation	Mid-Section	Mean Velocity	0.3919
		Total Discharge	**12.2859**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:30	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	10:30	2.00	0.6	0.800	0.6	0.320	0.1430	1.00	0.1430	0.800	0.1144	0.9
2	10:31	3.00	0.6	1.350	0.6	0.540	0.2835	1.00	0.2835	1.350	0.3827	3.1
3	10:32	4.00	0.6	1.430	0.6	0.572	0.3301	1.00	0.3301	1.430	0.4720	3.8
4	10:34	5.00	0.6	1.620	0.6	0.648	0.4386	1.00	0.4386	1.620	0.7106	5.8
5	10:35	6.00	0.6	1.650	0.6	0.660	0.4875	1.00	0.4875	1.650	0.8044	6.5
6	10:36	7.00	0.6	1.700	0.6	0.680	0.5115	1.00	0.5115	1.700	0.8696	7.1
7	10:37	8.00	0.6	1.760	0.6	0.704	0.5853	1.00	0.5853	1.760	1.0300	8.4
8	10:38	9.00	0.6	1.800	0.6	0.720	0.5955	1.00	0.5955	1.800	1.0718	8.7
9	10:39	10.00	0.6	1.790	0.6	0.716	0.6427	1.00	0.6427	1.790	1.1505	9.4
10	10:41	11.00	0.6	1.600	0.6	0.640	0.6191	1.00	0.6191	1.600	0.9906	8.1
11	10:42	12.00	0.6	1.700	0.6	0.680	0.5325	1.00	0.5325	1.700	0.9053	7.4
12	10:43	13.00	0.6	1.860	0.6	0.744	0.4491	1.00	0.4491	1.860	0.8354	6.8
13	10:44	14.00	0.6	2.000	0.6	0.800	0.4501	1.00	0.4501	2.000	0.9003	7.3
14	10:45	15.00	0.6	1.800	0.6	0.720	0.4088	1.00	0.4088	1.800	0.7358	6.0
15	10:46	16.00	0.6	1.720	0.6	0.688	0.3074	1.00	0.3074	1.720	0.5288	4.3
16	10:47	17.00	0.6	1.570	0.6	0.628	0.3094	1.00	0.3094	1.570	0.4857	4.0
17	10:48	18.00	0.6	1.500	0.6	0.600	0.1749	1.00	0.1749	1.500	0.2623	2.1
18	*10:49*	*19.00*	*0.6*	*1.520*	*0.6*	*0.608*	*0.0922*	*1.00*	*0.0922*	*1.520*	*0.1401*	*1.1*
19	*10:50*	*20.00*	*0.6*	*1.430*	*0.6*	*0.572*	*-0.0659*	*1.00*	*-0.0659*	*1.430*	*-0.0943*	*-0.8*
20	*10:52*	*21.00*	*0.6*	*1.250*	*0.6*	*0.500*	*-0.0135*	*1.00*	*-0.0135*	*0.750*	*-0.0101*	*-0.1*
21	10:52	21.20	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 Sep 27 2012

File Information

File Name	C9US.920.WAD
Start Date and Time	2011/09/21 16:24:08

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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%	2.8%
Velocity	0.8%	5.0%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.3%	-
Overall	**3.2%**	**5.8%**

Summary

Averaging Int.	30	# Stations	22
Start Edge	REW	Total Width	39.600
Mean SNR	27.4 dB	Total Area	26.000
Mean Temp	53.91 °F	Mean Depth	0.657
Disch. Equation	Mid-Section	Mean Velocity	0.4776
		Total Discharge	**12.4177**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:24	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*16:24*	*3.00*	*0.6*	*0.460*	*0.6*	*0.184*	*0.3173*	*1.00*	*0.3173*	*0.920*	*0.2919*	*2.4*
2	16:25	5.00	0.6	0.620	0.6	0.248	0.6873	1.00	0.6873	1.240	0.8524	6.9
3	16:26	7.00	0.6	0.700	0.6	0.280	0.6030	1.00	0.6030	1.050	0.6333	5.1
4	16:27	8.00	0.6	0.670	0.6	0.268	0.6667	1.00	0.6667	0.670	0.4466	3.6
5	16:28	9.00	0.6	0.700	0.6	0.280	0.5387	1.00	0.5387	1.050	0.5658	4.6
6	16:30	11.00	0.6	0.550	0.6	0.220	0.4091	1.00	0.4091	1.100	0.4499	3.6
7	16:31	13.00	0.6	0.670	0.6	0.268	0.5030	1.00	0.5030	1.340	0.6739	5.4
8	16:32	15.00	0.6	0.670	0.6	0.268	0.5801	1.00	0.5801	1.340	0.7772	6.3
9	16:33	17.00	0.6	0.670	0.6	0.268	0.7490	1.00	0.7490	1.340	1.0036	8.1
10	16:36	19.00	0.6	0.630	0.6	0.252	0.5768	1.00	0.5768	1.260	0.7266	5.9
11	16:37	21.00	0.6	0.820	0.6	0.328	0.2064	1.00	0.2064	1.640	0.3384	2.7
12	16:38	23.00	0.6	0.520	0.6	0.208	0.1952	1.00	0.1952	1.040	0.2030	1.6
13	*16:40*	*25.00*	*0.6*	*0.600*	*0.6*	*0.240*	*0.2628*	*1.00*	*0.2628*	*1.200*	*0.3154*	*2.5*
14	*16:41*	*27.00*	*0.6*	*0.680*	*0.6*	*0.272*	*0.3337*	*1.00*	*0.3337*	*1.360*	*0.4539*	*3.7*
15	16:42	29.00	0.6	0.970	0.6	0.388	0.5092	1.00	0.5092	1.940	0.9880	8.0
16	16:43	31.00	0.6	1.050	0.6	0.420	0.4984	1.00	0.4984	2.100	1.0464	8.4
17	16:44	33.00	0.6	0.900	0.6	0.360	0.6644	1.00	0.6644	1.800	1.1958	9.6
18	16:45	35.00	0.6	0.800	0.6	0.320	0.5066	1.00	0.5066	1.600	0.8104	6.5
19	16:47	37.00	0.6	0.600	0.6	0.240	0.5348	1.00	0.5348	1.200	0.6418	5.2
20	*16:48*	*39.00*	*0.6*	*0.450*	*0.6*	*0.180*	*0.0043*	*1.00*	*0.0043*	*0.810*	*0.0035*	*0.0*
21	16:48	40.60	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 Sep 27 2012

File Information

File Name	C12US.920.WAD
Start Date and Time	2011/09/21 15:38:22

Site Details

Site Name	
Operator(s)	NJT

System Information

Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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%	2.3%
Velocity	0.9%	3.7%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.0%	-
Overall	**3.1%**	**4.4%**

Summary

Averaging Int.	30	# Stations	25
Start Edge	REW	Total Width	30.400
Mean SNR	31.3 dB	Total Area	20.595
Mean Temp	52.20 °F	Mean Depth	0.677
Disch. Equation	Mid-Section	Mean Velocity	0.4916
		Total Discharge	**10.1238**

Measurement Results

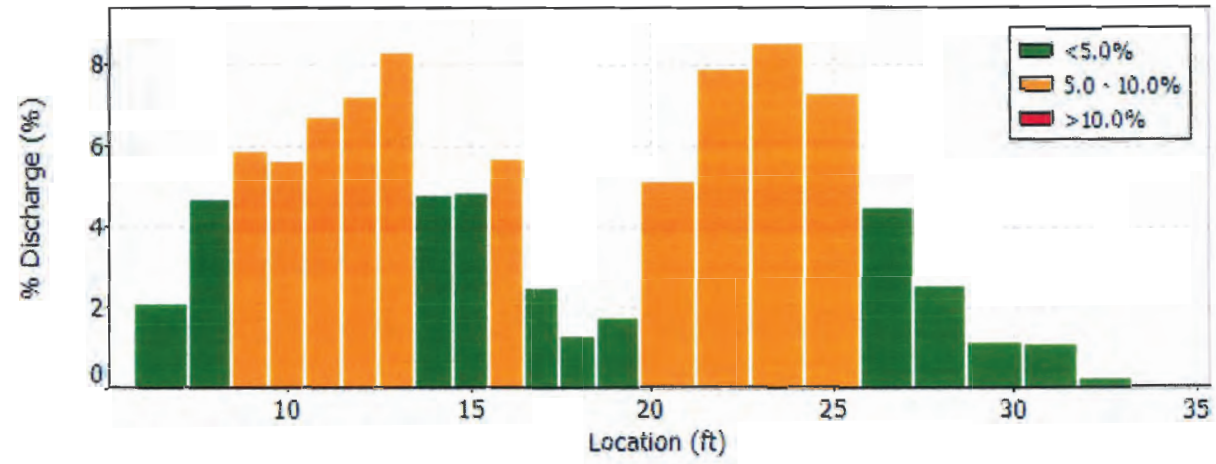
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:38	5.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	15:38	6.50	0.6	0.500	0.6	0.200	0.2822	1.00	0.2822	0.750	0.2116	2.1
2	15:39	8.00	0.6	0.920	0.6	0.368	0.4140	1.00	0.4140	1.150	0.4761	4.7
3	15:41	9.00	0.6	1.050	0.6	0.420	0.5663	1.00	0.5663	1.050	0.5945	5.9
4	15:42	10.00	0.6	1.100	0.6	0.440	0.5203	1.00	0.5203	1.100	0.5724	5.7
5	15:43	11.00	0.6	1.250	0.6	0.500	0.5463	1.00	0.5463	1.250	0.6828	6.7
6	15:44	12.00	0.6	1.250	0.6	0.500	0.5840	1.00	0.5840	1.250	0.7300	7.2
7	15:45	13.00	0.6	1.220	0.6	0.488	0.6877	1.00	0.6877	1.220	0.8390	8.3
8	15:46	14.00	0.6	1.220	0.6	0.488	0.3957	1.00	0.3957	1.220	0.4828	4.8
9	15:47	15.00	0.6	1.220	0.6	0.488	0.4016	1.00	0.4016	1.220	0.4900	4.8
10	15:48	16.00	0.6	1.300	0.6	0.520	0.4409	1.00	0.4409	1.300	0.5732	5.7
11	*15:49*	*17.00*	*0.6*	*1.100*	*0.6*	*0.440*	*0.2293*	*1.00*	*0.2293*	*1.100*	*0.2523*	*2.5*
12	*15:50*	*18.00*	*0.6*	*0.620*	*0.6*	*0.248*	*0.2175*	*1.00*	*0.2175*	*0.620*	*0.1349*	*1.3*
13	15:52	19.00	0.6	0.400	0.6	0.160	0.3553	1.00	0.3553	0.500	0.1776	1.8
14	15:53	20.50	0.6	0.600	0.6	0.240	0.5761	1.00	0.5761	0.900	0.5186	5.1
15	15:54	22.00	0.6	0.650	0.6	0.260	0.8238	1.00	0.8238	0.975	0.8031	7.9
16	15:55	23.50	0.6	0.650	0.6	0.260	0.8901	1.00	0.8901	0.975	0.8678	8.6
17	15:56	25.00	0.6	0.500	0.6	0.200	0.9902	1.00	0.9902	0.750	0.7426	7.3
18	*15:57*	*26.50*	*0.6*	*0.430*	*0.6*	*0.172*	*0.7047*	*1.00*	*0.7047*	*0.645*	*0.4547*	*4.5*
19	15:58	28.00	0.6	0.300	0.6	0.120	0.5791	1.00	0.5791	0.450	0.2605	2.6
20	15:59	29.50	0.6	0.330	0.6	0.132	0.2339	1.00	0.2339	0.495	0.1158	1.1
21	16:00	31.00	0.6	0.330	0.6	0.132	0.2320	1.00	0.2320	0.495	0.1148	1.1
22	*16:02*	*32.50*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0472*	*1.00*	*0.0472*	*0.600*	*0.0283*	*0.3*
23	*16:03*	*34.00*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0007*	*1.00*	*0.0007*	*0.580*	*0.0004*	*0.0*
24	16:03	35.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

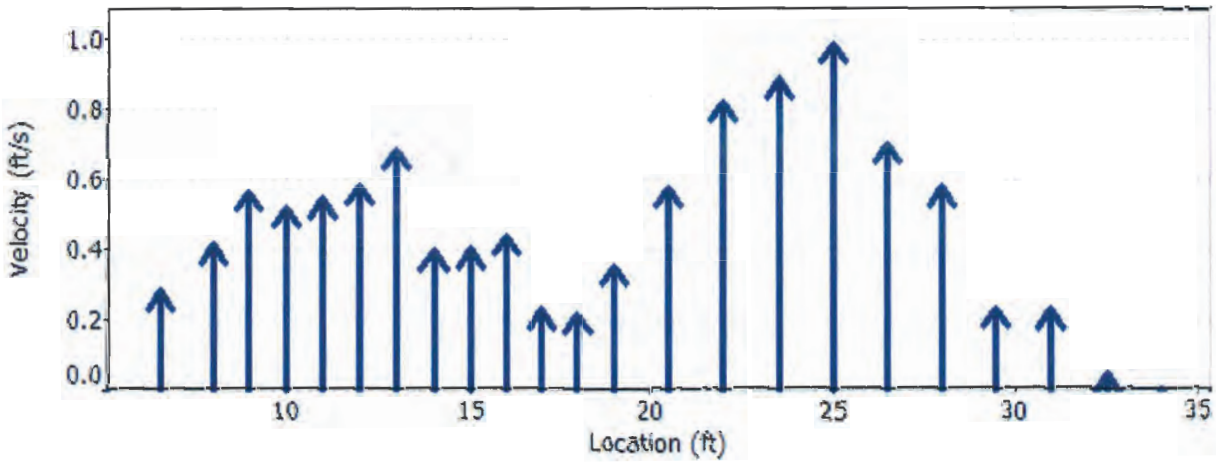
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

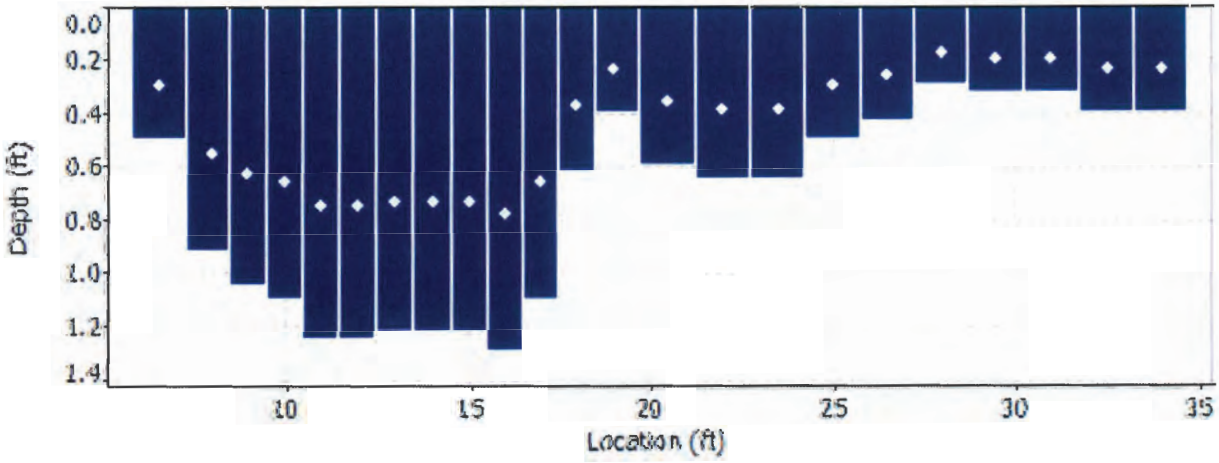
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12US.920.WAD	Site Name	
Start Date and Time	2011/09/21 15:38:22	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	C12US.920.WAD
Start Date and Time	2011/09/21 15:38:22

Site Details

Site Name	
Operator(s)	NJT

Quality Control

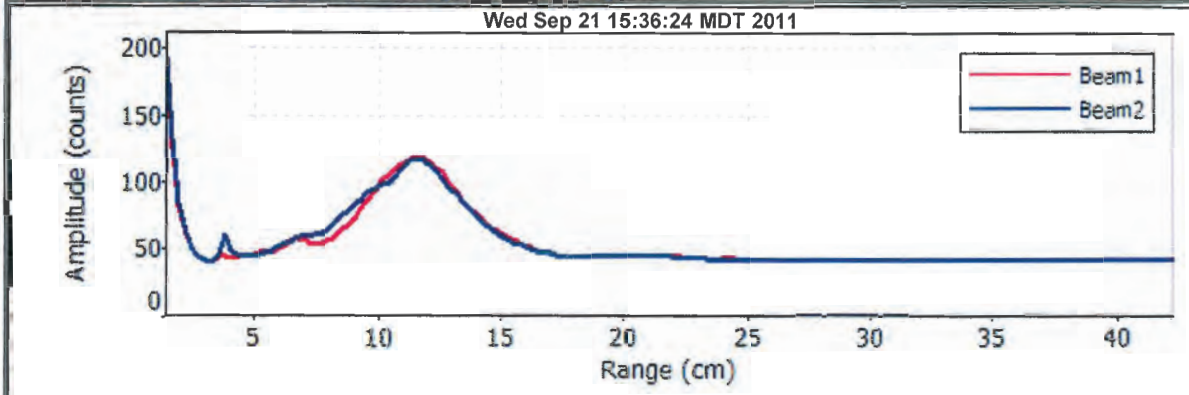
St	Loc	%Dep	Message
11	17.00	0.6	High angle: -21
12	18.00	0.6	High angle: -31
		0.6	Boundary QC is Good; possible boundary interference
18	26.50	0.6	High angle: -23
22	32.50	0.6	Boundary QC is Fair; possible boundary interference
23	34.00	0.6	SNR (60.2) is different from typical SNR (31.3)

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	C12US.920.WAD	Site Name	
Start Date and Time	2011/09/21 15:38:22	Operator(s)	NJT

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 Sep 27 2012

File Information	
File Name	SS05.920.WAD
Start Date and Time	2011/09/21 08:20:40

Site Details	
Site Name	
Operator(s)	NJT

System Information	
Sensor Type	FlowTracker
Serial #	P3012
CPU Firmware Version	3.7
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	0.1%	0.7%
Velocity	1.3%	2.5%
Width	0.1%	0.1%
Method	2.0%	-
# Stations	1.8%	-
Overall	**3.1%**	**2.8%**

Summary			
Averaging Int.	30	# Stations	29
Start Edge	REW	Total Width	14.700
Mean SNR	31.4 dB	Total Area	17.704
Mean Temp	45.31 °F	Mean Depth	1.204
Disch. Equation	Mid-Section	Mean Velocity	0.6368
		Total Discharge	**11.2747**

Measurement Results

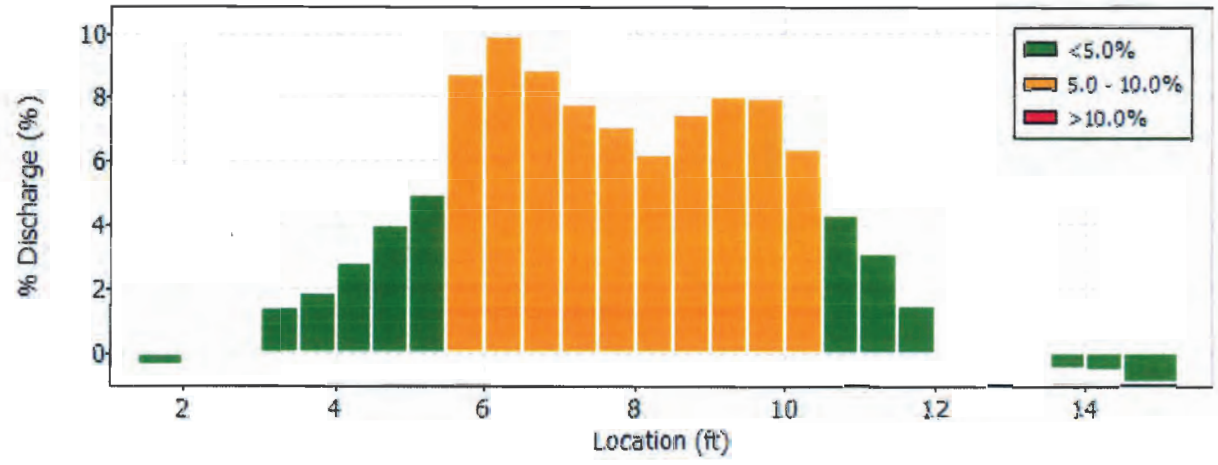
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	08:20	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*08:20*	*1.75*	*0.6*	*0.720*	*0.6*	*0.288*	*-0.1076*	*1.00*	*-0.1076*	*0.450*	*-0.0484*	*-0.4*
2	08:22	2.25	0.6	0.780	0.6	0.312	0.0102	1.00	0.0102	0.390	0.0040	0.0
3	*08:25*	*2.75*	*0.6*	*1.030*	*0.6*	*0.412*	*0.0210*	*1.00*	*0.0210*	*0.515*	*0.0108*	*0.1*
4	*08:26*	*3.25*	*0.6*	*1.150*	*0.6*	*0.460*	*0.2831*	*1.00*	*0.2831*	*0.575*	*0.1628*	*1.4*
5	*08:28*	*3.75*	*0.6*	*1.250*	*0.6*	*0.500*	*0.3379*	*1.00*	*0.3379*	*0.625*	*0.2112*	*1.9*
6	*08:32*	*4.25*	*0.6*	*1.300*	*0.6*	*0.520*	*0.4829*	*1.00*	*0.4829*	*0.650*	*0.3139*	*2.8*
7	08:37	4.75	0.6	1.300	0.6	0.520	0.6890	1.00	0.6890	0.650	0.4478	4.0
8	08:38	5.25	0.6	1.400	0.6	0.560	0.7986	1.00	0.7986	0.700	0.5590	5.0
9	08:41	5.75	0.6	1.470	0.6	0.588	1.3356	1.00	1.3356	0.735	0.9818	8.7
10	*08:43*	*6.25*	*0.6*	*1.600*	*0.6*	*0.640*	*1.3957*	*1.00*	*1.3957*	*0.800*	*1.1166*	*9.9*
11	08:44	6.75	0.6	1.620	0.6	0.648	1.2290	1.00	1.2290	0.810	0.9955	8.8
12	08:45	7.25	0.6	1.550	0.6	0.620	1.1312	1.00	1.1312	0.775	0.8766	7.8
13	*08:48*	*7.75*	*0.6*	*1.530*	*0.6*	*0.612*	*1.0407*	*1.00*	*1.0407*	*0.765*	*0.7960*	*7.1*
14	08:49	8.25	0.6	1.610	0.6	0.644	0.8675	1.00	0.8675	0.805	0.6983	6.2
15	08:51	8.75	0.6	1.610	0.6	0.644	1.0453	1.00	1.0453	0.805	0.8414	7.5
16	08:52	9.25	0.6	1.580	0.6	0.632	1.1503	1.00	1.1503	0.790	0.9087	8.1
17	08:54	9.75	0.6	1.520	0.6	0.608	1.1798	1.00	1.1798	0.760	0.8966	8.0
18	*08:55*	*10.25*	*0.6*	*1.620*	*0.6*	*0.648*	*0.8927*	*1.00*	*0.8927*	*0.810*	*0.7231*	*6.4*
19	08:56	10.75	0.6	1.520	0.6	0.608	0.6411	1.00	0.6411	0.760	0.4872	4.3
20	08:57	11.25	0.6	1.300	0.6	0.520	0.5367	1.00	0.5367	0.650	0.3488	3.1
21	08:59	11.75	0.6	1.230	0.6	0.492	0.2687	1.00	0.2687	0.615	0.1652	1.5
22	09:00	12.25	0.6	1.250	0.6	0.500	0.0043	1.00	0.0043	0.625	0.0027	0.0
23	09:01	12.75	0.6	1.150	0.6	0.460	0.0039	1.00	0.0039	0.575	0.0023	0.0
24	*09:02*	*13.25*	*0.6*	*1.050*	*0.6*	*0.420*	*0.0243*	*1.00*	*0.0243*	*0.525*	*0.0127*	*0.1*
25	*09:04*	*13.75*	*0.6*	*1.030*	*0.6*	*0.412*	*-0.1188*	*1.00*	*-0.1188*	*0.515*	*-0.0612*	*-0.5*
26	*09:05*	*14.25*	*0.6*	*0.900*	*0.6*	*0.360*	*-0.1549*	*1.00*	*-0.1549*	*0.450*	*-0.0697*	*-0.6*
27	*09:07*	*14.75*	*0.6*	*0.800*	*0.6*	*0.320*	*-0.1883*	*1.00*	*-0.1883*	*0.580*	*-0.1092*	*-1.0*
28	09:07	15.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

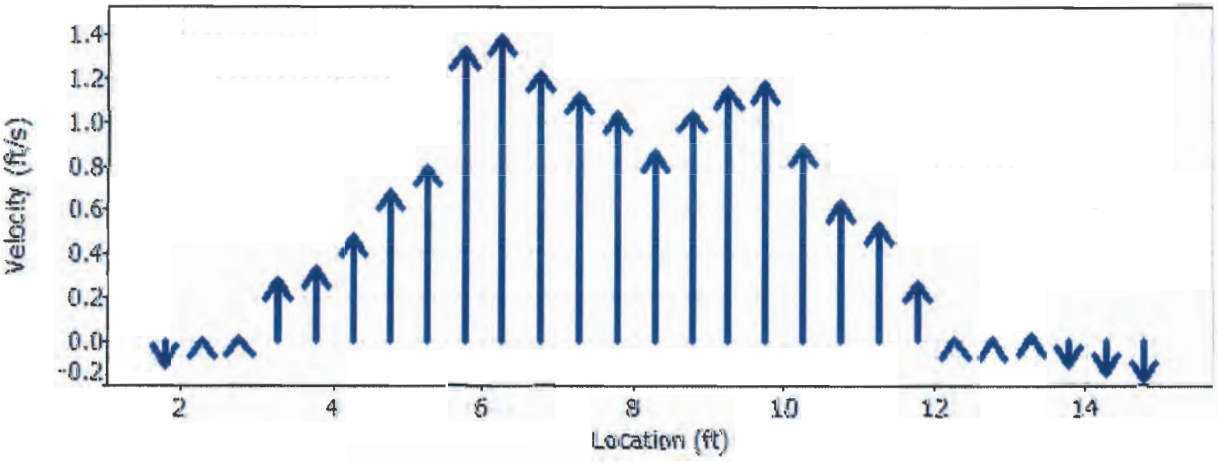
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

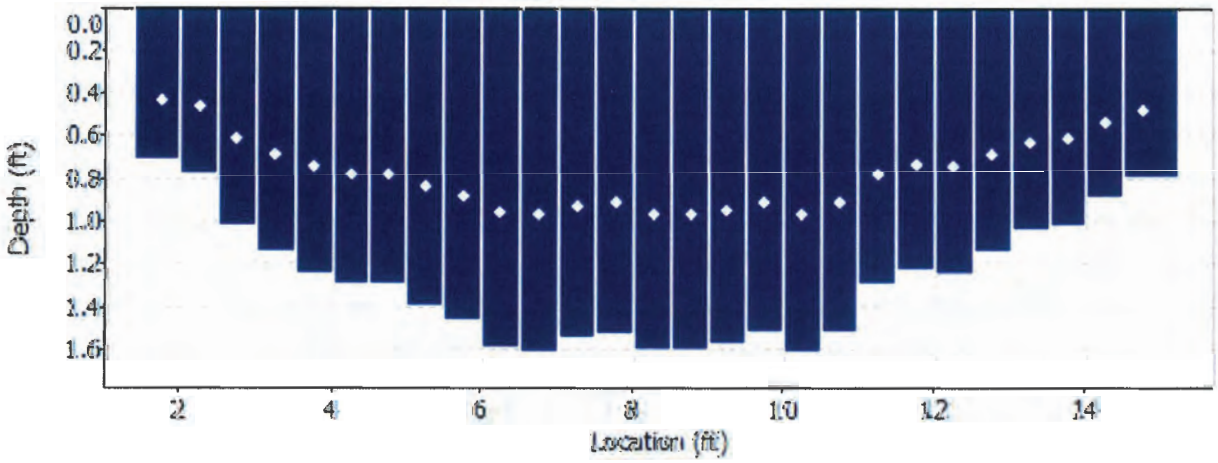
Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information		Site Details	
File Name	SS05.920.WAD	Site Name	
Start Date and Time	2011/09/21 08:20:40	Operator(s)	NJT







Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

File Information

File Name	SS05.920.WAD
Start Date and Time	2011/09/21 08:20:40

Site Details

Site Name	
Operator(s)	NJT

Quality Control

St	Loc	%Dep	Message
1	1.75	0.6	High angle: 165
		0.6	High differences in beam SNR: 39.1,27.5
3	2.75	0.6	High angle: 57
4	3.25	0.6	High angle: -20
5	3.75	0.6	High angle: -25
6	4.25	0.6	High angle: -37
10	6.25	0.6	High angle: -21
13	7.75	0.6	High standard error: 0.065
18	10.25	0.6	High angle: -25
24	13.25	0.6	High angle: 71
25	13.75	0.6	High angle: -154
26	14.25	0.6	High angle: -172
27	14.75	0.6	High angle: 170

Discharge Measurement Summary

Date Generated: Thu Sep 27 2012

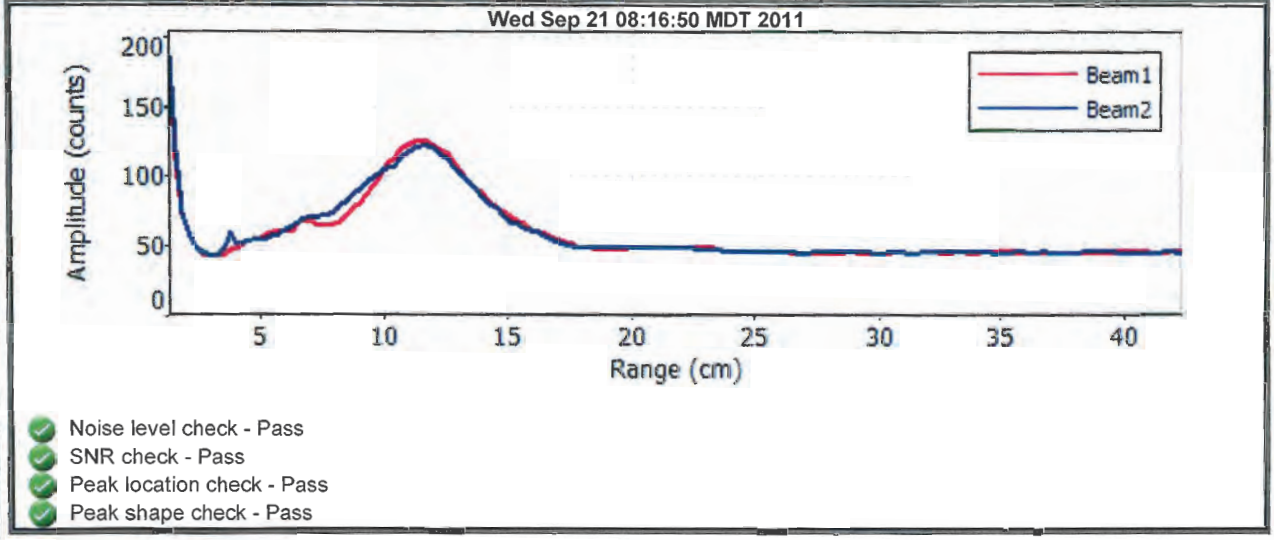
File Information

File Name	SS05.920.WAD
Start Date and Time	2011/09/21 08:20:40

Site Details

Site Name	
Operator(s)	NJT

Automatic Quality Control Test (BeamCheck)



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

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