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TECHNICAL MEMO

WEST ELK MINE

SUMMARY OF WATER YEAR 2019 SURFACE WATER AND GROUNDWATER QUANTITY AND QUALITY DATA

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WEST ELK MINE

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1.0 INTRODUCTION

This Mountain Coal Company, LLC (MCC) West Elk Mine 2019 Summary of Water Quantity and Quality Data technical memo summarizes Hydrogeology Solutions Inc.'s (HSI's) hydrologic monitoring activities and pertinent data associated with the West Elk Mine mining operations for the Water Year (WY) 2019 (October 1, 2018 through September 30, 2019). The hydrologic monitoring activities were performed in accordance with the Colorado Division of Reclamation, Mining and Safety (CDRMS) Permit C-1980-007.

2.0 HYDROLOGIC MONITORING PLAN

The MCC hydrologic monitoring program is designed to collect the monitoring data needed to assess mining related impacts on hydrologic resources. CDRMS approved a revised hydrologic monitoring plan for the West Elk Mine permit area in June 2006 (CDRMS, 2006), that was implemented from the latter months of WY 2006 through WY 2016. The hydrologic monitoring plan was again revised (Technical Revision No. 139), was approved by CDRMS in October 2016 (CDRMS, 2016) and was implemented in WYs 2017 to 2019. The Sunset Trail hydrology monitoring plan was added with Permit Revision No. PR-15 in 2018.

The hydrologic monitoring plan for the permit area includes monitoring surface water resources, springs and seeps, groundwater resources, the coal refuse pile underdrains, and pertinent mine water resources. The locations of these hydrologic resources are shown on Permit Map 34 (CDRMS, 2016). Routine monitoring, i.e., subsequent to the baseline monitoring period, includes collecting field water quality data (pH, electrical conductivity [EC], and temperature) and collecting a sample for independent laboratory analysis annually. Flow or water level measurements are collected three times per year corresponding with the rising limb period between April 3rd and May 13th; the peak flow period between April 21st and June 26th; and the low flow period between July 10th and October 8th, as shown on Table 1. The chemical analyte suite for the first five years of sampling for both groundwater and surface water samples, including one year of baseline sampling, is presented in Table 2.

The current hydrologic monitoring plan for MCC incorporates a separate baseline monitoring schedule for all new monitoring sites for approximately one year prior to the time when mine development operations expand into new potentially affected areas. The baseline monitoring schedule protocols stipulate collecting monthly field water quality data, flow or water level measurements, and collecting samples for laboratory analysis for the year prior to initiation of mining and potential impacts (Table 2). Site-specific baseline schedules are dependent on site accessibility and mine development timing. In general, baseline monitoring is conducted for at least six months, usually from April through September, in order to provide adequate data to show seasonal variations in water quality and quantity. Winter access to most sites within the MCC permit area is impractical and not feasible, so baseline monthly monitoring is generally not performed from October through March. A summary of the approved baseline and routine monitoring program frequencies is presented in Table 1.

Table 1. Baseline and Routine Monitoring Frequencies

Routine Monitoring	Baseline Monitoring			
	Month	Flow / Level	Field Parameters	Laboratory Analysis
	January			
Rising Limb	February			
April 3 to May 13	March			
	April	X	X	X
Peak Flow	May	X	X	X
April 21 to June 26	June	X	X	X
	July	X	X	X
Low Flow	August	X	X	X
July 10 to October 8	September	X	X	X
	October			
	November			
	December			

Adapted from CDRMS (2006)

After monitoring sites have been monitored for five years (including approximately one year of baseline monitoring), the analytical parameter suite list is typically reduced and samples are submitted for laboratory analysis of total suspended solids (TSS), total dissolved solids (TDS), EC, pH, dissolved iron, and total iron. Field parameters (pH, EC, temperature, and flow or water level) are also recorded.

The Upper and Lower North Fork and Middle Sylvester Gulch monitoring sites have expanded analytical parameter suite lists, in order to provide data for the on-going characterization of the North Fork of the Gunnison River (North Fork). The North Fork and Middle Sylvester Gulch lab parameters include those listed in Table 2, plus chromium, nickel, silver (total), cyanide (total), iron (total recoverable), alkalinity (total $CaCO_3$), bicarbonate, carbonate, hydroxide, nitrogen (ammonia), ortho-phosphorus (dissolved), and sodium adsorption ratio (SAR).

Table 2. Laboratory Parameters for First Five Years of Monitoring (including Baseline Period)

Springs/Surface Water[3,4]	
pH (lab and field)[1]	Sodium (Na^{+})
Electrical conductivity at 25^{0} C (lab and field)	Sulfate (SO_{4}-)
Temperature (field)[1]	Aluminum (Al)
Total Dissolved Solids[1] (TDS)	Arsenic (As) (Total Recoverable)
Total Suspended Solids[1] (TSS)	Cadmium (Cd)
Sodium Adsorption Ratio (SAR)	Copper (Cu)
Bicarbonate (HCO_3^-)	Iron (Fe)[1] (Total and Dissolved)
Calcium (Ca^{+2})	Lead (Pb)
Chloride (Cl^-)	Manganese (Mn)[1] (Total and Dissolved)
Hardness[2]	Mercury (Hg) (Total Recoverable)
Magnesium (Mg^{+2})	Molybdenum (Mo)
Nitrate/Nitrite	Selenium (Se) (Total Recoverable)
Phosphate (PO_4^{-3} as P)	Zinc (Zn)
Potassium	Boron (B)
Groundwater[3]	
pH (lab and field)[1]	Nitrate/Nitrite
Electrical conductivity at 25^{0}C (lab and field)[1]	Phosphate (PO_4^{-3} as P)
Temperature (field)[1]	Potassium
Total Dissolved Solids[1]	Turbidity[1]
Sodium Adsorption Ratio (SAR)	Sodium (Na)
Bicarbonate (HCO_3^-)	Sulfate (SO_4^-)
Calcium (Ca^{+2})	Arsenic (As)
Carbonate (CO_3^-)	Cadmium (Cd)
Chloride (Cl^-)	Iron (Fe)[1] (Total and Dissolved)
Hardness[2]	Manganese (Mn)[1] (Total and Dissolved)
Magnesium (Mg^{+2})	Lead (Pb)
Ammonia (NH_3)	Mercury (Hg)
Selenium (Se)	Zinc (Zn)
	Boron (B)

Adapted from CDRMS (2006)

1. Parameters monitored as a result of PR-10
2. Added to baseline analyses in 1996, not for analyses completed prior to 1996.
3. All metals analyzed for their dissolved form unless stated otherwise.
4. North Fork of the Gunnison and Middle Sylvester Gulch expanded parameters include those listed in Table 2 for surface water, plus chromium, nickel, silver (total), cyanide (total), iron (total recoverable), alkalinity (Total $CaCO_3$), bicarbonate, carbonate, hydroxide; nitrogen (ammonia), ortho-phosphorus (dissolved), and sodium adsorption ratio (SAR).

2.1 SURFACE WATER MONITORING PROGRAM

The surface water monitoring program for the permit area includes 24 stations comprised of 11 stream stations with continuous recording devices, eight stream stations where flow is recorded instantaneously, two stream stations where flow is not recorded, and three ponds. A detailed discussion of monitored surface water stations can be found in the 2014 Annual Hydrology Report (HydroGeo, 2015), and their locations are shown on Permit Map 34 (CDRMS, 2016). The surface water monitoring locations are shown on Permit Map 34 (CDRMS, 2016). A summary of the surface water monitoring program details is presented in Table 3. The surface water flow data and surface water hydrographs for the period of record are presented in Appendix A and B, respectively. The water quality data for the period of record for all of the surface water monitoring stations are summarized in Appendix C.

In July 2018, four stream monitoring locations, three ponds, and one spring in the Sunset Trail Lease Modification Area of the Minnesota Creek Drainage Basin were added to the monitoring program. These new monitoring stations underwent monthly baseline sampling from July through September 2018, and May through July 2019 (the sites are inaccessible between October and April). Beginning in WY 2020, they will be sampled at the routine monitoring frequency (Table 1). A detailed description of the Sunset Trail area monitoring sites can be found in the Sunset Trail Lease Area Baseline Monitoring Recommendations Technical Memo (HSI, 2018), and a summary of the new monitoring station location details is presented in Table 4.

There are eight temperature data loggers in Sylvester Gulch and in the North Fork, in order to monitor the effects of mine discharge from Sylvester Gulch on the water temperature of the North Fork. Details of the temperature monitoring program can be found in the 2014 Annual Hydrology Report (HydroGeo, 2015). The temperature monitoring data and graphs are presented in Appendices I and J, respectively.

Table 3. Summary of the Surface Water Monitoring Program

Monitoring Station [1]	Monitored Area	Flow Measurement	Field WQ (pH, EC, T)	Annual Lab Water Quality	Period of Record
Surface Water Stations Upper North Fork of the Gunnison River Drainage Basin					
Upper Deep Creek	Up-gradient of SE mine panels; down-gradient of SOD mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	1996 to present
Lower Deep Creek	Down-gradient of SE mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	1996 to present
Box Canyon	Down-gradient of Box Canyon mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	1999 to present
North Fork Upper (USGS 09132500)	Up-gradient of mine facilities and mine discharge points	Continuous	3 x Year	Low Flow Period, Peak Irrigation Season [3]	1977 to present
Upper Sylvester Gulch	Up-gradient of mine surface facilities area and NE mine panels	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	1977 to present
Middle Sylvester Gulch	Down-gradient of mine water discharge point and NE mine panels	Continuous	3 x Year	Peak Flow Period [3]	1977 to present
Lower Sylvester Gulch	Down-gradient of mine surface facilities area and NE mine panels	Not Measured	3 x Year	Peak Flow Period [1]	1977 to present
Surface Water Stations Lower North Fork of the Gunnison River Drainage Basin					
North Fork Lower	Down-gradient of mine facilities and mine discharge.	Not Measured	3 x Year	Low Flow Period, Peak Irrigation Season [3]	1935-present
Surface Water Stations Minnesota Creek Drainage Basin					
Lick Creek Flume	Up-gradient of SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1977 to present
Upper Dry Fork Flume	SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1977 to present
Middle Dry Fork Flume	SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1977 to present
Lower Dry Fork Flume	Down-gradient of SW and SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1977 to present
Minnesota Reservoir Flume	Down-gradient of SW and SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	2006 to present
Deep Creek Ditch Flume	Up-gradient of SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	2006 to present
Poison Gulch	SOD mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	2005 to present
Deer Creek	SOD mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	2005 to present
Horse Gulch	Down-gradient of the SW mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1]	1977 to present
East Gulch, East of Horse Gulch	SOD and SW mine panels area	Instantaneous, 3 x Year	3 x Year	Peak Flow Period [1	1977 to present
Upper Minnesota Creek (USFS)	SOD mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1977 to present
Lower Minnesota Creek (USGS)	Down-gradient of SOD and SW mine panels area	Continuous	3 x Year	Peak Flow Period [1]	1937-1947 and 1985 to April 2, 2014
Lower Minnesota Creek (CDWR)	Down-gradient of SOD and SW mine panels area	Continuous	3 x Year	Peak Flow Period [1]	April 30, 2014 to present
South Prong Creek	Mouth of South Prong Creek	Continuous	6 x Year	Baseline Period[2]	July 2018 to Present
North Fork of South Prong Creek	Sunset Trail Area	Instantaneous, 6 x Year	6 x Year	Baseline Period[2]	July 2018 to Present
South Fork of South Prong Creek	Sunset Trail Area	Instantaneous, 6 x Year	6 x Year	Baseline Period[2]	July 2018 to Present
Stream ST-SW-1	Sunset Trail Area	Instantaneous, 6 x Year	6 x Year	Baseline Period[2]	July 2018 to Present
Pond ST-P-1	Sunset Trail Area	Water Level, 6 x Year	6 x Year	Baseline Period[2]	August 2018 to Present
Pond ST-P-2	Sunset Trail Area	Water Level, 6 x Year	6 x Year	Baseline Period[2]	July 2018 to Present

Table 3. Summary of the Surface Water Monitoring Program (continued)

Pond ST-P-3	Sunset Trail Area	Water Level, 6 x Year	6 x Year	Baseline Period(2)	July 2018 to Present

SW mine panels area – southwest B-seam longwall panels; SE mine panels area - southeast B-seam longwall panels
Box Canyon mine panels area - Box Canyon B-seam longwall panels; West Flatiron mine panels area - West Flatiron B-seam longwall panels
SOD mine panels area - South of the Divide E-seam longwall panels

1. For sites with more than 5 years of data, lab parameters include TSS, TDS, EC, pH, and Fe (dissolved & total)
2. For sites with 5 years or less data see Table 2
3. North Fork of the Gunnison and Middle Sylvester Gulch expanded parameters include those listed in Table 2 for surface water, plus chromium, nickel, silver (total), cyanide (total), iron (total recoverable), nitrate/nitrite (as N), alkalinity (Total CaCO3), bicarbonate, carbonate, hydroxide; nitrogen (ammonia), phosphorous-ortho (dissolved), and sodium adsorption ratio (SAR).

Table 4. Summary of Sunset Trail Area Surface Water Monitoring Stations

Monitoring Station	Location Description	Latitude (NAD 83 dd)	Longitude (NAD 83 dd)
South Prong Creek	Upstream of Confluence with Minnesota Creek	38.839794	-107.451729
North Fork of South Prong Creek	About ½ mile upstream of South Prong Creek Station	38.839970	-107.444520
South Fork of South Prong Creek	About ½ mile upstream of South Prong Creek Station	38.839974	-107.444393
Stream ST-SW-1	Unnamed Tributary to South Prong Creek. About 1.5 miles upstream of So South Prong Creek Station	38.833121	-107.426038
Pond ST-P-1	Headwaters of Unnamed Tributary to Lick Creek	38.848707	-107.424765
Pond ST-P-2	Upland Area to the North of South Prong Creek	38.842051	-107.426975
Pond ST-P-3	Upland Area to the North of South Prong Creek	38.841420	-107.424671
Spring ST-S-1	Located in the N. Fork of South Prong Drainage, about one mile upstream of the NFSPC Station	38.847033	-107.434802

2.2 SPRING AND SEEP MONITORING PROGRAM

The spring monitoring program for the permit area includes 28 spring and seep locations. A detailed discussion of monitored springs and seeps can be found in the 2014 Annual Hydrology Report (HydroGeo, 2015), and their locations are shown on Permit Map 34 (CDRMS, 2016). A summary of the spring and seep monitoring program details is presented in Table 5. Spring hydrographs and water quality data for the period of record are presented in Appendix D and E, respectively.

Table 5. Summary of the Spring and Seep Monitoring Program

Monitoring Station	Monitored Area	Flow Measurement	Field WQ (pH, EC, T)	Annual Lab Water Quality	Period of Record
Springs above the F-seam in the North Fork of the Gunnison River Drainage Basin					
Spring 26-1	Deep Creek, SE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1996 to present
Spring 27-1 (two ponds)	Upper Syl. Gulch, SE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1996 to present
Spring G-7	Upper Syl. Gulch, NE and SW mine panels areas	3 x Year	3 x Year	Peak Flow Period (1)	1977 to present
Spring G-16	Syl. Gulch, east of NE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1979 to present
Spring G-24 (decreed spring #8)	Syl. Gulch, east of NE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1979 to present
Spring G-14 (decreed spring #7)	Syl. Gulch, east of NE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1977 to present
Spring G-22 (decreed spring #3)	Syl. Gulch, north of NE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1977 to present
Spring 35-3	U. Deep Creek, east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2006 to present
96-2-2 Area Spring	U Deep Creek, SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2007 to present
Deep Creek Spring # 2	U Deep Creek, SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1	2007 to present
Deep Creek Trail Spring	U Deep Creek, south of SE mine panels area and east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2007 to present
Spring 2012-1	U Deep Creek, south of SE mine panels area and east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (2)	2013 to present
Spring 2012-2	U Deep Creek, south of SE mine panels area and east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (2)	2013 to present
Spring 2012-3	U Deep Creek, south of SE mine panels area and east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (2)	2013 to present
Spring 2012-4	U Deep Creek, south of SE mine panels area and east of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (2)	2013 to present
Springs in or below the F-seam in the North Fork of the Gunnison River Drainage Basin					
Spring 11-2	Unnamed drainage east of Box Canyon, north of Box Canyon mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2000 to present
Spring 10-1	Lower Box Canyon, north of Box Canyon mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1999 to present
Spring E10-2	Unnamed drainage east of Syl. Gulch, north of Box Canyon mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1996 to present
Spring 15-1	Unnamed drainage east of Syl. Gulch, north of Box Canyon	3 x Year	3 x Year	Peak Flow Period (1)	1996 to present

Table 5. Summary of the Spring and Seep Monitoring Program (continued)

Monitoring Station	Monitored Area	Flow Measurement	Field WQ (pH, EC, T)	Annual Lab Water Quality	Period of Record
	mine panels area				
Spring G-1a	Syl. Gulch, north of NE mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1983 to present
Spring G-20	Middle Syl. Gulch, east of mine facilities	3 x Year	3 x Year	Peak Flow Period (1)	1979 to present
Springs above the E-seam in the Dry Fork Drainage Basin					
Spring J-4	M. Dry Fork, SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	1981 to present
Deer Creek Spring	Deer Creek, SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2006 to present
Spring WCC-24	Lower Dry Fork, west of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2006 to present
Spring J-2	Lick Creek, south of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2006 to present
Spring J-7	Poison Gulch, SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2006 to present
Spring J-10	Dry Fork, west of SOD mine panels area	3 x Year	3 x Year	Peak Flow Period (1)	2011 to present
Spring ST-S-1	N. Fork of S. Prong Creek area	6 x Year	6 x Year	Baseline Period (2)	July 2018 to present

SW mine panels area – southwest B-seam longwall panels; SE mine panels area – southeast B-seam longwall panels
Box Canyon mine panels area – Box Canyon B-seam longwall panels; W. Flatiron mine panels area – West Flatiron B-seam longwall panels
SOD mine panels area – South of the Divide E-seam longwall panels

1. For sites with more than 5 years of data, lab parameters include TSS, TDS, EC, pH, and Fe (dissolved & total).
2. For sites with 5 or less years of data, see Table 2

2.3 GROUNDWATER MONITORING PROGRAM

In WY 2019, a total of 13 wells were monitored as part of the MCC groundwater monitoring program (Tables 6 and 7).

A detailed discussion of the groundwater monitoring wells can be found in the 2014 Annual Hydrology Report (HydroGeo, 2015), and their locations are shown on Permit Map 34 (CDRMS, 2016). A summary of the groundwater monitoring well characteristics is presented in Table 6, and a summary of the groundwater monitoring program, including mining areas monitored is presented in Table 7. The water level elevation graphs and water quality data for the period of record for all of the groundwater monitoring wells are summarized in Appendix F and G, respectively.

Table 6. Summary of the Groundwater Monitoring Well Characteristics

Monitoring Well	Location	Ground Elevation (Toc, ft.)	Screened Interval Depth (ft)	Total Depth (ft)	Formation of Completion
Facility Area Wells and Alluvial Wells					
GP-3 (MW-8)	T13S, R90W, Sec. 10, SW,SW	6145.5	25-30	33.8	Colluvium
GP-4 (MW-9)	T13S, R90W, Sec. 10, SW,SW	6147.5	25-30	33.0	Colluvium
GP-6	T13S, R90W, Sec. 10, SW,SW	6204.8	78-83	83.0	Alluvium (Syl. Gulch)
GP-7	T13S, R90W, Sec. 15, SW,SW	6205.7	50-55	55	Alluvium (Syl. Gulch)
RPE-1	T13S, R90W, Sec. 10, SW,SE	6187.0	n.a.	30.0	Colluvium
RPE-7	T13S, R90W, Sec. 10, SE,SW	6116.3	12-32	32.0	Colluvium
Upper Dry Fork Alluvial	T14S, R90W, Sec. 2, SW,NW	8100	24-29	29	Alluvium
Lower Dry Fork Alluvial	T13S, R90W, Sec. 33, NE,NW	7640	17.5-22.5	22.5	Alluvium
Permit Area Wells Completed in the Barren Member above F-Seam					
SOM-80	T13S, R90W, Sec. 21, NW,NE	6854.4	50-90	142.5	Barren Mbr. Mesa Verde Fm.
SOM-45-H1	T13S, R90W, Sec. 29, NE,SW	7703.8	160-260	260.0	Barren Mbr. Mesa Verde Fm.
Permit Area Wells Completed in the F-Seam					
SOM C-76	T13S, R90W, Sec. 33, NW,NE	7579.6	444-457	457.0	F-Seam
Permit Area Wells Completed in the E-Seam					
03-11-1	T13S, R90W, Sec. 11, SE,SE	6281	240-250	250	E-Seam
Permit Area Wells Completed in B-Seam					
01-11-1	T13S, R90W, Sec. 11, SE,NE	6281.3	489-499	509.0	B-Seam

toc – top of casing

Table 7. Summary of the Groundwater Monitoring Program

Monitored Station	Monitored Area	Water Level Measurement	Field WQ (pH, EC, temp)	Annual Lab Water Quality	Period of Record
Facility Area Wells and Alluvial Wells					
GP-3 (MW-8)	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1985 to present
GP-4 (MW-9)	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1985 to present
GP-6	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1997 to present
GP-7	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1997 to present
RPE-1	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1996 to present
RPE-7	Mine facility area	3 x Year	3 x Year	Low Flow Period (1)	1999 to present
Upper Dry Fork Alluvial (1)	SOD mine panels area	3 x Year	3 x Year	Low Flow Period (1)	2003 to present
Lower Dry Fork Alluvial (1)	SOD mine panels area	3 x Year	3 x Year	Low Flow Period (1)	2003 to present
Wells Completed in the Barren Member above F-Seam					
SOM-80	NE mine panels area	3 x Year	3 x Year	Low Flow Period (1)	1979 to present
SOM-45-H1	SW mine panels area	3 x Year	3 x Year	Low Flow Period (1)	1979 to present
Wells Completed in the F-Seam					
SOM-C-76	SOD mine panels area	3 x Year	3 x Year	Low Flow Period (1)	1978 to present
Wells Completed in the E-Seam					
03-11-1	North of Box Canyon mine panels area	3 x Year	3 x Year	Low Flow Period (1)	2003 to present
Wells Completed in –B-Seam					
01-11-1	North of Box Canyon mine panels area	3 x Year	3 x Year	Low Flow Period (1)	2001 to present

SW mine panels area – southwest B-seam longwall panels
SE mine panels area – southeast B-seam longwall panels
Box Canyon mine panels area – Box Canyon B-seam longwall panels
W. Flatiron mine panels area – West Flatiron B-seam longwall panels
SOD mine panels area – South of the Divide E-seam longwall panels
Shaded cells indicate wells with compromised, blocked, or collapsed casing.

1. For sites with >5 years of data, lab parameters include TSS, TDS, EC, pH, and Fe (dissolved & total).
2. Due to a blockage, monitoring well RAV-4b was plugged & abandoned in July 2018.

2.4 UNDERDRAIN AND MINE WATER MONITORING

Two underdrains were monitored in WY 2019. The underdrains are located at the lower refuse pile (LRP) and at the refuse pile expansion (RPE) area. The LRP underdrain is located above the sediment ditch at the base of the pile, east of the stacktube #5 coal stockpile. The RPE underdrain is located just south of, and drains into the RPE sediment pond.

A discussion of the underdrain monitoring sites, mine inflow water sampling criteria, and a map showing the location of the sites can be found in the 2014 Annual Hydrology Report (HydroGeo, 2015). The underdrain monitoring program details are summarized in Table 8 and the underdrain water quality data are presented in Appendix H. In WY 2019, no mine inflows met the monitoring and sampling criteria.

Table 8. Summary of the Underdrain and Mine Inflow Monitoring Program

Monitoring Site	Flow Measurement	Field WQ (pH, EC, temp)	Annual Lab Water Quality
Underdrains			
LRP	3 x Year	3 x Year	Low Flow Period (1)
RPE	3 x Year	3 x Year	Low Flow Period (1)
Mine Inflows (if sampling criteria are met)(2)			

(1) Lab parameters include TDS, EC, pH, Ca, Mg, Na, K, SAR, hardness, bicarbonate, Cl, Nitrite/Nitrate, PO4, SO4, Fe (tot & dissolved), Mn (tot & dissolved), Al, As (tot), Cd, Cu, Pb, Hg (tot), Mb, Se (tot), Bo, Zn.

(2) See Section 3.4 of the WY 2014 AHR (HydroGeo, 2015) for mine inflow sampling criteria.

3.0 ASSESSMENT OF MINE-INDUCED HYDROLOGIC IMPACTS IN WY 2019 AND ANTICIPATED IMPACTS IN WY 2020

3.1 SURFACE WATER

MCC maintains a network of 20 stream flow gauging stations, 3 pond stations, and eight temperature monitoring stations throughout the permit and lease areas (Table 3). Daily mean surface water flow summary tables are presented in Appendix A. Surface water flow hydrographs are presented in Appendix B and the field and laboratory surface water quality data are summarized in Appendix C. Tables and graphs of the Sylvester Gulch and North Fork temperature monitoring data are presented in Appendix I and Appendix J, respectively.

3.1.1 *IMPACTS TO AREA STREAM WATER QUALITY*

Surface water quality data are collected for permit-specified parameters at monitoring stations throughout the permit area, in order to detect potential impacts of mining activities to surface water resources. Potential impacts to water quality in area streams are determined by comparing recent water quality and flow data to baseline values while considering the effects of climatological factors, such as drought or high precipitation in areas near mining activity. Monitoring sites with values greater than 10 percent over comparable baseline maximums (or outside of 6.0-9.5 standard units for pH) are noted in the table below. Field pH values are used for comparison when they are available, as the holding time for lab pH is typically exceeded, due to the shipping time required for samples to reach the analytical lab. In general, water quality parameters that are above 10 percent over baseline maximums are likely due to natural variations in climate or flow conditions on the day the sample was collected. Impacts that appear to be directly linked to mining activities are noted. It should also be noted that baseline values are based on limited data and only give a general indication of seasonal variability. The surface water quality data for stream monitoring stations in WY 2019 are presented in Appendix C.

In WY 2019 none of the tested parameters were elevated 10 percent or more above maximum baseline values at the following surface water monitoring locations: Upper North Fork, Lower North Fork, Middle Sylvester Gulch, Lower Minnesota Creek, Lower Dry Fork, Upper Dry Fork, Lick Creek, East Gulch East of Horse Gulch, Upper and Lower Deep Creek, Deep Creek Ditch, and Minnesota Reservoir Flume. The Horse Gulch and Box Canyon sites were dry, so there are no water quality data for these sites in WY 2019. There are no baseline data for comparison for Upper Minnesota Creek (WWE, 2001). Baseline sampling and monitoring was conducted in WYs 2018 and 2019 at South Prong Creek, South Fork of South Prong Creek, North Fork of South Prong Creek, Stream ST-SW-1, and Ponds ST-P-1, ST-P-2, and ST-P-3.

Surface water monitoring sites where tested parameters were elevated 10 percent or more above maximum baseline values are summarized in Table 9. These exceedances are not likely mining related, since mining discharges have not and are not occurring in the vicinity of the monitoring sites. The elevated measurements are likely due to natural physical and or seasonal variations.

Table 9. Summary of Surface Water Quality Parameters Elevated 10 Percent or More above Baseline Maximum Values

Site Name	Sample Date	Parameter	Units	Result	Baseline Maximum
Upper Sylvester Gulch	5/7/2019	Conductivity (Field)	µmhos/cm	657	380
	6/20/2019			720	
	6/20/2019	Conductivity @25C	µmhos/cm	657	462
	6/20/2019	Residue, Filterable (TDS) @180C	mg/L	426	260
Lower Sylvester Gulch	5/2/2019	Conductivity (Field)	µmhos/cm	880	700
	6/18/2019			881	
	6/20/2019	Conductivity @25C	µmhos/cm	824	597
	6/20/2019	Residue, Filterable (TDS) @180C	mg/L	502	430
Deer Creek	6/20/2019	Conductivity (Field)	µmhos/cm	1,550 (1)	796
		Conductivity @25C	µmhos/cm	1,680 (1)	547
		Iron, Total	mg/L	143 (1)	2.92
		Residue, Filterable (TDS) @180C	mg/L	1,190 (1)	330
		Residue, Non-Filterable (TSS) @105C	mg/L	390 (1)	68
Poison Gulch	5/6/2019	Conductivity (Field)	µmhos/cm	533	479

(1) Suspect Data. On 6/20/2019 The Deer Creek site was muddy because of low flows and cattle activity.

3.1.2 IMPACTS TO AREA STREAM WATER QUANTITY

Stream flows at the monitoring sites for the Upper North Fork (USGS), Middle Sylvester Gulch, Lower Minnesota Creek, Upper Minnesota Creek Flume (USGS), Upper, Lower and Middle Dry Fork Flume, Lick Creek Flume, Deep Creek Ditch, Minnesota Reservoir Flume, and the South Prong Creek stations are measured with data loggers that collect data continuously. Stream flows of the other monitored streams (Upper and Lower Sylvester Gulch, Horse Gulch; East Gulch east of Horse Gulch, Upper and Lower Deep Creek. Box Canyon, Deer Creek, Poison Gulch, and ST-SW-1) are measured as instantaneous flow three times per year, corresponding with rising limb, peak flow, and low flow monitoring periods. No specific flow data are available for the Lower North Fork, although no mining related stream flow impacts are expected. Flow at Lower Sylvester Gulch is not measured, because of its close proximity to the Middle Sylvester Gulch Flume. Potential mining related impacts to stream flows are based on dramatic decreases or total loss of stream flow due to subsidence.

Based on the flow monitoring data through WY 2019 (Appendices A and B), there are no mining induced impacts to the water quantity of these streams.

3.2 SPRINGS AND SEEPS

MCC currently monitors 28 springs and seeps (Table 5). Hydrographs of the spring and seep flows are presented in Appendix D and spring and seep water quality data are presented in Appendix E.

3.2.1 IMPACTS TO SPRING AND SEEP WATER QUALITY

Spring water quality data are collected for permit-specified parameters at monitored springs and seeps throughout the permit area, in order to detect potential impacts of mining activities. Typically, underground coal mining does not impact spring water quality, but it can reduce or eliminate flows due to subsidence or dewatering.

Water quality data from WY 2019 do not indicate significant changes from baseline conditions for most of the monitored springs. However, some of the springs had elevated TDS/TSS, and/or conductivity values that were also noted in WYs 2004 through 2018. These elevated values are likely the result of physical and or seasonal variations and are not related to mining operations.

Potential mining impacts to area spring and seep water quality are determined by comparing current water quality data to maximum baseline values and climatological conditions such as drought or high precipitation periods at monitored sites hydraulically connected to areas with mining activities. Field pH values are used for comparison when they were available, as the holding time for the lab pH is typically exceeded due to the shipping time required for samples to reach the analytical lab. The discussion below includes monitoring locations where one or more parameters had values 10 percent or higher than comparable maximum (or outside of 6.0-9.5 standard units for pH) baseline values. Spring water quality parameters that are 10 percent or more above the baseline maximum are typically the result of natural variations in climate or flow conditions the day the sample was collected. It should also be noted that baseline values are based on limited data and only give a general indication of seasonal variability.

The following springs did not have any parameters elevated 10 percent or more over baseline maximums in WY 2019: Springs G-16, 35-3, WCC-24, Deep Creek Trail Spring, 96-2-2 Area Spring, J-10, 2012-2, 2012-3, and 2012-4. In WY 2019, Springs G-1A, G-20, Deep Creek Spring # 2, and 2012-1 were dry or did not have sufficient flow to collect a laboratory sample. There are no baseline water quality data for comparison for the following springs: 11-2, 10-1, and E10-2 (WWE, 2001; HydroGeo, 2015). Baseline sampling and monitoring was conducted in WYs 2018 and 2019 at Spring ST-S-1.

Several springs had one or more parameters that were 10 percent or higher in WY 2019 than the comparable maximum baseline value (Table 10).

Table 10. Summary of Spring and Seep Water Quality Parameters Elevated 10 Percent or More above Baseline Maximum Values

Site Name	Sample Date	Parameter	Units	Result	Baseline Maximum Value
Spring 26-1		Conductivity (Field)	µmhos/cm	883	640
Spring 27-1	5/7/2019	Conductivity (Field)	µmhos/cm	580	460
	6/20/2019			654	
	9/12/2019			861	
	6/20/2019	Conductivity @25C	µmhos/cm	606	437
	6/20/2019	Residue, Filterable (TDS) @180C	mg/L	378	300
Spring G-7	6/20/2019	Conductivity @25C	µmhos/cm	491	414
		Residue, Filterable (TDS) @180C	mg/L	316	230
Spring G-24	6/20/2019	Conductivity @25C	µmhos/cm	846	564
Spring G-14	6/20/2019	Conductivity @25C	µmhos/cm	1,050	682
Spring G-22	6/22/2019	Conductivity @25C	µmhos/cm	1,200	640
		Iron, Total	mg/L	1.17	0.2
		Residue, Filterable (TDS) @180C	mg/L	745	516
		Residue, Non-Filterable (TSS) @105C	mg/L	29	24
Spring 15-1	6/18/2019	Conductivity @25C	µmhos/cm	2,080	1,120
		Residue, Filterable (TDS) @180C	mg/L	1,450	730
Spring J-4	5/7/2019	Conductivity (Field)	µmhos/cm	573	480
	6/20/2019			637	
	6/20/2019	Conductivity @25C	µmhos/cm	593	429
		Residue, Filterable (TDS) @180C	mg/L	384	300
Deer Creek Spring	6/20/2019	Conductivity (Field)	µmhos/cm	1,158	889
		Conductivity @25C	µmhos/cm	1,080	660
		Iron, dissolved	mg/L	0.08	<0.02
		Iron, Total	mg/L	0.47	0.20
		Residue, Filterable (TDS) @180C	mg/L	682	360
		Residue, Non-Filterable (TSS) @105C	mg/L	21	14
Spring J-2	6/19/2019	Conductivity @25C	µmhos/cm	1,340	1,190
Spring ST-S-1	9/9/2019	Conductivity (Field)	µmhos/cm	764	596
Spring J-7	6/20/2019	Conductivity (Field)	µmhos/cm	813 (1)	496
	9/11/2019			964	
	6/20/2019	Iron, Total	mg/L	217 (1)	1.96
		Residue, Filterable (TDS) @180C	mg/L	880 (1)	270
		Residue, Non-Filterable (TSS) @105C	mg/L	7,720 (1)	24

(1) Suspect Data. On 6/20/2019 The Spring J-7 site was muddy because of low flows and cattle activity.

3.2.2 IMPACTS TO SPRING AND SEEP WATER QUANTITY

Routine (post-baseline) monitoring of spring and seep flow is conducted three times per year, corresponding with rising limb, peak flow, and low flow periods. As a result, spring and seep flows may be highly variable from year to year. However, subsidence associated with coal mining can reduce or eliminate spring flows, or alter spring locations due to stratigraphic changes.

The spring flow hydrographs are presented in Appendix D. In general, spring and seep flows in WY 2019 were generally below or near the range of historical averages due to regional long-term drought conditions. Some springs were above recent averages During the WY 2019 Rising Limb monitoring period due to above average springtime snowpack.

Springs G-1a, G-20, and Deep Creek Spring # 2 have been continuously dry or damp at the time of monitoring for multiple years including WY 2019 and may have been originally impacted by mining. Deer Creek Spring was dry in WYs 2017 and 2018, and recovered slightly in WY 2019. This spring is located above Longwall Panel E5 that was mined during the summer of 2015, and may have been impacted by mining, although long-term drought conditions have likely been a contributing factor.

3.3 GROUNDWATER

In WY 2019, MCC's groundwater monitoring program included 14 monitoring wells throughout the permit and lease areas. Field water quality and the depth to water are recorded three times annually, corresponding to the rising limb, peak flow, and low flow sampling rounds. The Lower and Upper Dry Fork Alluvial Wells are equipped with continuous water level loggers. Routine monitoring (post-baseline) includes collecting a sample for laboratory analysis one time per year during the low flow monitoring round. The well water elevation and depth to water data are presented in Appendix F and the groundwater quality data are presented in Appendix G.

3.3.1 IMPACTS TO GROUNDWATER QUALITY

Groundwater quality data are collected for permit-specified parameters at monitoring wells throughout the permit area, in order to detect potential impacts of mining activities to groundwater resources. Potential impacts to groundwater are determined by comparison to baseline values and consideration of climatic conditions. Field pH values were used for comparison when they were available, as the holding time for the lab pH is typically exceeded, due to the shipping time required for samples to reach the analytical lab. Overall, there were only minor notable water quality changes in a few of the groundwater monitoring wells during WY 2019 (Appendix G), these changes are likely the result of sediment in the wells, and not related to mining induced effects.

No water quality data are available for the following wells because they were dry or did not have enough water to collect samples during the low flow sampling period in WY 2019: GP-3, GP-4, RPE-1, RPE-7, and SOM-C76. Wells GP-6 and GP-7 do not have baseline data for comparison (WWE, 2001).

Lower Dry Fork Alluvial Well, and Well 01-11-1 did not have any parameters elevated 10 percent or more over baseline maximums in WY 2019. Wells where tested parameters were elevated 10 percent or more above maximum baseline values are summarized in Table 11.

Table 11. Summary of Well Water Quality Parameters Elevated 10 Percent or More above Baseline Maximum Values

Site Name	Sample Date	Parameter	Units	Result	Baseline Maximum Value
Upper Dry Fork Alluvial Well	9/11/2019	Conductivity @25C	µmhos/cm	812	509
		Residue, Filterable (TDS) @180C	mg/L	524	390
Well 03-11-1	9/10/2019	Conductivity @25C	µmhos/cm	3,090	2,730
Well SOM-80	9/12/2019	Conductivity @25C	µmhos/cm	1,070	897
Well SOM-45-H-1	5/7/2019	Conductivity (Field)	µmhos/cm	1,859	1,626
	6/20/2019			1,974	
	9/12/2019			1,980	
	9/12/2019	Conductivity @25C	µmhos/cm	1,900	1,390

3.3.2 *IMPACTS TO GROUNDWATER QUANTITY*

Routine (post-baseline) monitoring of groundwater levels in the monitoring wells is conducted three times per year, corresponding with rising limb, peak flow, and low flow periods. Groundwater level and elevation data for the monitoring wells for the period of record are summarized in Appendix F.

Mining operations appear to have impacted long-term groundwater levels in wells SOM 45-H-1, SOM C-76, and 03-11-1. Water levels likely have also been impacted by drought conditions in recent years. Wells GP-3, GP-4, and RPE-7 have been dry or nearly dry through the period of record due to the intentional up-gradient diversion of surface water runoff.

4.0 ADEQUACY OF THE MONITORING PROGRAM

MCC's hydrologic monitoring program operates in accordance with CDRMS Permit No. C-1980-007, as revised by Permit Revision Nos. PR-10 and PR-15, and Technical Revision No. TR-139. PR-10 included a revised comprehensive hydrologic monitoring plan for the entire permit area including the SOD mine plan area. PR-15 included the monitoring plan for the Sunset Trail mining area. The plan is presented in Exhibits 71 and 71A in the permit document (CDRMS, 2006; CDRMS 2016; CDRMS 2018).

4.1 MINING RELATED HYDROLOGIC IMPACTS

In WY 2019 the West Elk Mine hydrologic monitoring program was conducted in accordance with all permit requirements. The data collected in WY 2019 from sites in the current monitoring program were adequate to assess potential mine-induced impacts to the area's hydrologic system. These potential impacts are summarized in the previous sections.

During WY 2019, MCC operations were in compliance with Permit CO-0038776 limits (Section 4.6.1).

5.0 REFERENCES

Colorado Division of Reclamation, Mining and Safety (CDRMS), formerly CDMG.

2006 Approval of Permit Revision 10, SOD area, June 2006.

2016 West Elk Mine (Permit No. C-1980-007) Technical Revision No. 139, TR-139) Initial Adequacy Review, October 12, 2016.

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Hydrogeology Solutions, Inc. (HSI).

2018 Sunset Trail Lease Area Baseline Monitoring Recommendations Technical Memo. July 2018.

2018a West Elk Mine 2017 Surface Water and Groundwater Quantity and Quality Data Summary. June 2018.

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Wright Water Engineers, Inc. (WWE)

2001 2000 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. September 2001.

APPENDICES (Attached)

APPENDIX A

SURFACE WATER - FLOW DATA

Upper North Fork (USGS)
Daily Mean Discharge Values
(cubic feet per second)

Day	Oct-18	Q[1]	Nov-18	Q[1]	Dec-18	Q[1]	Jan-19	Q[1]	Feb-19	Q[1]	Mar-19	Q[1]	Apr-19	Q[1]	May-19	Q[1]	Jun-19	Q[1]	Jul-19	Q[1]	Aug-19	Q[1]	Sep-19	Q[1]
1	35.8	A	59.3	A	90.6	A:e	50.5	A:e	50.8	A:e	70.3	A:e	241.0	A	2500.0	A	1900.0	A	2580.0	A	374.0	A	236.0	A
2	48.5	A	57.4	A	60.8	A	52.9	A:e	54.2	A:e	78.5	A:e	271.0	A	2080.0	A	2200.0	A	2320.0	A	359.0	A	235.0	A
3	86.8	A	59.8	A	95.9	A	58.8	A:e	58.3	A:e	83.5	A:e	300.0	A	1910.0	A	2350.0	A	2160.0	A	330.0	A	242.0	A
4	81.1	A	55.2	A	47.2	A	68.9	A:e	61.9	A:e	77.6	A:e	322.0	A	1880.0	A	2410.0	A	1980.0	A	340.0	A	235.0	A
5	72.4	A	57.0	A	56.4	A:e	75.3	A:e	60.9	A:e	60.3	A:e	401.0	A	1910.0	A	2540.0	A	1800.0	A	376.0	A	234.0	A
6	73.4	A	51.1	A	55.8	A:e	70.0	A:e	56.0	A:e	74.9	A:e	464.0	A	2010.0	A	2750.0	A	1670.0	A	317.0	A	239.0	A
7	66.4	A	45.6	A	56.5	A:e	63.6	A:e	49.4	A:e	84.0	A:e	515.0	A	2130.0	A	2990.0	A	1560.0	A	291.0	A	235.0	A
8	66.6	A	44.4	A	52.7	A:e	59.0	A:e	42.5	A:e	91.3	A:e	635.0	A	2150.0	A	3180.0	A	1550.0	A	279.0	A	235.0	A
9	67.7	A	35.9	A	39.7	A:e	55.6	A:e	50.1	A:e	92.0	A:e	852.0	A	1980.0	A	3300.0	A	1460.0	A	268.0	A	233.0	A
10	75.6	A	60.8	A	28.7	A:e	54.1	A:e	51.6	A:e	84.2	A:e	919.0	A	1820.0	A	2920.0	A	1320.0	A	253.0	A	231.0	A
11	83.9	A	61.0	A	37.5	A:e	52.8	A:e	49.0	A:e	81.7	A:e	701.0	A	1750.0	A	2750.0	A	1270.0	A	259.0	A	235.0	A
12	77.5	A	60.2	A	46.4	A:e	51.8	A:e	50.9	A:e	103.0	A:e	537.0	A	1800.0	A	2770.0	A	1240.0	A	257.0	A	230.0	A
13	72.1	A	48.6	A	50.5	A:e	51.0	A:e	60.2	A:e	119.0	A:e	447.0	A	2000.0	A	3010.0	A	1210.0	A	233.0	A	229.0	A
14	71.2	A	70.1	A	44.9	A:e	49.8	A:e	69.9	A:e	102.0	A:e	416.0	A	2210.0	A	3310.0	A	1130.0	A	224.0	A	228.0	A
15	63.9	A	70.5	A	53.3	A:e	50.4	A:e	82.3	A:e	89.6	A	442.0	A	2350.0	A	3110.0	A	1110.0	A	229.0	A	230.0	A
16	61.9	A	70.1	A	57.0	A:e	52.4	A:e	78.7	A:e	90.9	A	534.0	A	2470.0	A	3080.0	A	1070.0	A	252.0	A	230.0	A
17	61.8	A	75.4	A	57.7	A:e	54.4	A:e	44.7	A:e	96.0	A	614.0	A	2500.0	A	3080.0	A	1000.0	A	275.0	A	226.0	A
18	59.3	A	55.9	A	58.0	A:e	55.3	A:e	59.4	A:e	113.0	A	784.0	A	2130.0	A	2790.0	A	886.0	A	267.0	A	224.0	A
19	59.6	A	54.8	A	57.5	A:e	54.7	A:e	57.7	A:e	128.0	A	1070.0	A	1870.0	A	2820.0	A	764.0	A	261.0	A	224.0	A
20	58.4	A	57.6	A	55.4	A:e	52.7	A:e	54.2	A:e	144.0	A	1280.0	A	1770.0	A	2860.0	A	716.0	A	256.0	A	225.0	A
21	58.3	A	54.6	A	54.3	A:e	50.6	A:e	51.9	A:e	164.0	A	1270.0	A	1690.0	A	2680.0	A	669.0	A	252.0	A	226.0	A
22	60.3	A	57.8	A:e	54.0	A:e	49.2	A:e	49.8	A:e	159.0	A	1350.0	A	1640.0	A	2560.0	A	620.0	A	249.0	A	227.0	A
23	66.0	A	60.5	A:e	54.9	A:e	50.9	A:e	46.7	A:e	149.0	A	1560.0	A	1640.0	A	2100.0	A	592.0	A	245.0	A	229.0	A
24	75.4	A	65.8	A:e	56.3	A:e	52.4	A:e	26.7	A:e	144.0	A	1720.0	A	1590.0	A	1660.0	A	558.0	A	241.0	A	227.0	A
25	71.8	A	46.4	A:e	57.8	A:e	52.6	A:e	24.7	A:e	143.0	A	1840.0	A	1600.0	A	1640.0	A	543.0	A	241.0	A	228.0	A
26	65.9	A	44.4	A:e	58.6	A:e	50.8	A:e	30.7	A:e	162.0	A	2030.0	A	1660.0	A	1830.0	A	486.0	A	241.0	A	228.0	A
27	62.3	A	49.8	A:e	55.3	A:e	48.9	A:e	37.6	A:e	214.0	A	2330.0	A	1700.0	A	2030.0	A	479.0	A	241.0	A	226.0	A
28	60.4	A	72.6	A:e	52.6	A:e	46.7	A:e	59.1	A:e	294.0	A	2350.0	A	1690.0	A	2220.0	A	508.0	A	246.0	A	229.0	A
29	59.8	A	97.5	A:e	51.3	A:e	44.6	A:e	--	--	324.0	A	2550.0	A	1650.0	A	2420.0	A	430.0	A	243.0	A	226.0	A
30	62.7	A	104.0	A:e	50.4	A:e	43.5	A:e	--	--	262.0	A	2900.0	A	1640.0	A	2450.0	A	404.0	A	241.0	A	228.0	A
31	64.5	A	--	--	49.9	A:e	45.0	A:e	--	--	243.0	A	--	--	1720.0	A	--	--	430.0	A	239.0	A	--	--
Mean	66.2	--	60.1	--	54.8	--	53.8	--	52.5	--	133.0	--	1054.8	--	1917.4	--	2590.3	--	1113.4	--	270.3	--	230.3	--
Min	35.8	--	35.9	--	28.7	--	43.5	--	24.7	--	60.3	--	241.0	--	1590.0	--	1640.0	--	404.0	--	224.0	--	224.0	--
Max	86.8	--	104.0	--	95.9	--	75.3	--	82.3	--	324.0	--	2900.0	--	2500.0	--	3310.0	--	2580.0	--	376.0	--	242.0	--

[1] USGS Qualifiers: A = Period of approved data, e = Estimated value

Lower Minnesota Creek
Discharge and Gage Height

Daily Mean Streamflow (cfs)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	1.3	2.0	3.7	3.0	3.3	3.1	2.8	116.0	102.0	128.0	23.0	15.0
2	1.3	2.4	6.3	5.7	3.0	3.1	3.0	82.0	111.0	136.0	22.0	14.0
3	1.5	2.2	6.6	2.7	2.8	3.7	3.1	56.0	120.0	133.0	21.0	13.0
4	1.6	2.2	6.3	2.2	2.8	3.5	3.1	44.0	131.0	123.0	21.0	12.0
5	1.8	2.7	9.6	1.9	2.7	3.5	3.5	40.0	144.0	109.0	21.0	13.0
6	1.9	2.7	7.2	1.8	2.5	3.3	3.9	40.0	159.0	96.0	21.0	13.0
7	2.0	2.1	6.0	1.4	5.5	3.5	4.1	41.0	174.0	80.0	21.0	13.0
8	2.1	1.6	4.7	1.3	5.7	4.1	4.7	43.0	181.0	70.0	21.0	12.0
9	2.2	2.7	3.3	1.3	4.3	4.1	5.2	45.0	191.0	63.0	19.0	12.0
10	2.2	2.1	9.6	1.2	3.9	4.1	5.7	43.0	194.0	57.0	19.0	12.0
11	2.4	2.7	7.8	1.2	3.5	3.9	5.5	40.0	198.0	49.0	18.0	13.0
12	2.8	3.5	7.5	1.1	3.1	3.7	4.5	38.0	191.0	42.0	18.0	12.0
13	2.7	3.3	6.6	1.1	3.0	3.9	3.3	41.0	187.0	40.0	17.0	12.0
14	2.7	4.5	8.1	2.2	2.7	4.1	3.0	52.0	177.0	39.0	17.0	12.0
15	2.7	4.7	6.3	2.7	2.7	4.1	3.0	68.0	171.0	39.0	17.0	12.0
16	2.7	3.7	10.0	2.4	2.7	4.1	3.3	82.0	165.0	37.0	16.0	12.0
17	2.5	2.8	6.3	2.1	4.5	4.1	4.1	98.0	153.0	34.0	16.0	10.0
18	2.5	3.0	5.0	1.9	5.0	4.1	5.0	106.0	144.0	30.0	15.0	10.0
19	2.7	3.3	4.1	1.6	3.9	4.3	6.3	106.0	139.0	28.0	15.0	9.6
20	3.1	5.7	6.0	1.5	4.1	4.5	8.1	98.0	133.0	27.0	15.0	9.2
21	3.5	7.5	7.2	1.4	3.7	4.5	8.1	91.0	133.0	26.0	15.0	8.9
22	3.5	6.0	4.7	1.3	3.1	4.3	8.1	87.0	131.0	25.0	15.0	8.5
23	3.5	5.5	7.5	1.3	2.8	4.3	8.9	84.0	133.0	24.0	15.0	7.8
24	3.9	3.7	4.7	1.3	5.7	4.3	10.0	84.0	123.0	24.0	15.0	6.6
25	1.8	3.9	4.1	1.4	4.3	4.3	11.0	80.0	113.0	26.0	15.0	6.0
26	1.4	5.5	3.5	3.1	5.0	4.7	13.0	84.0	106.0	25.0	15.0	5.2
27	1.6	8.9	3.1	4.5	3.9	4.5	16.0	89.0	102.0	25.0	14.0	4.7
28	1.6	6.9	2.8	4.3	3.3	4.3	22.0	104.0	102.0	25.0	18.0	4.3
29	2.7	5.0	2.8	7.2	--	3.5	32.0	111.0	106.0	25.0	17.0	3.7
30	2.4	4.1	7.5	4.5	--	3.0	168.0	106.0	113.0	24.0	15.0	3.3
31	1.6	--	2.5	3.7	--	3.0	--	102.0	--	23.0	16.0	--
Mean	2.3	3.9	6.0	2.4	3.7	4.0	12.7	73.3	144.2	52.6	17.5	10.0
Min	1.3	1.6	2.8	1.1	2.5	3.0	2.8	38.0	102.0	23.0	14.0	3.3
Max	3.9	8.9	10.0	7.2	5.7	4.7	168.0	116.0	198.0	136.0	23.0	15.0

Measured Streamflow

Date	Streamflow (cfs)
10/18/2018	2.7
11/19/2018	3.0
12/30/2018	**3.0**
1/25/2019	**1.9**
2/15/2019	**2.7**
3/27/2019	3.0
5/1/2019	98.0
5/29/2019	111.0
6/17/2019	153.0
7/29/2019	24.0
8/14/2019	17.0
9/9/2019	16.0

0.01 Stream Ice Affected or Frozen.

Upper Minnesota Creek (USFS)
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	1.68	1.91	2.27	2.09	1.97	2.39	3.66	ND	40.15	42.72	15.95	18.84
2	1.87	1.91	4.06	6.58	1.95	2.39	4.26	ND	42.12	41.46	15.93	19.11
3	1.95	1.91	2.27	10.32	1.94	2.46	4.77	ND	43.90	39.61	15.19	22.51
4	1.91	1.91	2.24	7.99	2.08	2.48	4.75	ND	45.52	37.86	15.70	22.51
5	1.93	1.91	2.34	6.54	2.20	2.40	6.13	ND	46.87	35.89	15.66	22.24
6	1.93	1.91	2.27	1.83	2.27	2.41	6.90	ND	47.03	33.29	14.63	21.96
7	1.91	1.98	2.27	1.91	2.27	2.82	7.66	ND	46.03	30.78	14.57	21.79
8	1.91	2.39	2.27	1.91	2.27	2.52	8.17	29.35	46.44	30.30	14.02	21.60
9	1.91	3.41	2.27	1.88	2.27	2.52	8.69	29.10	48.76	29.89	10.52	21.13
10	1.96	3.06	2.92	1.89	2.27	2.47	9.15	27.02	47.64	27.36	9.99	21.03
11	1.94	2.32	2.27	1.91	2.26	2.49	6.47	25.75	46.53	25.04	9.82	20.83
12	1.91	2.84	2.56	1.91	2.19	2.44	4.88	26.69	46.83	25.29	9.14	20.27
13	1.91	4.10	2.32	1.86	2.15	2.52	4.14	31.46	46.08	25.20	8.08	20.08
14	1.91	2.27	2.27	1.88	2.15	2.65	3.76	35.16	46.45	25.10	10.80	20.00
15	1.91	2.27	2.27	1.83	2.21	2.91	4.43	36.66	45.65	24.77	15.10	19.55
16	1.91	2.27	2.23	1.80	2.27	3.03	6.30	38.73	43.44	22.93	14.81	19.18
17	1.91	2.33	2.16	1.80	4.65	2.60	7.34	41.88	42.99	21.01	14.46	18.66
18	1.82	2.27	2.15	1.80	2.39	2.52	8.27	42.99	42.78	19.73	16.30	18.00
19	1.95	2.56	2.15	1.80	2.39	2.49	10.61	39.26	42.04	18.50	18.67	17.31
20	2.10	3.38	2.15	1.80	2.39	2.60	12.18	38.89	42.76	18.95	18.42	17.11
21	2.12	4.89	2.15	1.80	2.37	2.49	11.46	37.79	42.13	17.96	18.25	16.55
22	2.08	5.02	2.15	1.80	2.34	2.45	12.35	36.59	42.42	17.45	18.10	15.01
23	2.04	2.25	2.15	4.19	2.27	2.39	13.90	37.38	39.86	19.43	17.90	8.58
24	2.03	2.25	2.15	2.03	4.21	2.39	15.79	35.74	38.56	20.49	17.64	8.43
25	2.03	2.23	2.15	2.03	2.39	2.75	17.37	36.13	37.92	19.35	17.24	8.18
26	2.03	5.22	2.15	2.02	2.39	3.34	20.68	37.76	37.59	17.78	16.84	8.03
27	2.03	6.54	2.15	2.03	2.37	4.89	25.10	39.92	37.48	18.29	16.55	8.26
28	2.03	2.27	2.04	2.03	2.39	6.45	27.90	41.49	38.43	18.93	16.12	8.02
29	2.03	2.27	2.03	2.02	--	4.77	31.53	40.83	39.80	16.49	16.95	7.74
30	2.03	2.27	2.03	2.00	--	3.68	ND	39.60	41.00	16.56	19.60	7.72
31	2.00	--	2.03	1.99	--	3.49	--	39.32	--	16.57	19.23	--
Mean	1.96	2.80	2.28	2.75	2.40	2.91	10.64	36.06	43.17	25.00	15.23	16.68
Min	1.68	1.91	2.03	1.80	1.94	2.39	3.66	25.75	37.48	16.49	8.08	7.72
Max	2.12	6.54	4.06	10.32	4.65	6.45	31.53	42.99	48.76	42.72	19.60	22.51

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	1.80
11/19/2018	**2.15**
12/30/2018	**1.80**
1/25/2019	**1.68**
2/15/2019	**2.39**
3/27/2019	3.33
5/7/2019	40.45
5/29/2019	47.76
6/19/2019	47.76
7/29/2019	17.02
8/14/2019	9.53
9/9/2019	21.33

0.01 Flume Ice Affected or Frozen.
ND No Data. Flume Obstructed by Logjam.
Note: When height of water in flume is above 1.57 feet (32.60 cfs), bypass spillways overflow and flow through flume is less than total flow in stream.

Middle Sylvester Gulch
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.00	ND	ND	ND	ND	ND	0.53	1.15	0.22	0.26	0.00	0.00
2	0.00	ND	ND	ND	ND	ND	0.50	1.03	0.32	0.21	0.00	0.00
3	0.00	ND	ND	ND	ND	ND	0.64	0.90	0.35	0.22	0.00	0.00
4	0.34	ND	ND	ND	ND	ND	0.77	0.50	0.45	0.47	0.00	0.00
5	0.28	ND	ND	ND	ND	ND	0.71	0.34	0.33	0.65	0.00	0.00
6	0.10	ND	ND	ND	ND	ND	0.77	0.29	0.27	0.52	0.00	0.00
7	0.07	ND	ND	ND	ND	ND	0.63	0.23	0.18	0.31	0.00	0.00
8	0.05	ND	ND	ND	ND	ND	0.65	0.72	0.28	0.27	0.00	0.00
9	0.04	ND	ND	ND	ND	ND	0.60	1.01	1.24	0.63	0.00	0.00
10	0.07	ND	ND	ND	ND	ND	1.22	0.89	0.72	0.60	0.00	0.00
11	0.11	ND	ND	ND	ND	ND	1.18	0.74	0.48	0.40	0.00	0.00
12	0.05	ND	ND	ND	ND	ND	0.72	0.51	0.29	0.27	0.00	0.00
13	0.03	ND	ND	ND	ND	ND	0.68	0.48	0.18	0.28	0.00	0.00
14	0.02	ND	ND	ND	ND	ND	0.47	0.50	0.13	0.30	0.00	0.00
15	0.01	ND	ND	ND	ND	ND	0.44	0.36	0.30	0.25	0.00	0.00
16	0.00	ND	ND	ND	ND	ND	0.48	0.13	0.29	0.18	0.00	0.00
17	0.00	ND	ND	ND	ND	ND	0.67	0.62	0.36	0.16	0.00	0.00
18	0.00	ND	ND	ND	ND	ND	0.99	0.57	0.35	0.14	0.00	0.00
19	ND	ND	ND	ND	ND	ND	1.03	0.59	0.33	0.13	0.00	0.00
20	ND	ND	ND	ND	ND	ND	0.91	0.38	0.18	0.16	0.00	0.00
21	ND	ND	ND	ND	ND	ND	0.94	0.58	0.21	0.12	0.00	0.00
22	ND	ND	ND	ND	ND	ND	1.07	0.49	1.31	0.09	0.00	0.00
23	ND	ND	ND	ND	ND	ND	1.21	1.50	1.15	0.08	0.00	0.00
24	ND	ND	ND	ND	ND	ND	1.37	1.16	0.48	0.04	0.00	0.00
25	ND	ND	ND	ND	ND	ND	1.45	0.46	0.28	0.00	0.00	0.00
26	ND	ND	ND	ND	ND	ND	1.63	0.27	0.30	0.00	0.00	0.00
27	ND	ND	ND	ND	ND	ND	0.84	0.37	0.40	0.00	0.00	0.00
28	ND	ND	ND	ND	ND	0.58	0.61	0.73	0.39	0.00	0.00	0.00
29	ND	ND	ND	ND	--	0.75	0.81	0.61	0.25	0.00	0.00	0.00
30	ND	ND	ND	ND	--	0.69	0.95	0.59	0.37	0.00	0.00	0.00
31	ND	--	ND	ND	--	0.44	--	0.44	--	0.00	0.00	--
Mean	0.06	ND	ND	ND	ND	0.61	0.85	0.62	0.41	0.22	0.00	0.00
Min	0.00	ND	ND	ND	ND	0.44	0.44	0.13	0.13	0.00	0.00	0.00
Max	0.34	ND	ND	ND	ND	0.75	1.63	1.50	1.31	0.65	0.00	0.00

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.000
11/19/2018	0.000
12/30/2018	**0.000**
1/25/2019	**0.000**
2/15/2019	**0.001**
3/27/2019	0.576
5/2/2019	0.954
5/29/2019	0.608
6/18/2019	0.345
7/29/2019	0.000
8/14/2019	0.000
9/10/2019	0.000

0.01 Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.
Note: Water Level in flume below 0.02 feet not connected to stilling well.

Lower Dry Fork
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	. . .	ND	ND	ND	ND	ND	. . .	1.05	3.20	1.35	4.05	1.91
2	. . .	ND	ND	ND	ND	ND	. . .	0.48	3.70	2.61	4.19	1.87
3	0.53	ND	ND	ND	ND	ND	. . .	. . .	3.99	3.25	4.02	1.63
4	. . .	ND	ND	ND	ND	ND	. . .	. . .	3.54	3.27	4.76	1.56
5	. . .	ND	ND	ND	ND	ND	. . .	. . .	3.31	3.04	5.12	1.47
6	. . .	ND	ND	ND	ND	ND	. . .	. . .	3.15	2.90	5.44	1.54
7	. . .	ND	ND	ND	ND	ND	. . .	. . .	3.09	3.01	7.23	1.49
8	0.37	ND	ND	ND	ND	ND	. . .	. . .	2.90	3.18	7.38	1.60
9	. . .	ND	ND	ND	ND	ND	. . .	. . .	2.63	2.92	7.72	1.47
10	. . .	ND	ND	ND	ND	ND	. . .	. . .	2.31	2.73	9.75	1.70
11	0.76	ND	ND	ND	ND	ND	. . .	. . .	2.05	2.71	10.70	1.48
12	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.92	2.75	11.24	1.31
13	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.79	4.02	11.42	1.28
14	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.73	4.65	12.68	1.22
15	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.67	4.56	12.65	1.30
16	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.58	4.98	12.55	1.18
17	. . .	ND	ND	ND	ND	ND	. . .	. . .	1.54	5.18	12.60	1.19
18	. . .	ND	ND	ND	ND	ND	. . .	0.36	1.57	4.82	12.39	1.06
19	ND	ND	ND	ND	ND	ND	. . .	. . .	1.70	4.72	12.09	1.03
20	ND	ND	ND	ND	ND	ND	. . .	0.36	1.49	4.99	11.81	0.88
21	ND	ND	ND	ND	ND	ND	. . .	3.93	1.37	5.09	11.62	1.00
22	ND	ND	ND	ND	ND	ND	. . .	4.61	1.56	4.56	11.49	1.06
23	ND	ND	ND	ND	ND	ND	. . .	3.10	1.70	4.42	11.13	1.11
24	ND	ND	ND	ND	ND	ND	. . .	2.69	1.68	5.01	10.74	1.04
25	ND	ND	ND	ND	ND	ND	. . .	2.37	1.45	4.02	10.33	0.98
26	ND	ND	ND	ND	ND	ND	. . .	2.45	1.29	3.22	9.94	1.01
27	ND	ND	ND	ND	ND	ND	. . .	2.89	1.13	2.60	9.59	0.99
28	ND	ND	ND	ND	ND	. . .	. . .	3.63	1.02	2.34	9.06	0.99
29	ND	ND	ND	ND	--	. . .	0.35	3.25	0.97	2.42	8.54	0.83
30	ND	ND	ND	ND	--	. . .	1.46	2.99	0.97	3.53	5.57	0.92
31	ND	--	ND	ND	--	. . .	--	2.83	--	3.85	2.04	--
Mean	0.55	ND	ND	ND	ND	ND	0.90	2.47	2.07	3.64	9.03	1.27
Min	0.37	ND	ND	ND	ND	ND	0.35	0.36	0.97	1.35	2.04	0.83
Max	0.76	ND	ND	ND	ND	ND	1.46	4.61	3.99	5.18	12.68	1.91

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.23
11/19/2018	0.23
12/30/2018	**0.00**
1/25/2019	**0.00**
2/15/2019	**0.01**
3/27/2019	0.07
5/1/2019	0.94
5/29/2019	3.50
6/20/2019	1.37
7/28/2019	3.29
8/14/2019	12.43
9/9/2019	1.69

0.01 - Flume Ice Affected or Frozen.
ND - No Data. Data Logger Removed for Winter.
. . . - Indicates daily average flow less than 0.28 cfs. Stilling well inlet is 0.10 feet above flume bottom, and data logger does not record flows between 0.00 (dry) and 0.28 cfs.

Middle Dry Fork
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.40	ND	ND	ND	ND	ND	ND	ND	4.02	3.49	4.12	2.61
2	0.59	ND	ND	ND	ND	ND	ND	7.06	4.27	3.42	4.08	2.56
3	0.58	ND	ND	ND	ND	ND	ND	6.34	3.97	3.34	4.44	2.53
4	0.54	ND	ND	ND	ND	ND	ND	6.35	3.78	3.27	4.98	2.49
5	0.56	ND	ND	ND	ND	ND	ND	6.91	3.68	3.20	4.90	2.45
6	0.57	ND	ND	ND	ND	ND	ND	7.44	3.64	3.20	4.26	2.43
7	0.50	ND	ND	ND	ND	ND	ND	7.79	3.48	3.23	4.30	2.44
8	0.51	ND	ND	ND	ND	ND	ND	7.88	3.15	3.21	4.74	2.42
9	0.51	ND	ND	ND	ND	ND	ND	6.90	2.94	3.06	4.11	2.37
10	0.63	ND	ND	ND	ND	ND	ND	5.84	2.73	3.08	3.95	2.34
11	0.72	ND	ND	ND	ND	ND	ND	5.46	2.53	2.95	4.01	2.18
12	0.59	ND	ND	ND	ND	ND	ND	6.17	2.41	3.55	3.86	1.78
13	0.54	ND	ND	ND	ND	ND	ND	7.53	2.37	4.17	3.68	1.75
14	0.57	ND	ND	ND	ND	ND	ND	8.95	2.33	4.05	3.53	1.72
15	0.49	ND	ND	ND	ND	ND	ND	9.37	2.31	3.94	3.86	1.72
16	0.51	ND	ND	ND	ND	ND	ND	9.04	2.26	4.56	3.39	1.72
17	0.52	ND	ND	ND	ND	ND	ND	8.24	2.19	4.37	3.21	1.73
18	0.51	ND	ND	ND	ND	ND	ND	7.49	2.29	4.17	3.15	1.68
19	ND	ND	ND	ND	ND	ND	ND	6.74	2.22	4.23	3.07	1.63
20	ND	ND	ND	ND	ND	ND	ND	6.50	1.82	4.81	3.06	1.60
21	ND	ND	ND	ND	ND	ND	ND	6.21	1.59	4.14	3.00	1.58
22	ND	ND	ND	ND	ND	ND	ND	4.71	1.99	3.85	3.01	1.58
23	ND	ND	ND	ND	ND	ND	ND	3.95	1.76	3.77	2.96	1.57
24	ND	ND	ND	ND	ND	ND	ND	4.02	1.55	3.91	2.93	1.57
25	ND	ND	ND	ND	ND	ND	ND	4.25	1.42	3.80	2.88	1.56
26	ND	ND	ND	ND	ND	ND	ND	4.66	1.27	3.70	2.80	1.51
27	ND	ND	ND	ND	ND	ND	ND	4.91	1.17	3.70	2.72	1.51
28	ND	ND	ND	ND	ND	ND	ND	5.04	1.11	3.77	2.72	1.50
29	ND	ND	ND	ND	--	ND	ND	4.09	1.08	3.71	2.72	1.48
30	ND	ND	ND	ND	--	ND	ND	3.44	1.38	4.28	2.69	1.46
31	ND	--	ND	ND	--	ND	--	3.61	--	4.40	2.66	--
Mean	0.55	ND	ND	ND	ND	ND	ND	6.23	2.42	3.75	3.54	1.92
Min	0.40	ND	ND	ND	ND	ND	ND	3.44	1.08	2.95	2.66	1.46
Max	0.72	ND	ND	ND	ND	ND	ND	9.37	4.27	4.81	4.98	2.61

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.57
11/19/2018	**0.42**
5/1/2019	8.49
5/29/2019	3.50
6/20/2019	1.78
7/29/2019	4.16
8/14/2019	3.50
9/11/2019	1.78

0.01 Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.

Upper Dry Fork
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	1.24	ND	ND	ND	ND	ND	ND	ND	3.31	5.33	5.17	2.55
2	1.53	ND	ND	ND	ND	ND	ND	ND	3.64	4.94	5.10	2.45
3	1.47	ND	ND	ND	ND	ND	ND	ND	3.26	4.83	5.86	2.44
4	1.42	ND	ND	ND	ND	ND	ND	ND	3.06	4.69	6.43	2.39
5	1.49	ND	ND	ND	ND	ND	ND	ND	2.94	4.52	5.99	2.33
6	1.46	ND	ND	ND	ND	ND	ND	ND	2.98	4.51	5.03	2.25
7	1.32	ND	ND	ND	ND	ND	ND	6.56	2.97	4.55	5.75	2.25
8	1.41	ND	ND	ND	ND	ND	ND	6.21	2.74	4.43	6.00	2.27
9	1.39	ND	ND	ND	ND	ND	ND	4.76	2.49	4.16	5.17	2.17
10	1.60	ND	ND	ND	ND	ND	ND	3.83	2.09	4.20	4.91	2.12
11	1.75	ND	ND	ND	ND	ND	ND	3.68	1.89	4.02	4.99	2.12
12	1.51	ND	ND	ND	ND	ND	ND	4.84	1.72	5.34	4.70	2.16
13	1.45	ND	ND	ND	ND	ND	ND	7.13	1.65	6.29	4.39	2.09
14	1.47	ND	ND	ND	ND	ND	ND	9.59	1.62	6.05	4.22	2.02
15	1.02	ND	ND	ND	ND	ND	ND	9.94	1.56	6.06	4.85	1.99
16	1.14	ND	ND	ND	ND	ND	ND	9.18	1.47	7.06	3.81	1.96
17	1.39	ND	ND	ND	ND	ND	ND	7.54	1.53	6.64	3.56	1.83
18	1.38	ND	ND	ND	ND	ND	ND	5.73	2.14	6.33	3.46	1.88
19	ND	ND	ND	ND	ND	ND	ND	5.06	2.10	6.46	3.33	1.82
20	ND	ND	ND	ND	ND	ND	ND	4.62	1.82	7.32	3.27	1.77
21	ND	ND	ND	ND	ND	ND	ND	4.11	1.74	6.04	3.16	1.76
22	ND	ND	ND	ND	ND	ND	ND	1.95	2.30	5.73	3.13	1.71
23	ND	ND	ND	ND	ND	ND	ND	1.13	1.90	5.67	3.10	1.69
24	ND	ND	ND	ND	ND	ND	ND	1.20	1.64	5.74	3.14	1.68
25	ND	ND	ND	ND	ND	ND	ND	1.67	1.42	5.76	3.10	1.67
26	ND	ND	ND	ND	ND	ND	ND	2.27	1.22	5.66	2.92	1.61
27	ND	ND	ND	ND	ND	ND	ND	2.57	1.05	5.66	2.83	1.58
28	ND	ND	ND	ND	ND	ND	ND	2.46	0.96	5.79	2.82	1.55
29	ND	ND	ND	ND	--	ND	ND	2.26	0.88	5.13	2.77	1.51
30	ND	ND	ND	ND	--	ND	ND	2.24	1.72	5.38	2.71	1.46
31	ND	--	ND	ND	--	ND	--	2.68	--	5.44	2.65	--
Mean	1.41	ND	ND	ND	ND	ND	ND	4.53	2.06	5.48	4.14	1.97
Min	1.02	ND	ND	ND	ND	ND	ND	1.13	0.88	4.02	2.65	1.46
Max	1.75	ND	ND	ND	ND	ND	ND	9.94	3.64	7.32	6.43	2.55

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	1.30
5/6/2019	5.23
6/17/2019	2.12
7/29/2019	4.99
8/14/2019	4.05
9/11/2019	2.30

0.01 Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.

Lick Creek
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.00	ND	ND	ND	ND	ND	ND	ND	2.07	0.41	0.01	0.00
2	0.00	ND	ND	ND	ND	ND	ND	ND	2.30	0.34	0.01	0.00
3	0.00	ND	ND	ND	ND	ND	ND	ND	2.27	0.32	0.01	0.00
4	0.00	ND	ND	ND	ND	ND	ND	ND	2.20	0.28	0.01	0.00
5	0.00	ND	ND	ND	ND	ND	ND	ND	2.22	0.26	0.01	0.00
6	0.00	ND	ND	ND	ND	ND	ND	ND	2.40	0.25	0.01	0.00
7	0.00	ND	ND	ND	ND	ND	ND	ND	2.52	0.26	0.00	0.00
8	0.00	ND	ND	ND	ND	ND	ND	ND	2.50	0.25	0.00	0.00
9	0.00	ND	ND	ND	ND	ND	ND	1.13	2.27	0.20	0.00	0.00
10	0.00	ND	ND	ND	ND	ND	ND	1.01	1.95	0.18	0.00	0.00
11	0.00	ND	ND	ND	ND	ND	ND	0.95	1.86	0.17	0.00	0.00
12	0.00	ND	ND	ND	ND	ND	ND	0.98	1.79	0.17	0.00	0.00
13	0.00	ND	ND	ND	ND	ND	ND	1.15	1.68	0.13	0.00	0.00
14	0.00	ND	ND	ND	ND	ND	ND	1.51	1.55	0.01	0.00	0.00
15	0.00	ND	ND	ND	ND	ND	ND	1.81	1.37	0.01	0.00	0.00
16	0.00	ND	ND	ND	ND	ND	ND	1.96	1.24	0.01	0.00	0.00
17	0.00	ND	ND	ND	ND	ND	ND	1.92	1.11	0.01	0.00	0.00
18	ND	ND	ND	ND	ND	ND	ND	1.73	1.07	0.01	0.00	0.00
19	ND	ND	ND	ND	ND	ND	ND	1.50	1.03	0.01	0.00	0.00
20	ND	ND	ND	ND	ND	ND	ND	1.51	0.88	0.00	0.00	0.00
21	ND	ND	ND	ND	ND	ND	ND	1.43	0.77	0.00	0.00	0.00
22	ND	ND	ND	ND	ND	ND	ND	1.38	0.87	0.00	0.00	0.00
23	ND	ND	ND	ND	ND	ND	ND	1.45	0.74	0.00	0.00	0.00
24	ND	ND	ND	ND	ND	ND	ND	1.45	0.63	0.02	0.00	0.00
25	ND	ND	ND	ND	ND	ND	ND	1.51	0.51	0.02	0.00	0.00
26	ND	ND	ND	ND	ND	ND	ND	1.63	0.49	0.01	0.00	0.00
27	ND	ND	ND	ND	ND	ND	ND	1.74	0.44	0.02	0.00	0.00
28	ND	ND	ND	ND	ND	ND	ND	1.79	0.38	0.04	0.00	0.00
29	ND	ND	ND	ND	--	ND	ND	1.72	0.36	0.01	0.00	0.00
30	ND	ND	ND	ND	--	ND	ND	1.72	0.38	0.01	0.00	0.00
31	ND	--	ND	ND	--	ND	--	1.83	--	0.01	0.00	--
Mean	0.00	ND	ND	ND	ND	ND	ND	1.50	1.39	0.11	0.00	0.00
Min	0.00	ND	ND	ND	ND	ND	ND	0.95	0.36	0.00	0.00	0.00
Max	0.00	ND	ND	ND	ND	ND	ND	1.96	2.52	0.41	0.01	0.00

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.00
5/8/2019	1.52
6/19/2019	1.04
7/30/2019	0.01
8/14/2019	0.00
9/9/2019	0.00

ND - No Data. Data Logger Removed for Winter.
Note: - Water Level below 0.02 feet not connected to stilling well. Flows below 0.02 cfs are approximate.

Deep Creek Ditch
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.17	ND	ND	ND	ND	ND	ND	ND	0.49	0.55	0.90	0.69
2	0.20	ND	ND	ND	ND	ND	ND	ND	0.47	0.62	0.91	0.68
3	0.20	ND	ND	ND	ND	ND	ND	ND	0.46	0.54	0.88	0.68
4	0.18	ND	ND	ND	ND	ND	ND	ND	0.48	0.54	0.58	0.68
5	0.20	ND	ND	ND	ND	ND	ND	ND	0.48	0.53	0.41	0.68
6	0.19	ND	ND	ND	ND	ND	ND	ND	0.49	0.55	0.44	0.69
7	0.18	ND	ND	ND	ND	ND	ND	0.86	0.48	0.52	0.37	0.69
8	0.19	ND	ND	ND	ND	ND	ND	0.67	0.48	0.54	0.44	0.68
9	0.19	ND	ND	ND	ND	ND	ND	0.75	0.47	0.57	0.43	0.69
10	0.20	ND	ND	ND	ND	ND	ND	0.81	0.44	0.55	0.44	0.69
11	0.22	ND	ND	ND	ND	ND	ND	0.73	0.42	0.57	0.45	0.59
12	0.20	ND	ND	ND	ND	ND	ND	0.69	0.37	0.51	0.43	0.53
13	0.19	ND	ND	ND	ND	ND	ND	0.57	0.35	0.51	0.46	0.52
14	0.20	ND	ND	ND	ND	ND	ND	0.56	0.34	0.48	0.52	0.54
15	0.37	ND	ND	ND	ND	ND	ND	0.63	0.33	0.48	0.75	0.54
16	0.18	ND	ND	ND	ND	ND	ND	0.63	0.32	0.35	0.73	0.54
17	0.20	ND	ND	ND	ND	ND	ND	0.59	0.33	0.40	0.72	0.53
18	0.20	ND	ND	ND	ND	ND	ND	0.56	0.44	0.45	0.74	0.52
19	ND	ND	ND	ND	ND	ND	ND	0.50	0.44	0.47	0.74	0.52
20	ND	ND	ND	ND	ND	ND	ND	0.46	0.39	0.87	0.75	0.52
21	ND	ND	ND	ND	ND	ND	ND	0.49	0.37	1.19	0.73	0.52
22	ND	ND	ND	ND	ND	ND	ND	0.28	0.45	1.18	0.77	0.52
23	ND	ND	ND	ND	ND	ND	ND	0.20	0.39	1.11	0.74	0.52
24	ND	ND	ND	ND	ND	ND	ND	0.21	0.35	1.16	0.74	0.52
25	ND	ND	ND	ND	ND	ND	ND	0.31	0.32	1.16	0.75	0.52
26	ND	ND	ND	ND	ND	ND	ND	0.38	0.28	1.18	0.73	0.51
27	ND	ND	ND	ND	ND	ND	ND	0.45	0.26	1.17	0.72	0.50
28	ND	ND	ND	ND	ND	ND	ND	0.46	0.24	1.15	0.73	0.50
29	ND	ND	ND	ND	--	ND	ND	0.43	0.24	1.05	0.72	0.49
30	ND	ND	ND	ND	--	ND	ND	0.44	0.36	0.95	0.70	0.47
31	ND	--	ND	ND	--	ND	--	0.47	--	0.96	0.68	--
Mean	0.20	ND	ND	ND	ND	ND	ND	0.53	0.39	0.74	0.65	0.58
Min	0.17	ND	ND	ND	ND	ND	ND	0.20	0.24	0.35	0.37	0.47
Max	0.37	ND	ND	ND	ND	ND	ND	0.86	0.49	1.19	0.91	0.69

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.22
5/6/2019	1.21
6/17/2019	0.46
7/29/2019	1.08
8/14/2019	0.83
9/11/2019	0.55

0.01 Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.

Minnesota Reservoir Flume
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.28	ND	ND	ND	ND	ND	ND	9.83	4.27	5.19	4.23	0.58
2	0.45	ND	ND	ND	ND	ND	ND	6.77	4.97	4.96	4.05	0.47
3	0.56	ND	ND	ND	ND	ND	ND	5.01	4.56	4.88	4.50	0.50
4	0.42	ND	ND	ND	ND	ND	ND	3.97	3.95	4.70	5.68	0.45
5	0.44	ND	ND	ND	ND	ND	ND	4.43	3.79	4.50	5.59	0.38
6	0.49	ND	ND	ND	ND	ND	ND	5.40	3.69	4.46	4.32	0.38
7	0.38	ND	ND	ND	ND	ND	ND	5.62	3.73	4.61	4.06	0.36
8	0.76	ND	ND	ND	ND	ND	ND	6.28	3.50	4.64	5.33	0.33
9	0.38	ND	ND	ND	ND	ND	ND	5.06	3.21	4.14	4.04	0.32
10	0.51	ND	ND	ND	ND	ND	ND	3.52	2.64	4.03	3.61	. . .
11	0.77	ND	ND	ND	ND	ND	ND	2.93	2.22	3.78	3.87	0.38
12	0.58	ND	ND	ND	ND	ND	ND	3.57	1.99	4.98	3.54	0.78
13	0.39	ND	ND	ND	ND	ND	ND	5.39	1.78	6.98	3.13	1.03
14	0.38	ND	ND	ND	ND	ND	ND	7.82	1.78	6.75	3.02	0.96
15	0.35	ND	ND	ND	ND	ND	ND	9.06	1.71	6.50	3.65	0.97
16	0.32	ND	ND	ND	ND	ND	ND	8.18	1.57	7.83	2.99	1.01
17	0.32	ND	ND	ND	ND	ND	ND	7.20	1.44	7.50	2.56	0.92
18	0.39	ND	ND	ND	ND	ND	ND	6.07	1.54	7.05	2.23	0.80
19	ND	ND	ND	ND	ND	ND	ND	4.26	1.64	7.14	2.12	0.49
20	ND	ND	ND	ND	ND	ND	ND	3.96	1.40	8.19	2.01	0.42
21	ND	ND	ND	ND	ND	ND	ND	3.77	1.42	6.79	1.84	0.37
22	ND	ND	ND	ND	ND	ND	ND	2.00	1.95	6.26	1.88	0.31
23	ND	ND	ND	ND	ND	ND	ND	0.71	1.75	6.16	1.69	0.35
24	ND	ND	ND	ND	ND	ND	ND	0.86	1.34	6.59	1.71	0.33
25	ND	ND	ND	ND	ND	ND	ND	0.95	1.10	6.35	1.59	0.32
26	ND	ND	ND	ND	ND	ND	ND	1.38	0.90	6.12	1.33	0.30
27	ND	ND	ND	ND	ND	ND	ND	1.68	0.70	6.17	1.06	0.32
28	ND	ND	ND	ND	ND	ND	ND	1.86	0.58	6.28	0.94	0.29
29	ND	ND	ND	ND	--	ND	ND	2.50	0.51	4.75	0.79	0.30
30	ND	ND	ND	ND	--	ND	ND	3.34	0.52	4.41	0.70	. . .
31	ND	--	ND	ND	--	ND	--	3.60	--	4.75	0.65	--
Mean	0.45	ND	ND	ND	ND	ND	ND	4.42	2.20	5.72	2.86	0.52
Min	0.28	ND	ND	ND	ND	ND	ND	0.71	0.51	3.78	0.65	0.29
Max	0.77	ND	ND	ND	ND	ND	ND	9.83	4.97	8.19	5.68	1.03

Measured Streamflow

Date	Streamflow (CFS)
10/18/2018	0.52
11/19/2018	**0.32**
5/1/2019	10.00
5/29/2019	3.61
6/20/2019	1.61
7/29/2019	4.28
8/14/2019	3.29
9/12/2019	1.30

0.01 Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.
. . . Indicates daily average flow less than 0.28 cfs. Stilling well inlet is 0.10 feet above flume bottom, and data logger does not record flows between 0.00 (dry) and 0.28 cfs.

South Prong Creek
Streamflow
(cubic feet per second)

Daily Mean Streamflow (CFS)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3	0.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6	0.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00
8	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00
9	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65
10	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67
11	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.69
12	0.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.66
13	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65
14	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.62
15	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.61
16	ND1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.66
17	0.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.65
18	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.62
19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.60
20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.60
21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.58
22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.57
23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.57
24	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND	0.58
25	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND	0.57
26	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND	0.58
27	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND	0.58
28	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND	0.58
29	ND	ND	ND	ND	--	ND	0.00	ND	ND	ND	ND	0.55
30	ND	ND	ND	ND	--	ND	0.00	ND	ND	ND	ND	0.54
31	ND	--	ND	ND	--	ND	--	ND	--	ND	ND	--
Mean	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.56
Min	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00
Max	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.69

Measured Streamflow

Date	Streamflow (CFS)
10/25/2018	0.00
3/27/2019	**0.00**
4/23/2019	0.00
5/11/2019	0.00
6/12/2019	0.00
7/19/2019	0.00
8/29/2019	0.00
9/25/2019	0.00

ND No Data. Data Logger Removed for Winter.
ND1 No Data. Logger Malfunction.
Note: Water Level below 0.02 feet not connected to stilling well. Flows below 0.02 cfs are approximate.
Note: When height of water in flume is above 1.50 feet (11.19 cfs), bypass spillways overflow and flow through

Upper Sylvester Gulch
Measured Flow

Date	GPM	CFS	Comments
4/30/2000	0.00	0.00	Dry
9/19/2000	0.00	0.00	Dry
4/28/2001	0.00	0.00	Dry
6/24/2001	0.00	0.00	Dry
9/28/2001	0.00	0.00	Dry
4/29/2002	0.00	0.00	Dry
6/18/2002	0.00	0.00	Dry
9/9/2002	0.00	0.00	Dry
4/10/2003	0.00	0.00	Dry
6/2/2003	0.00	0.00	Dry
9/18/2003	0.00	0.00	Dry
4/25/2004	0.00	0.00	Dry
5/29/2004	0.00	0.00	Dry
8/31/2004	0.00	0.00	Dry
5/3/2005	0.00	0.00	Dry
6/4/2005	0.00	0.00	No flow
9/20/2005	0.00	0.00	Dry
5/1/2006	0.00	0.00	Dry
5/16/2006	0.00	0.00	Dry
9/12/2006	0.00	0.00	Dry
5/30/2007	0.00	0.00	Dry
8/24/2007	0.00	0.00	Dry
4/25/2007	136	0.30	
5/30/2007	0.00	0.00	Dry
8/24/2007	0.00	0.00	Dry
5/9/2008	887.29	1.98	
6/6/2008	155.22	0.35	
8/20/2008	0.00	0.00	Dry
5/7/2009	155.22	0.35	
5/24/2009	75.62	0.17	
8/10/2009	0.00	0.00	Dry
5/4/2010	0.00	0.00	Dry
6/1/2010	0.00	0.00	Dry
9/1/2010	0.00	0.00	Dry
5/10/2011	365.42	0.81	
6/1/2011	175.44	0.39	
8/10/2011	1.20	0.003	
4/30/2012	0.00	0.00	Dry
5/15/2012	0.00	0.00	Dry
8/20/2012	0.00	0.00	Dry
5/2/2013	0.00	0.00	Dry
5/23/2013	0.00	0.00	Dry
8/20/2013	0.00	0.00	Dry
5/1/2014	0.00		
5/21/2014	18.46	0.04	
9/23/2014	0.00	0.00	Dry
4/24/2015	0.00	0.00	Dry
5/27/2015	2.24	0.01	
8/29/2015	2.24	0.01	
5/5/2016	34.70	0.08	
5/25/2016	23.62	0.05	
9/7/2016	14.12	0.03	
5/12/2017	18.66	0.04	
6/6/2017	3.47	0.01	
9/5/2017	0.00	0.00	Dry
5/12/2018	0.00	0.00	Dry
6/10/2018	0.00	0.00	Dry
9/29/2018	0.00	0.00	Dry
5/7/2019	28.98	0.06	
6/20/2019	1.20	0.00	
9/12/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Horse Gulch
Measured Flow

Date	GPM	CFS	Comments
5/7/2000	0.00	0.00	Dry
6/14/2000	0.00	0.00	Dry
9/17/2000	0.00	0.00	Dry
5/2/2001	0.00	0.00	Dry
6/25/2001	0.00	0.00	Dry
9/26/2001	0.00	0.00	Dry
4/25/2002	0.00	0.00	Dry
6/17/2002	0.00	0.00	Dry
9/10/2002	0.00	0.00	Dry
4/12/2003	0.00	0.00	Dry
6/2/2003	0.00	0.00	Dry
9/18/2003	0.00	0.00	Dry
4/25/2004	0.00	0.00	Dry
5/30/2004	0.00	0.00	Dry
9/2/2004	0.00	0.00	Dry
5/10/2005	0.00	0.00	Dry
6/5/2005	0.00	0.00	Dry
9/13/2005	0.00	0.00	Dry
5/1/2006	0.00	0.00	Dry
5/24/2006	0.00	0.00	Dry
9/6/2006	0.00	0.00	Dry
4/27/2007	0.00	0.00	Dry
5/30/2007	0.00	0.00	Dry
8/24/2007	0.00	0.00	Dry
5/5/2008	275	0.61	
6/7/2008	0.00	0.00	Dry
8/23/2008	0.00	0.00	Dry
5/8/2009	0.00	0.00	Dry
6/2/2009	0.00	0.00	Dry
8/11/2009	0.00	0.00	Dry
5/6/2010	0.00	0.00	Dry
6/2/2010	0.00	0.00	Dry
9/1/2010	0.00	0.00	Dry
5/5/2011	0.00	0.00	Dry
6/1/2011	0.00	0.00	Dry
8/11/2011	0.00	0.00	Dry
4/24/2012	0.00	0.00	Dry
5/15/2012	0.00	0.00	Dry
8/22/2012	0.00	0.00	Dry
5/2/2013	0.00	0.00	Dry
5/21/2013	0.00	0.00	Dry
8/23/2013	0.00	0.00	Dry
4/30/2014	0.00	0.00	Dry
5/21/2014		0.00	Dry
9/23/2014	0.00	0.00	Dry
4/25/2015	0.00	0.00	Dry
5/25/2015	0.00	0.00	Dry
8/18/2015	0.00	0.00	Dry
5/5/2016	0.00	0.00	Dry
5/24/2016	0.00	0.00	Dry
9/5/2016	0.00	0.00	Dry
5/10/2017	0.00	0.00	Dry
6/8/2017	0.00	0.00	Dry
9/7/2017	0.00	0.00	Dry
5/11/2018	0.00	0.00	Dry
6/11/2018	0.00	0.00	Dry
9/27/2018	0.00	0.00	Dry
5/1/2019	0.00	0.00	Dry
6/20/2019	0.00	0.00	Dry
9/11/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

East Gulch East of Horse Gulch
Measured Flow

Date	GPM	CFS	Comments
5/7/2000	3.00	0.01	
6/14/2000	2.50	0.01	
9/17/2000	0.00	0.00	Seep
5/2/2001	3.75	0.01	
6/25/2001	3.75	0.01	
9/26/2001	0.00	0.00	Dry
4/25/2002	0.00	0.00	Dry
6/17/2002	0.00	0.00	Dry
9/10/2002	0.00	0.00	Dry
4/12/2003	0.00	0.00	Dry
6/3/2003	0.00	0.00	Dry
9/18/2003	0.00	0.00	Dry
4/25/2004	0.00	0.00	Dry
5/29/2004	0.00	0.00	Dry
9/2/2004	0.00	0.00	Dry
5/1/2005	45	0.10	
6/5/2005	0.68	0.002	
10/2/2005	0.00	0.00	Wet
5/4/2006	0.00	0.00	Dry
5/23/2006	0.00	0.00	Dry
9/6/2006	0.00	0.00	Dry
4/27/2007	0.00	0.00	Dry
5/30/2007	0.00	0.00	Dry
8/24/2007	0.00	0.00	Dry
5/5/2008	0.00	0.00	Dry
6/7/2008	0.00	0.00	Dry
8/23/2008	0.00	0.00	Dry
5/8/2009	0.00	0.00	Dry
6/2/2009	0.00	0.00	Dry
8/11/2009	0.00	0.00	Dry
5/6/2010	0.00	0.00	Dry
6/2/2010	0.10	0.0002	Trickle
9/1/2010	0.00	0.00	Dry
5/5/2011	88.42	0.20	
6/3/2011	43.55	0.10	
8/12/2011	0.10	0.0002	Trickle
4/30/2012	0.00	0.00	Dry
5/14/2012	0.00	0.00	Dry
8/22/2012	0.00	0.00	Dry
5/1/2013	0.00	0.00	Dry
5/21/2013	0.00	0.00	Dry
8/23/2013	0.00	0.00	Dry
5/2/2014	4.04	0.01	Dry
5/19/2014	0.00	0.00	Wet
9/23/2014	0.00	0.00	Dry
5/28/2015	0.00	0.00	Dry
8/18/2015	0.00	0.00	Dry
4/25/2015	0.00	0.00	Dry
5/2/2016	25.28	0.06	
5/24/2016	2.45	0.01	
9/6/2016	0.00	0.00	Dry
5/10/2017	25.96	0.06	
6/8/2017	0.62	0.00	
9/5/2017	0.00	0.00	Dry
5/11/2018	0.00	0.00	Dry
6/11/2018	0.00	0.00	Dry
9/27/2018	0.00	0.00	Dry
5/1/2019	119	0.27	
6/20/2019	0.00	0.00	Dry
9/11/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Upper Deep Creek
Measured Flow

Date	GPM	CFS	Comments
5/4/2006	5,251	11.70	
5/24/2006	2,567	5.72	
8/17/2006	1,634	3.64	
4/28/2007	5,332	11.88	
5/29/2007	1,400	3.12	
9/11/2007	353	0.79	
5/11/2008	17,504	39	
6/8/2008	7,181	16	
8/21/2008	368	0.82	
5/9/2009	5,911	13.17	
6/4/2009	1,445	3.22	
8/9/2009	49.37	0.11	
5/7/2010	2,249	5.01	
6/3/2010	1,014	2.26	
8/31/2010	35.91	0.08	
5/9/2011	8,209	18.29	
6/1/2011	8,824	19.66	
8/11/2011	130	0.29	
4/26/2012	730	1.63	
5/16/2012	321	0.72	
8/22/2012	15.83	0.04	
5/3/2013	1,549	3.45	
5/21/2013	1,582	3.53	
8/21/2013	603	1.34	
5/3/2014	1,773	3.95	
5/20/2014	2,869	6.40	
9/24/2014	147	0.33	
4/23/2015	801	1.79	
5/27/2015	2,568	5.73	
8/19/2015	132	0.30	
5/4/2016	2,720	6.07	
5/24/2016	1,627	3.63	
9/5/2016	113	0.25	
5/11/2017	2,029	4.52	
6/7/2017	1,367	3.05	
9/7/2017	116	0.26	
5/10/2018	643	1.43	
6/11/2018	95	0.21	
9/28/2018	51	0.11	
5/6/2019	3,214	7.17	
6/17/2019	1,585	3.53	
9/11/2019	54	0.12	

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Lower Deep Creek
Measured Flow

Date	GPM	CFS	Comments
5/4/2006	5,745	12.80	
5/24/2006	2,437	5.43	
8/17/2006	1,557	3.47	
4/28/2007	8,039	17.91	
5/29/2007	2,298	5.12	
9/11/2007	467	1.04	
5/11/2008	16,607	37.00	
6/8/2008	8,079	18.00	
8/21/2008	368	0.82	
5/9/2009	3,793	8.45	
6/4/2009	1,423	3.17	
8/9/2009	53.86	0.12	
5/7/2010	3,039	6.77	
6/3/2010	1,346	3.00	
8/31/2010	67.32	0.15	
5/9/2011	11,800	26.29	
6/1/2011	10,067	22.43	
8/11/2011	171	0.38	
4/28/2012	1,061	2.37	
5/16/2012	437	0.97	
8/22/2012	13.44	0.03	
5/3/2013	2,401	5.35	
5/22/2013	1,547	3.45	
8/21/2013	983	2.19	
5/3/2014	2,933	6.54	
5/20/2014	3,283	7.32	
9/24/2014	157	0.35	
4/23/2015	849	1.89	
5/26/2015	2,456	5.48	
8/19/2015	100	0.22	
5/4/2016	2,846	6.35	
5/25/2016	3,670	8.18	
9/5/2016	143	0.32	
5/11/2017	2,939	6.55	
6/7/2017	1,397	3.12	
9/7/2017	119	0.27	
5/10/2018	1,065	2.37	
6/11/2018	90	0.20	
9/28/2018	53	0.12	
5/6/2019	5,840	13.02	
6/17/2019	2,222	4.96	
9/11/2019	149	0.33	

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Box Canyon
Measured Flow

Date	GPM	CFS	Comments
5/6/2000	0.00	0.00	Damp
6/12/2000	0.00	0.00	No Flow
9/18/2000	0.00	0.00	Dry
4/28/2001	0.00	0.00	Dry
6/24/2001	0.00	0.00	Dry
9/30/2001	0.00	0.00	Dry
4/23/2002	0.00	0.00	Dry
6/18/2002	0.00	0.00	Dry
9/9/2002	0.00	0.00	Dry
4/10/2003	0.00	0.00	Dry
6/4/2003	0.00	0.00	Dry
9/18/2003	0.00	0.00	Dry
4/25/2004	0.00	0.00	Dry
5/29/2004	0.00	0.00	Dry
8/31/2004	0.00	0.00	Dry
5/2/2005	0.00	0.00	Dry
6/4/2005	0.00	0.00	Dry
9/20/2005	0.00	0.00	Dry
4/29/2006	0.00	0.00	Dry
5/15/2006	0.00	0.00	Dry
9/6/2006	0.00	0.00	Dry
4/26/2007	0.00	0.00	Dry
5/24/2007	0.00	0.00	Dry
8/24/2007	0.00	0.00	Dry
5/6/2008	4.40	0.01	4.40
6/6/2008	9.60	0.02	9.60
8/23/2008	0.00	0.00	Trickle
5/7/2009	5.74	0.01	5.74
5/24/2009	1.08	0.00	1.08
8/10/2009	0.23	0.00	0.23
5/4/2010	0.00	0.00	Dry
6/1/2010	0.00	0.00	Dry
8/29/2010	0.00	0.00	Dry
5/6/2011	0.00	0.00	Dry
6/2/2011	0.00	0.00	Dry
8/12/2011	0.00	0.00	Dry
4/25/2012	0.00	0.00	Dry
5/15/2012	0.00	0.00	Dry
8/19/2012	0.00	0.00	Dry
5/1/2013	0.00	0.00	Dry
5/22/2013	0.00	0.00	Dry
8/23/2013	0.00	0.00	Dry
5/1/2014	0.00	0.00	Dry
5/21/2014		0.00	Dry
9/23/2014	0.00	0.00	Dry
4/26/2015	0.00	0.00	Dry
5/29/2015	0.00	0.00	Dry
8/29/2015	0.00	0.00	Dry
5/3/2016	0.00	0.00	Dry
5/26/2016	0.00	0.00	Dry
9/8/2016	0.00	0.00	Dry
5/12/2017	0.00	0.00	Dry
6/6/2017	0.00	0.00	Dry
9/7/2017	0.00	0.00	Dry
5/12/2018	0.00	0.00	Dry
6/10/2018	0.00	0.00	Dry
9/29/2018	0.00	0.00	Dry
5/2/2019	0.00	0.00	Dry
6/22/2019	0.00	0.00	Dry
9/10/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Deer Creek
Measured Flow

Date	GPM	CFS	Comments
5/3/2005	53	0.12	
5/9/2005	114	0.25	
6/6/2005	11.2	0.02	
7/5/2005	0.72	0.00	
8/4/2005	0.00	0.00	Damp
9/6/2005	0.00	0.00	Dry
10/2/2005	0.00	0.00	Dry
5/1/2006	0.00	0.00	Dry
7/22/2006	0.00	0.00	Dry
8/18/2006	0.00	0.00	Dry
4/27/2007	22.20	0.05	
5/30/2007	46.98	0.10	
8/23/2007	0.00	0.00	Dry
4/27/2007	22.20	0.05	
5/30/2007	46.98	0.10	
8/23/2007	0.00	0.00	Dry
5/5/2008	550	1.23	
6/8/2008	92	0.21	
8/22/2008	0	0.00	Dry
5/8/2009	0.00	0.00	Dry
6/3/2009	25.98	0.06	
8/10/2009	0.00	0.00	Dry
5/6/2010	0.00	0.00	Dry
6/2/2010	0.00	0.00	Dry
8/31/2010	0.00	0.00	Dry
5/5/2011	155	0.35	
6/3/2011	122	0.27	
8/12/2011	0.00	0.00	Dry
4/24/2012	0.00	0.00	Dry
5/17/2012	0.00	0.00	Dry
8/22/2012	0.00	0.00	Dry
5/1/2013	0.00	0.00	Dry
5/21/2013	0.00	0.00	Dry
8/23/2013	0.00	0.00	Dry
5/2/2014	3.66	0.01	
5/19/2014	12.20	0.03	
9/23/2014	0.00	0.00	Dry
4/24/2015	0.00	0.00	Dry
5/25/2015	0.00	0.00	Dry
8/19/2015	0.00	0.00	Dry
5/2/2016	83.48	0.19	
5/24/2016	33.05	0.07	
9/7/2016	0.00	0.00	Dry
5/10/2017	0.00	0.00	Dry
6/8/2017	0.00	0.00	Dry
9/7/2017	0.00	0.00	Dry
5/11/2018	0.00	0.00	Dry
6/12/2018	0.00	0.00	Dry
9/27/2018	0.00	0.00	Dry
5/1/2019	269	0.60	
6/20/2019	0.25	0.00	
9/11/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Poison Gulch
Measured Flow

Date	GPM	CFS	Comments
5/9/2005	97	0.22	
6/6/2005	12.5	0.03	
7/5/2005	0.00	0.00	Wet
8/4/2005	0.00	0.00	Dry
9/6/2005	0.00	0.00	Dry
10/2/2005	0.00	0.00	Dry
5/1/2006	31.33	0.07	
5/22/2006	4.01	0.01	
8/18/2006	0.00	0.00	Dry
4/27/2007	15	0.03	
5/30/2007	60	0.13	
8/23/2007	0.00	0.00	Dry
4/27/2007	15	0.03	
5/30/2007	60	0.13	
8/23/2007	0.00	0.00	Dry
5/5/2008	530	1.18	
6/8/2008	56	0.12	
8/22/2008	0.1	0.00	Trickle
5/9/2009	65.81	0.15	
6/3/2009	75	0.17	
8/9/2009	0.00	0.00	Dry
5/6/2010	38.89	0.09	
6/2/2010	5.39	0.01	
8/31/2010	0.00	0.00	Damp
5/9/2011	351	0.78	
6/1/2011	145	0.32	
8/11/2011	1.26	0.00	
4/30/2012	5.53	0.01	
5/16/2012	3.24	0.01	
8/22/2012	0.00	0.00	Dry
5/1/2013	22.40	0.05	
5/21/2013	0.78	0.00	
8/23/2013	0.00	0.00	Dry
5/2/2014	12.04	0.03	
5/19/2014	6.71	0.01	
9/24/2014	0.00	0.00	Dry
4/25/2015	0.00	0.00	Seep
5/28/2015	0.00	0.00	Seep
8/19/2015	0.00	0.00	Dry
5/4/2016	27.75	0.06	
5/24/2016	18.75	0.04	
9/5/2016	0.00	0.00	Dry
5/11/2017	16.29	0.04	
6/7/2017	0.80	0.00	
9/7/2017	0.00	0.00	Dry
5/11/2018	0.00	0.00	Dry
6/11/2018	0.00	0.00	Dry
9/27/2018	0.00	0.00	Dry
5/6/2019	45.2	0.10	
6/20/2019	0.00	0.00	Dry
9/11/2019	0.00	0.00	Dry

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

Stream ST-SW-1
Measured Flow

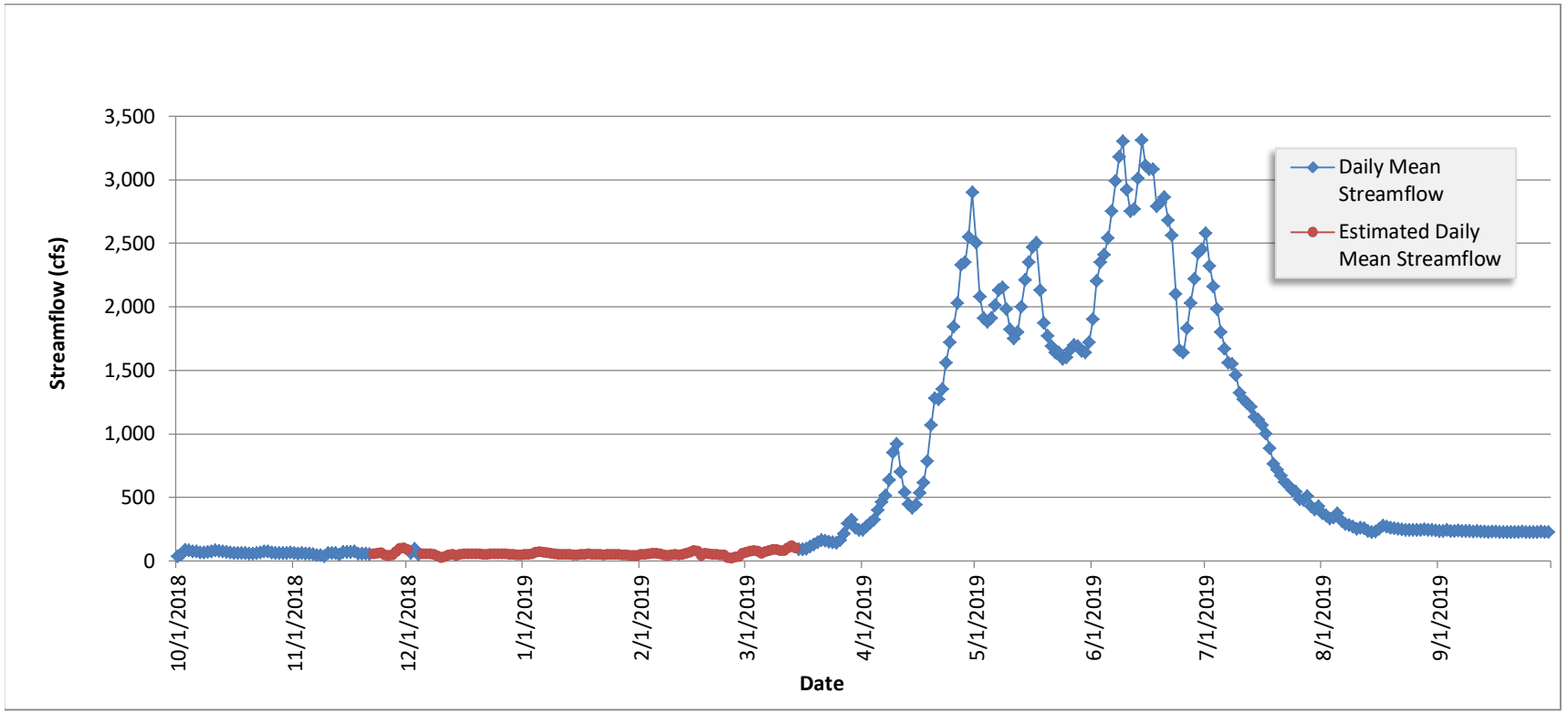
Date	GPM	CFS	Comments
7/18/2018	7.75	0.02	
8/29/2018	8.75	0.02	
9/25/2018	12.98	0.03	
6/19/2019	77.97	0.17	
7/30/2019	174.7	0.39	
9/9/2019	48.87	0.11	

Non-data logger site
GPM - gallons per minute
CFS - cubic feet per second

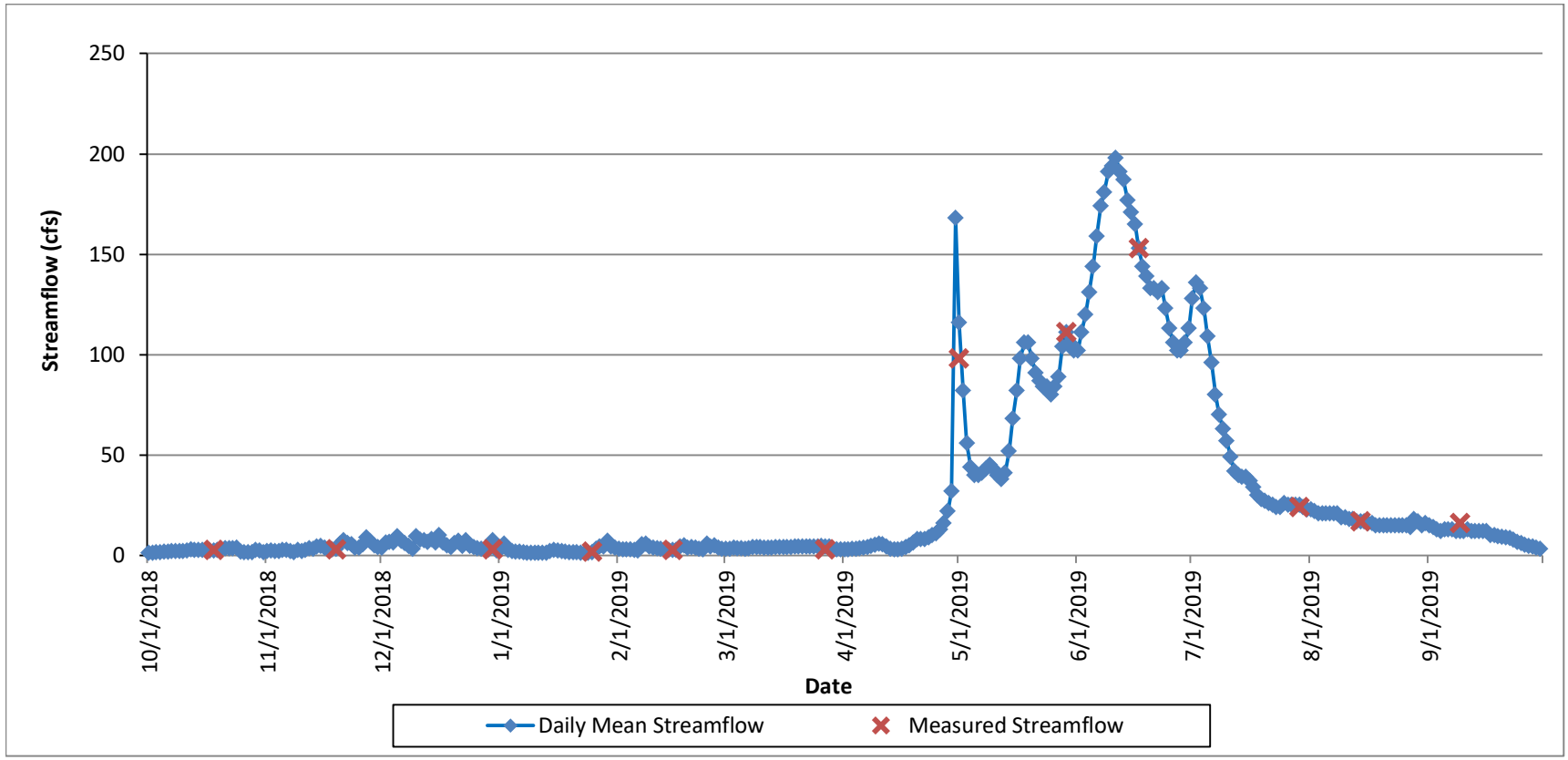
APPENDIX B

SURFACE WATER - HYDROGRAPHS

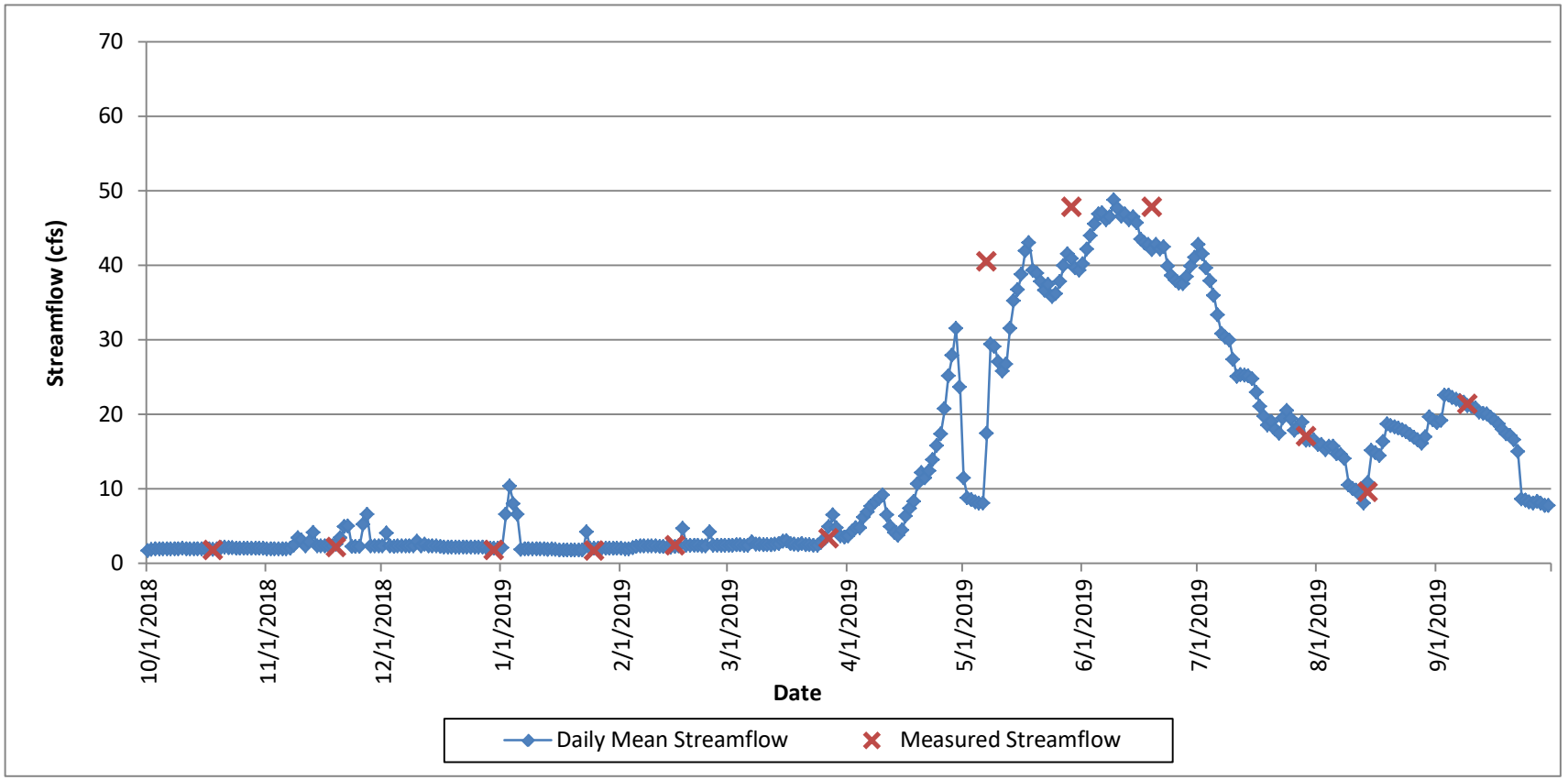
Upper North Fork (USGS) Hydrograph
WY 2019



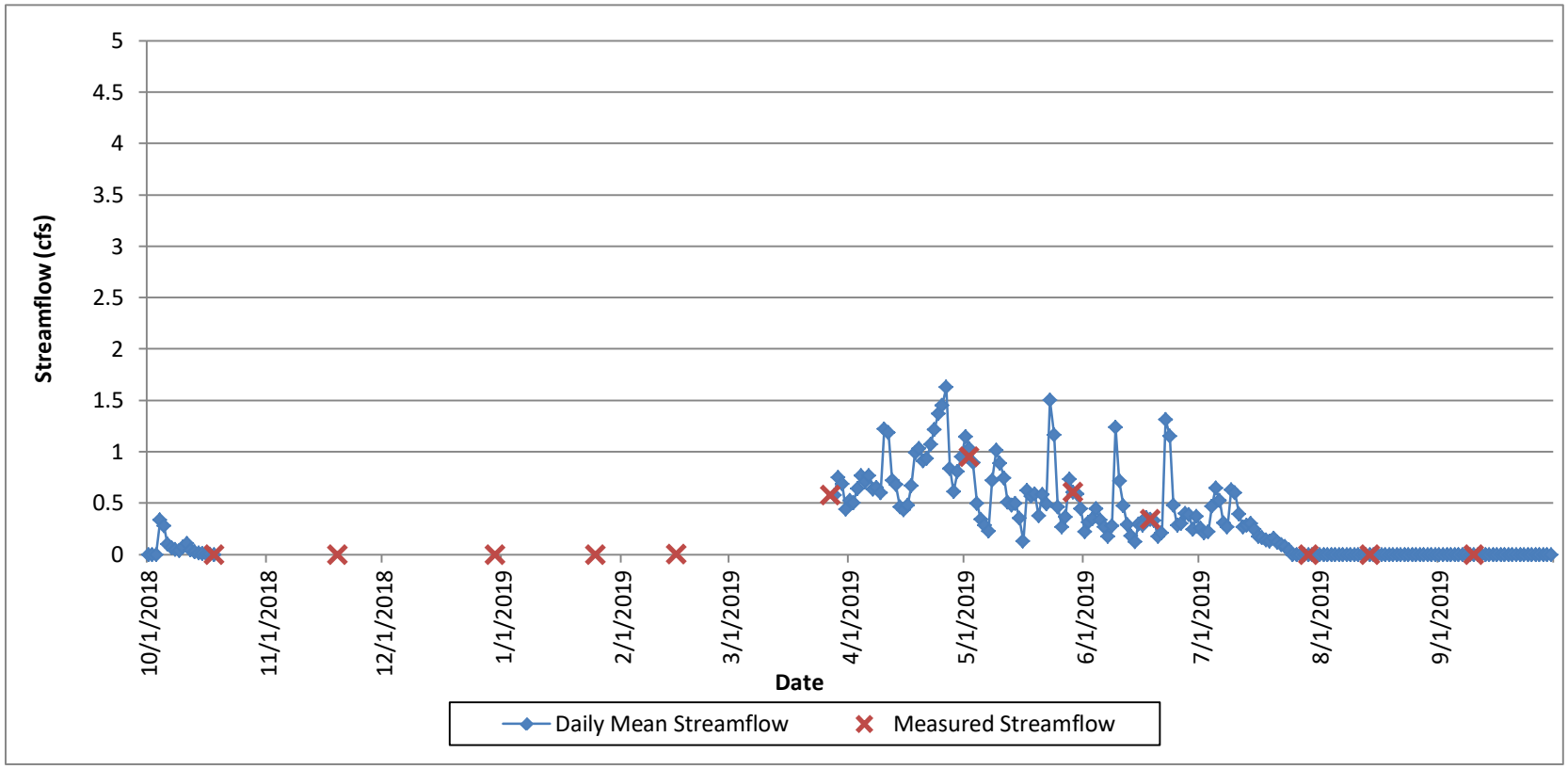
Lower Minnesota Creek Hydrograph
WY 2019



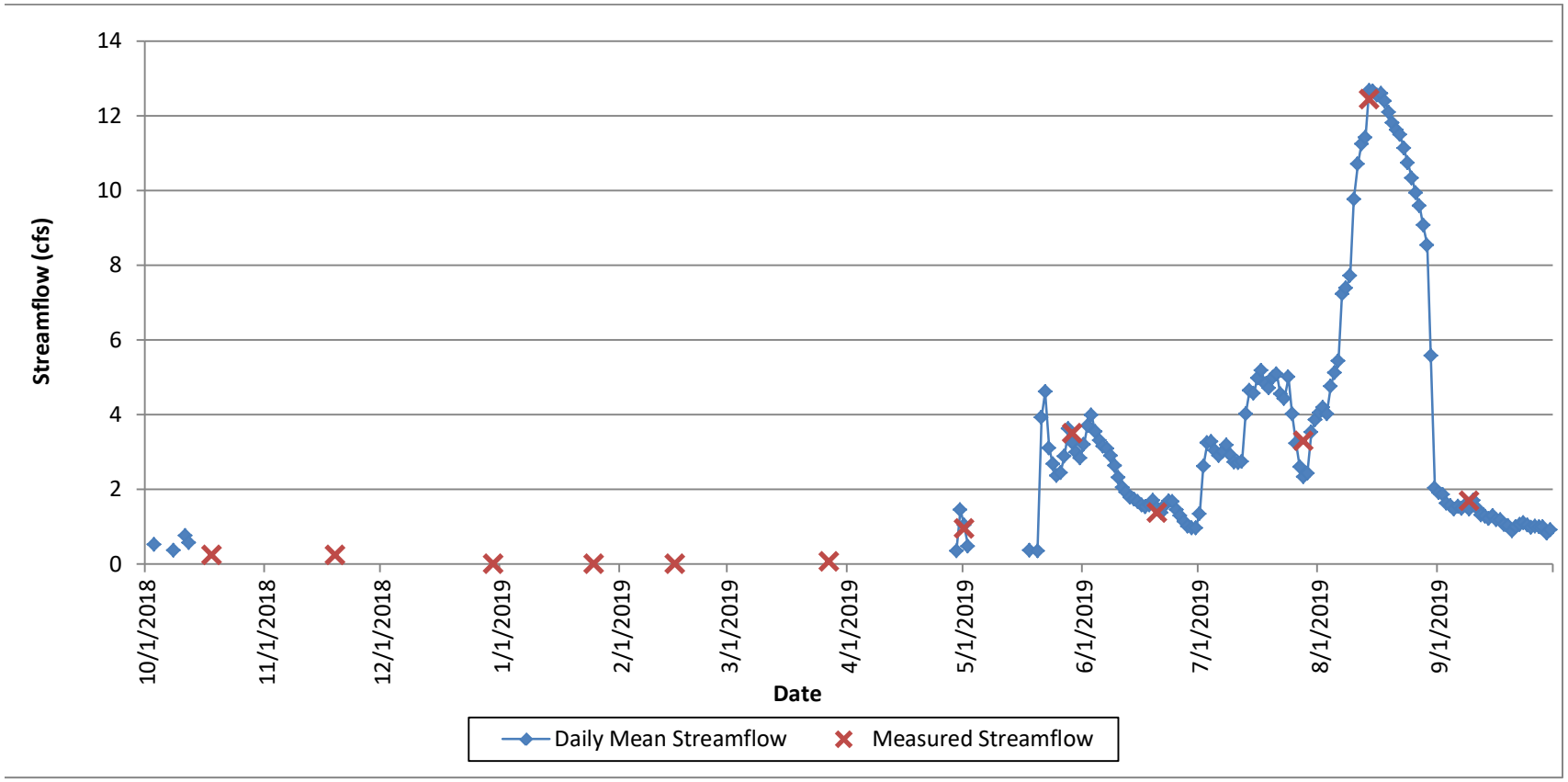
Upper Minnesota Creek Hydrograph
WY 2019



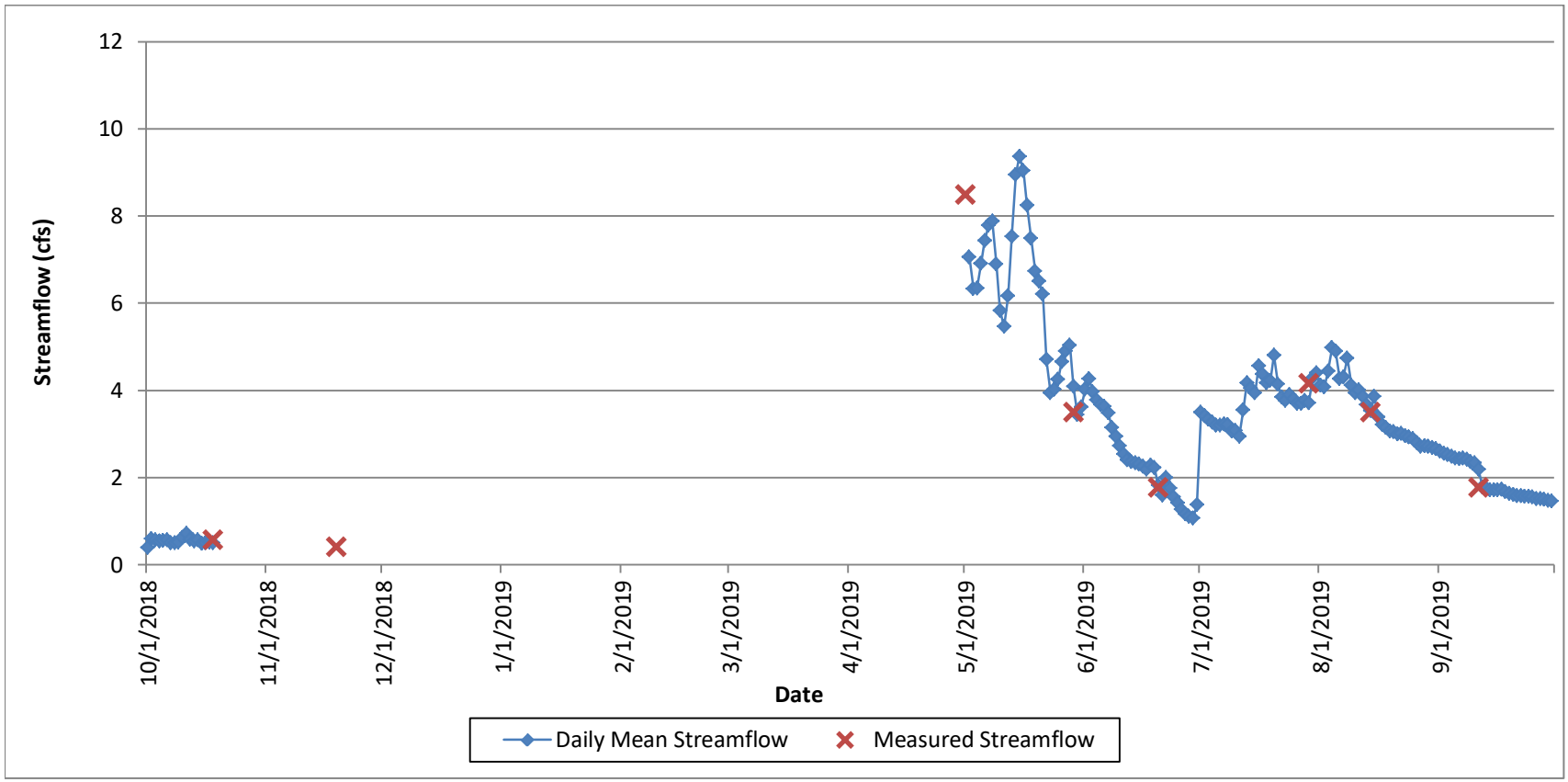
Middle Sylvester Gulch Hydrograph
WY 2019



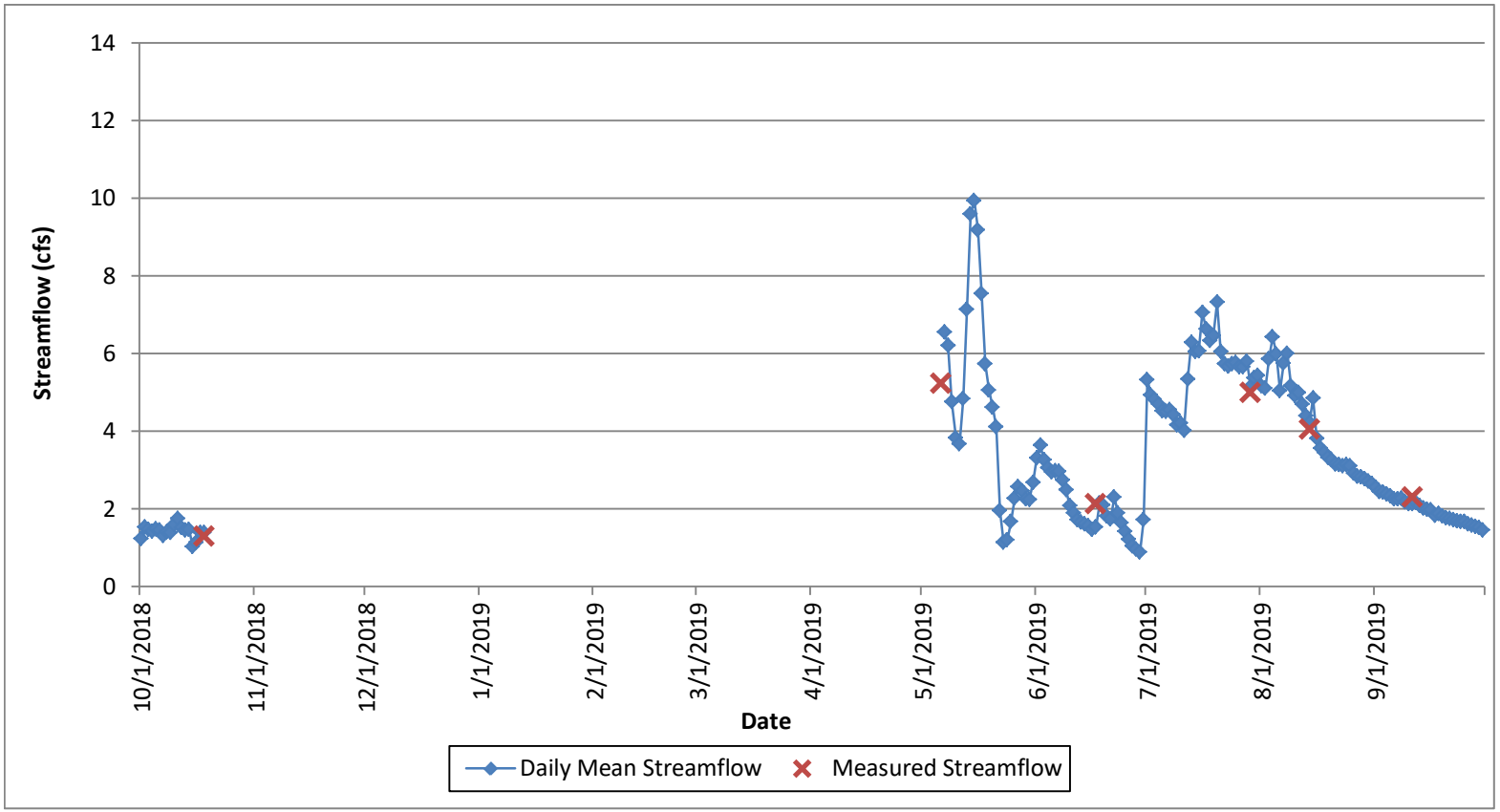
Lower Dry Fork Hydrograph
WY 2019



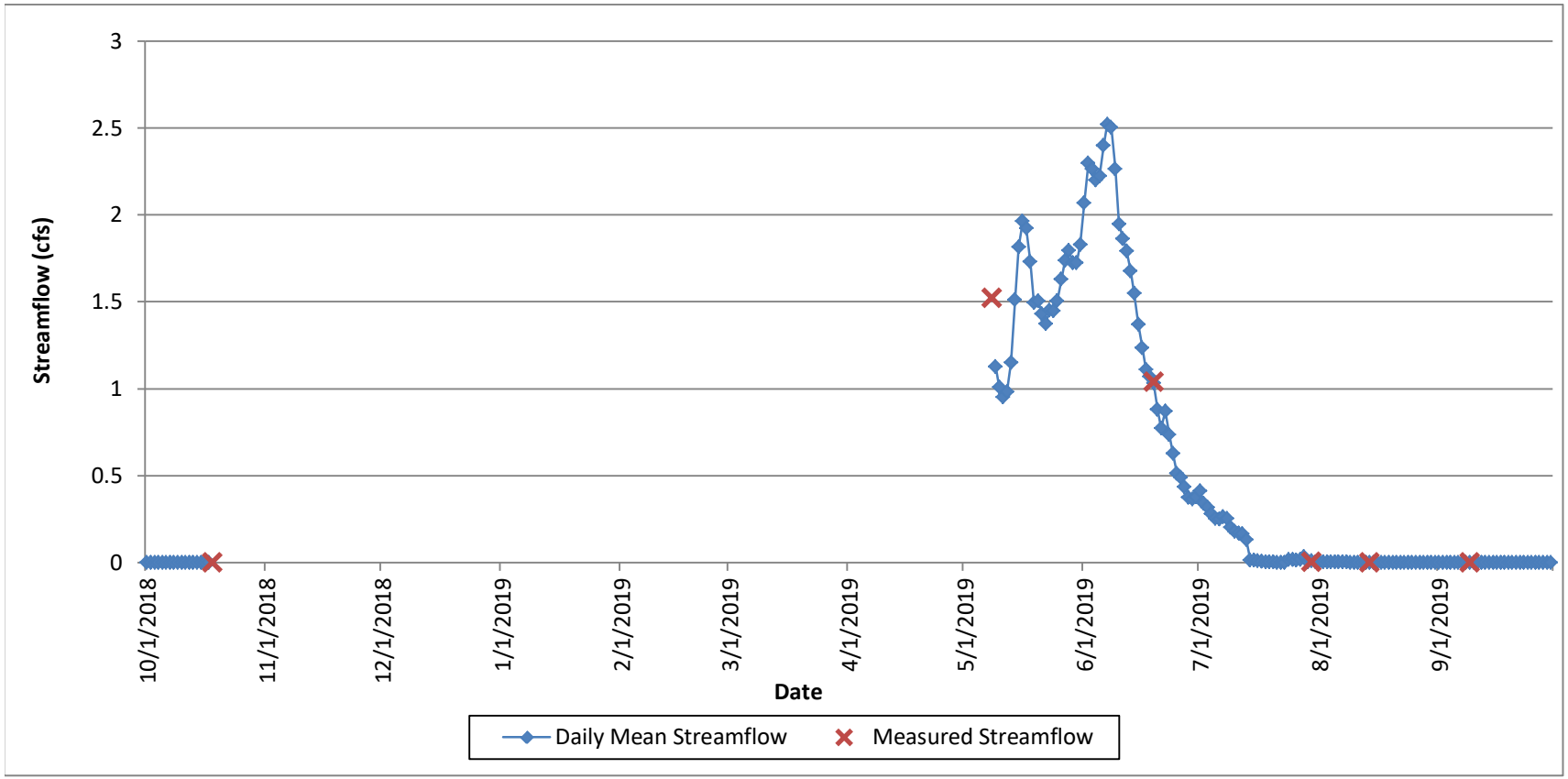
Middle Dry Fork Hydrograph
WY 2019



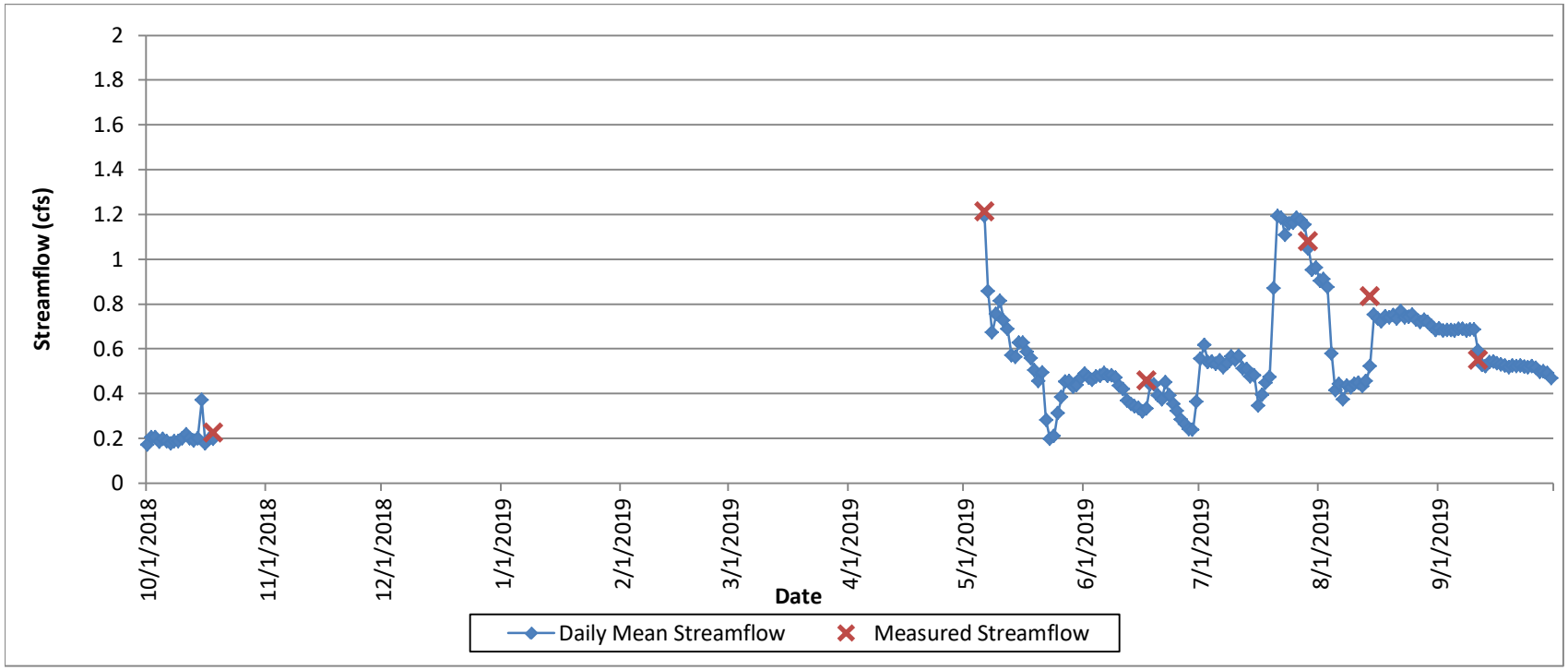
Upper Dry Fork Hydrograph
WY 2019



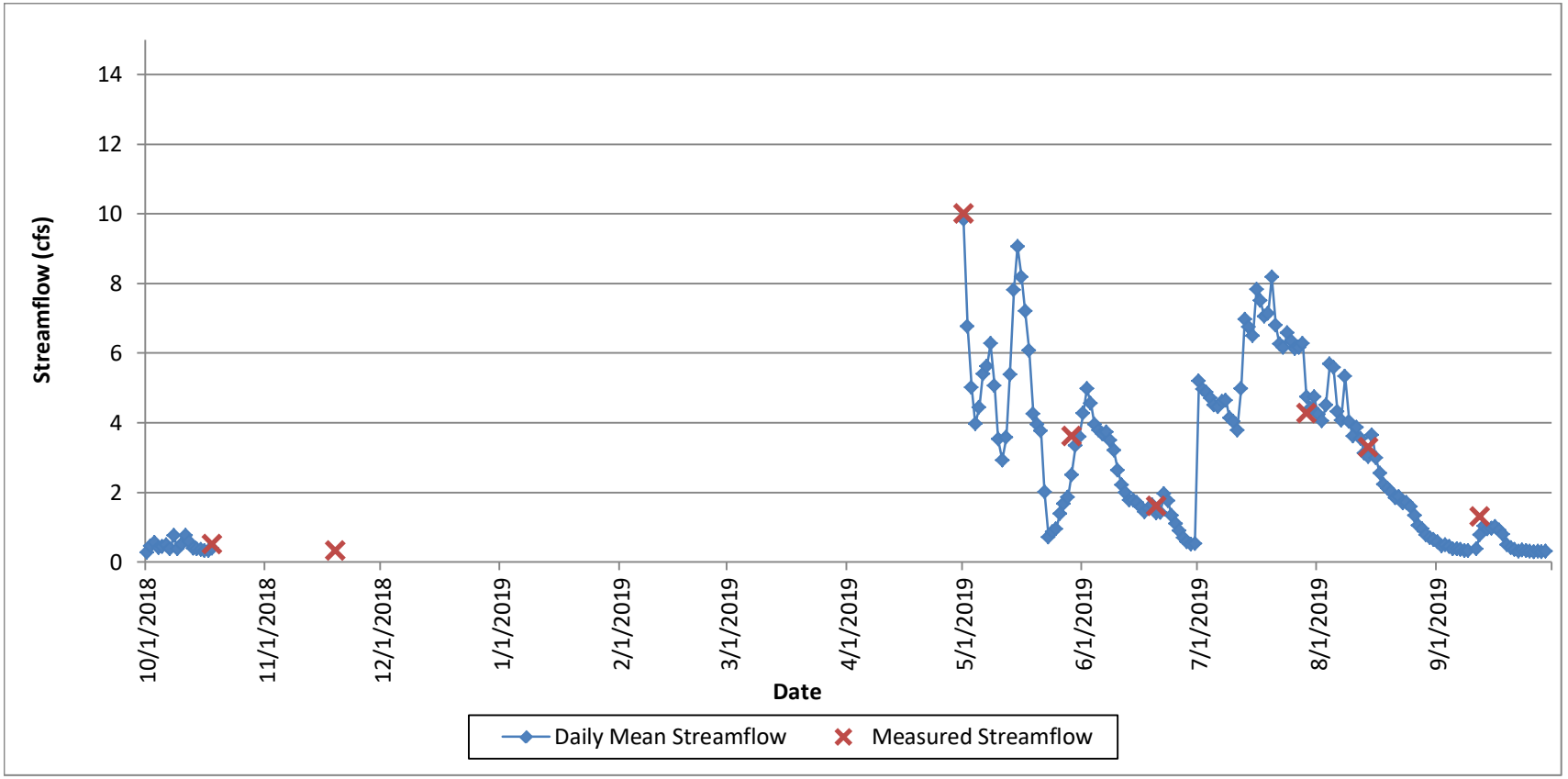
Lick Creek Hydrograph
WY 2019



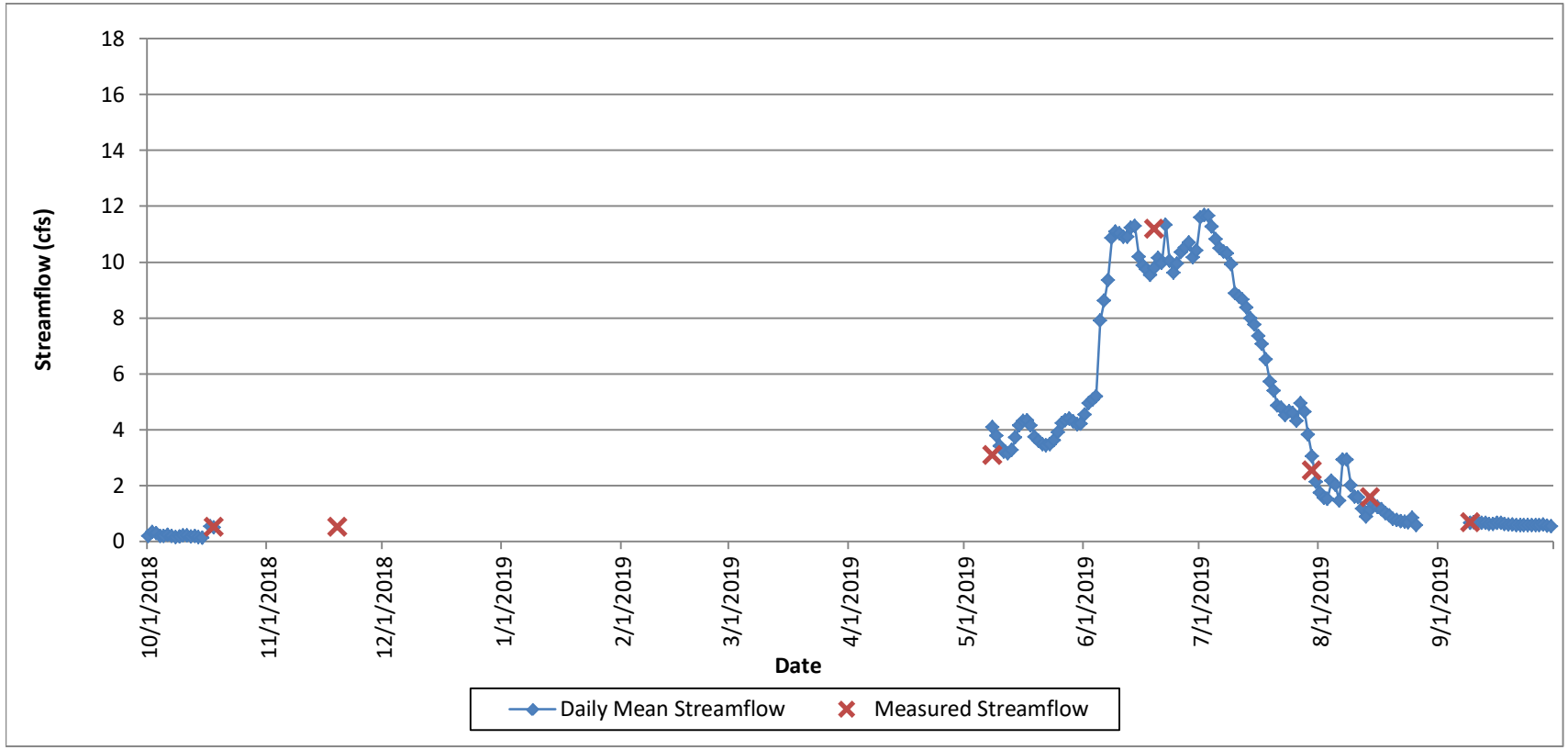
Deep Creek Ditch Hydrograph
WY 2019



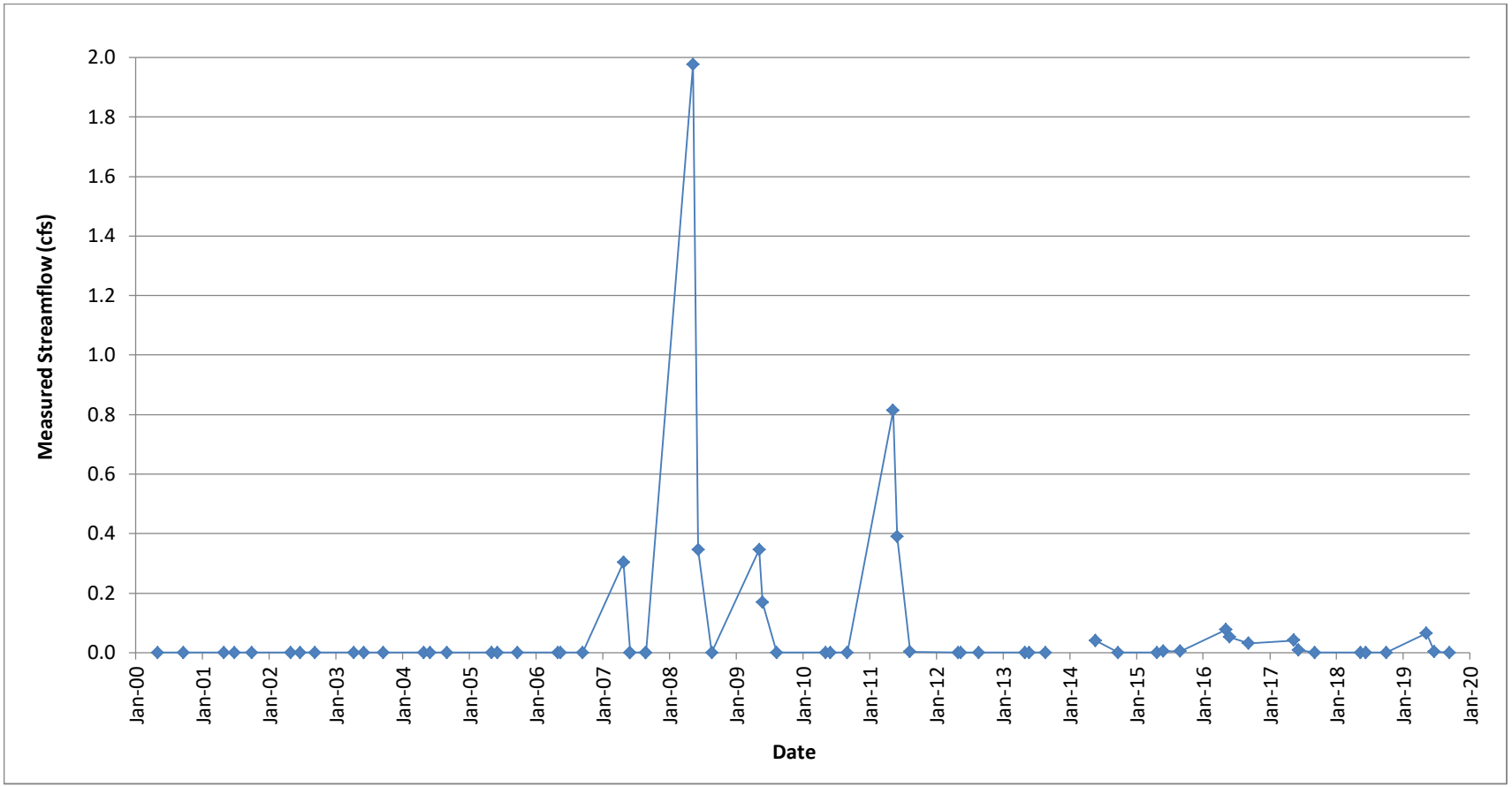
Minnesota Reservoir Flume Hydrograph
WY 2019



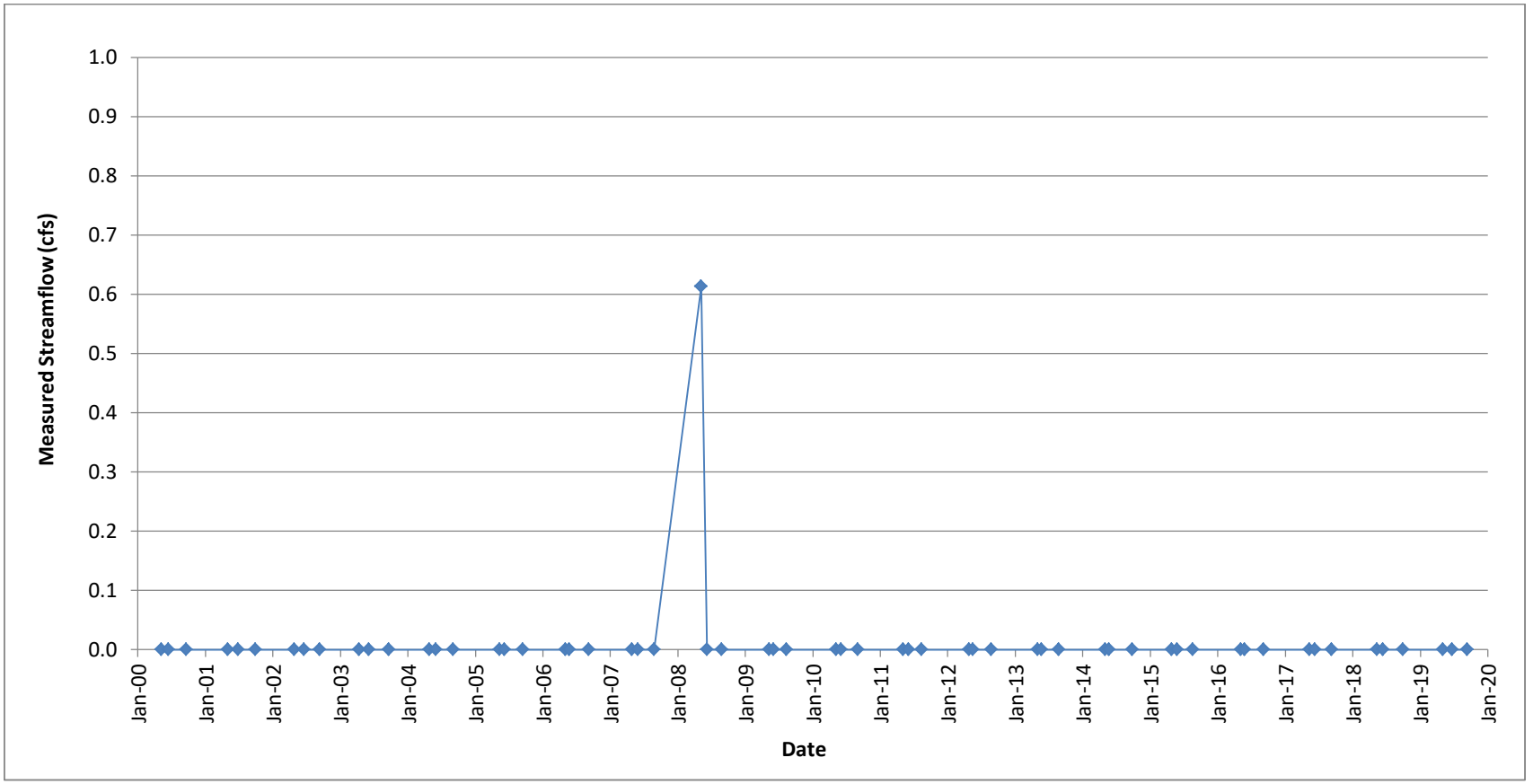
South Prong Creek Hydrograph
WY 2019



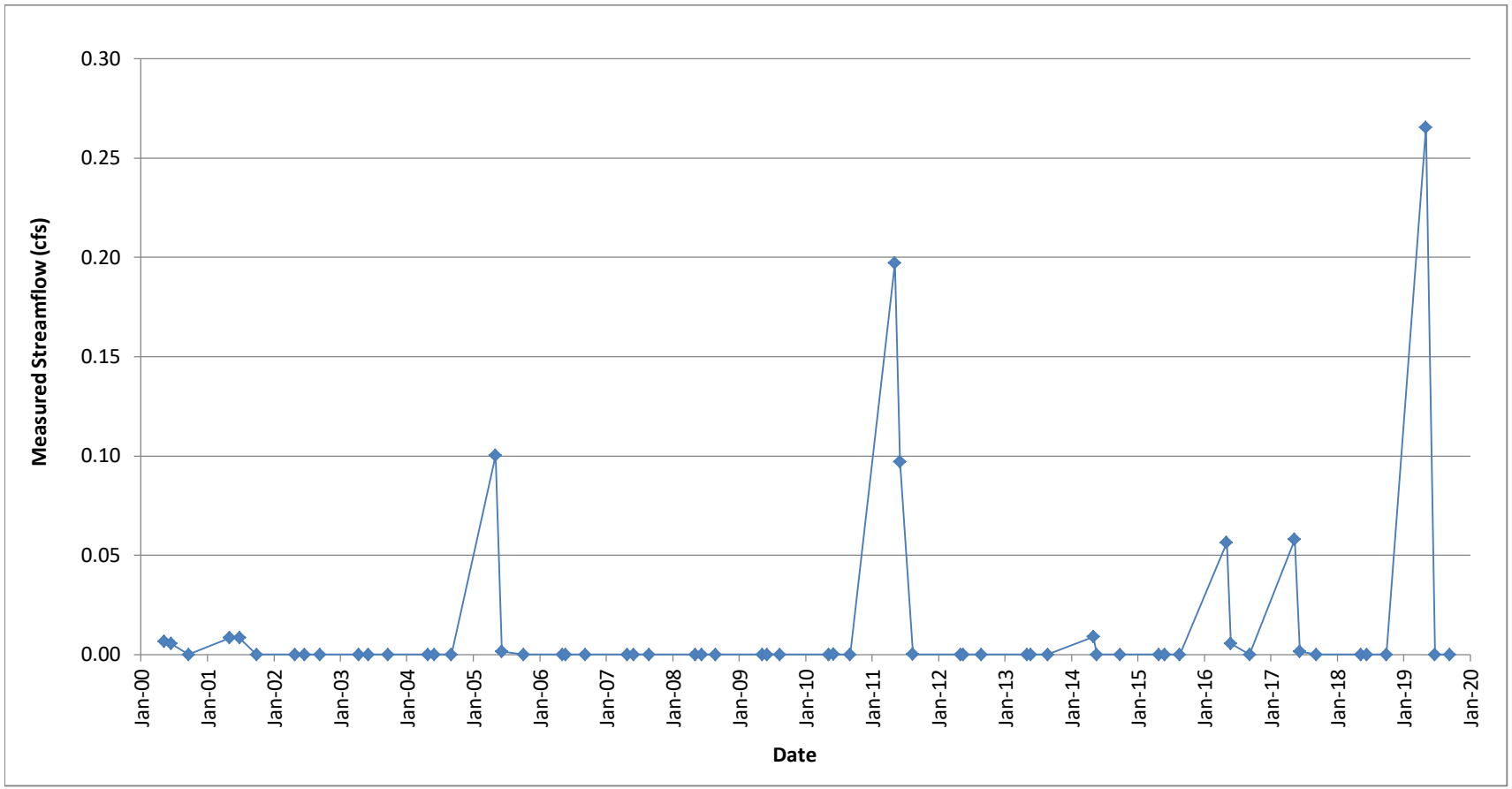
Upper Sylvester Gulch Flume
Hydrograph



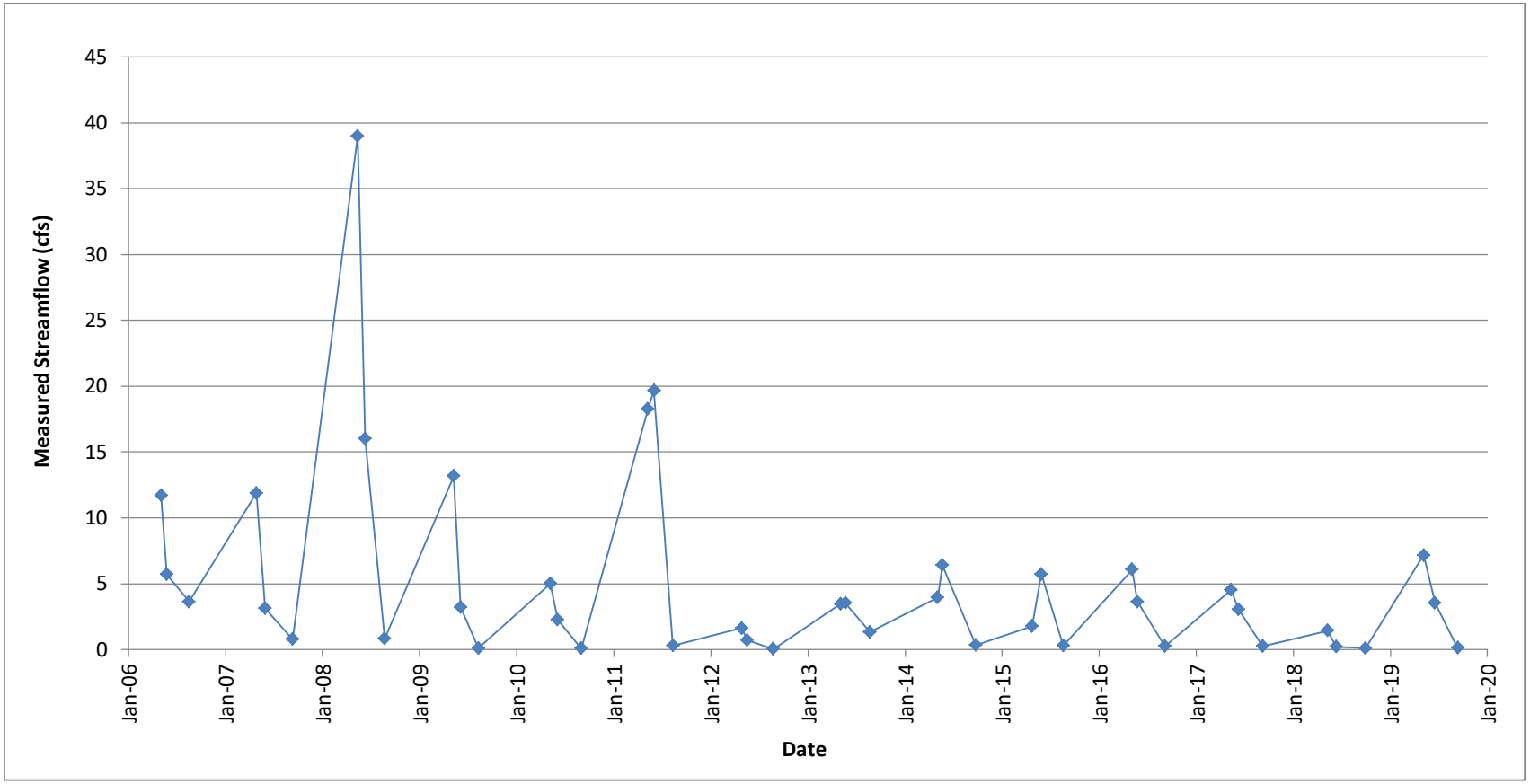
Horse Gulch
Hydrograph



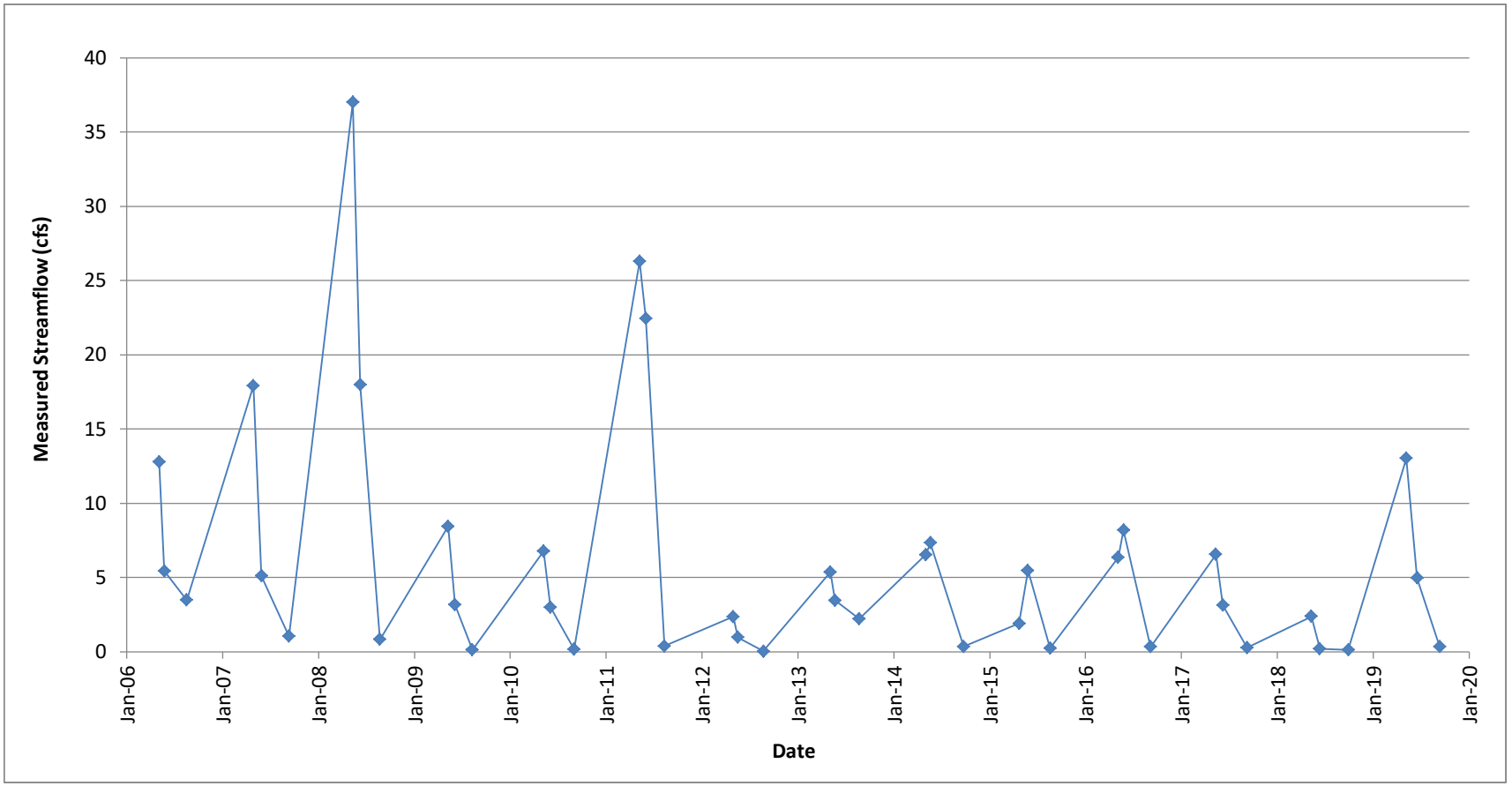
East Gulch east of Horse Gulch
Hydrograph



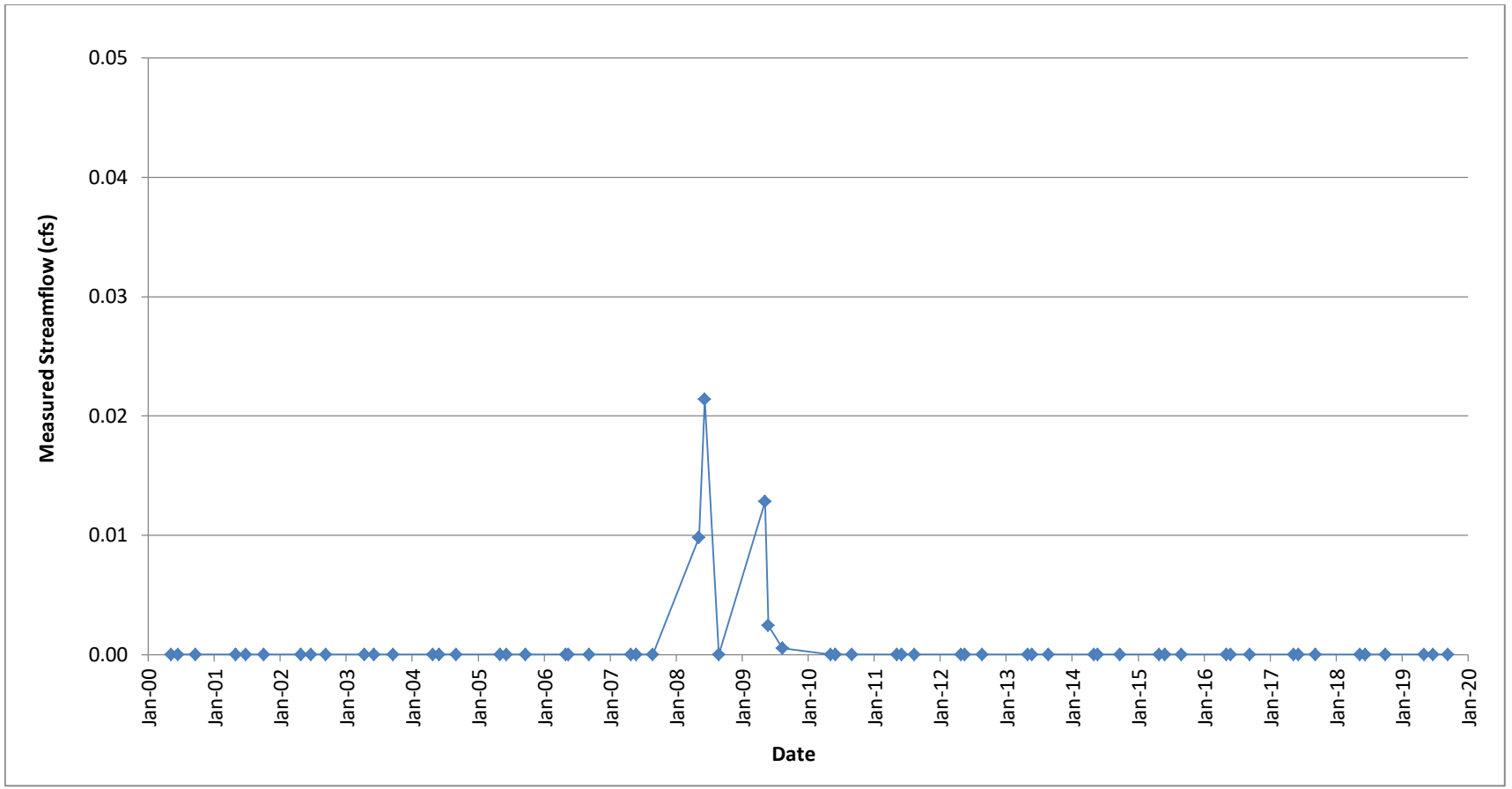
Upper Deep Creek
Hydrograph



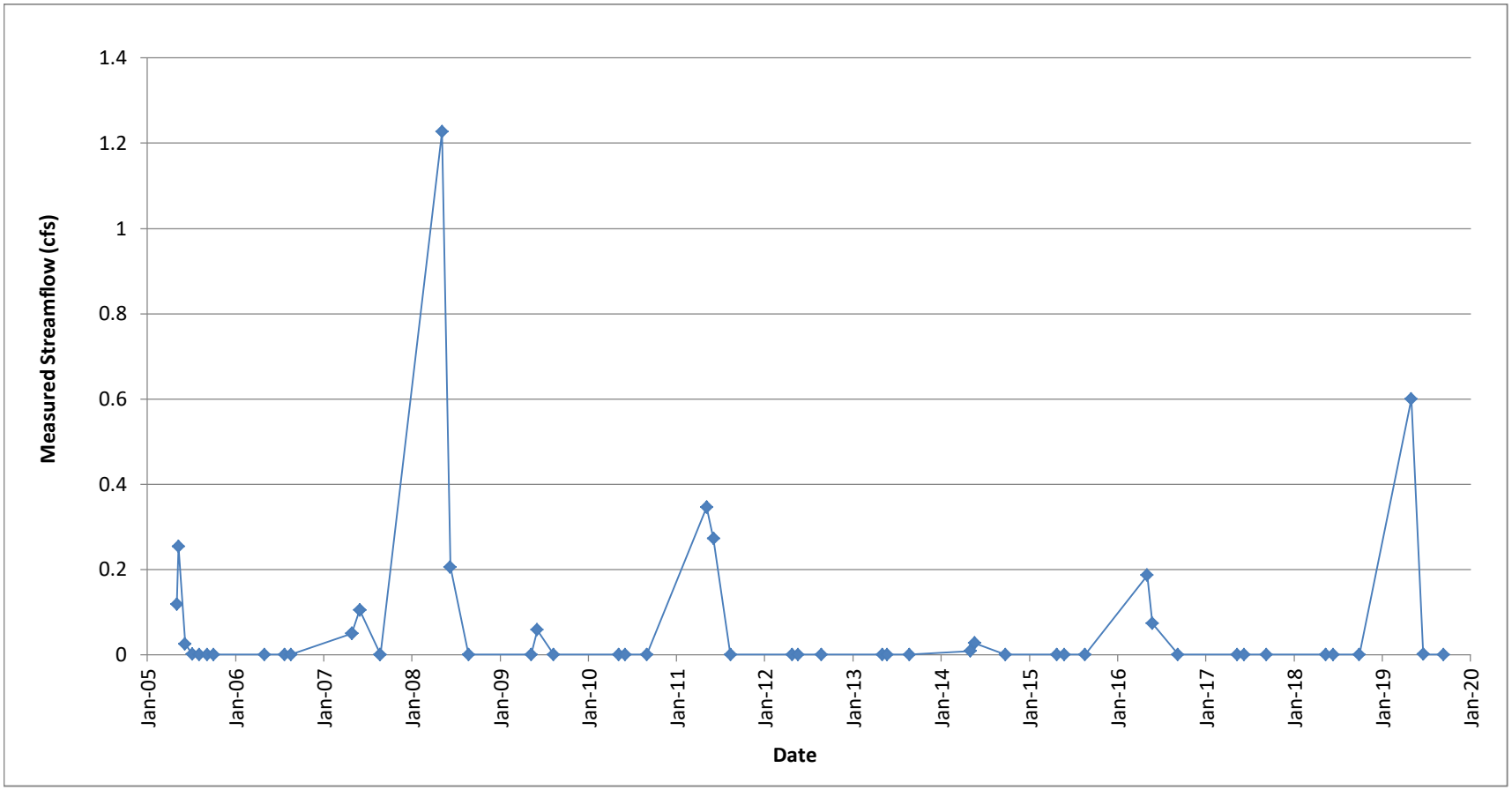
Lower Deep Creek
Hydrograph



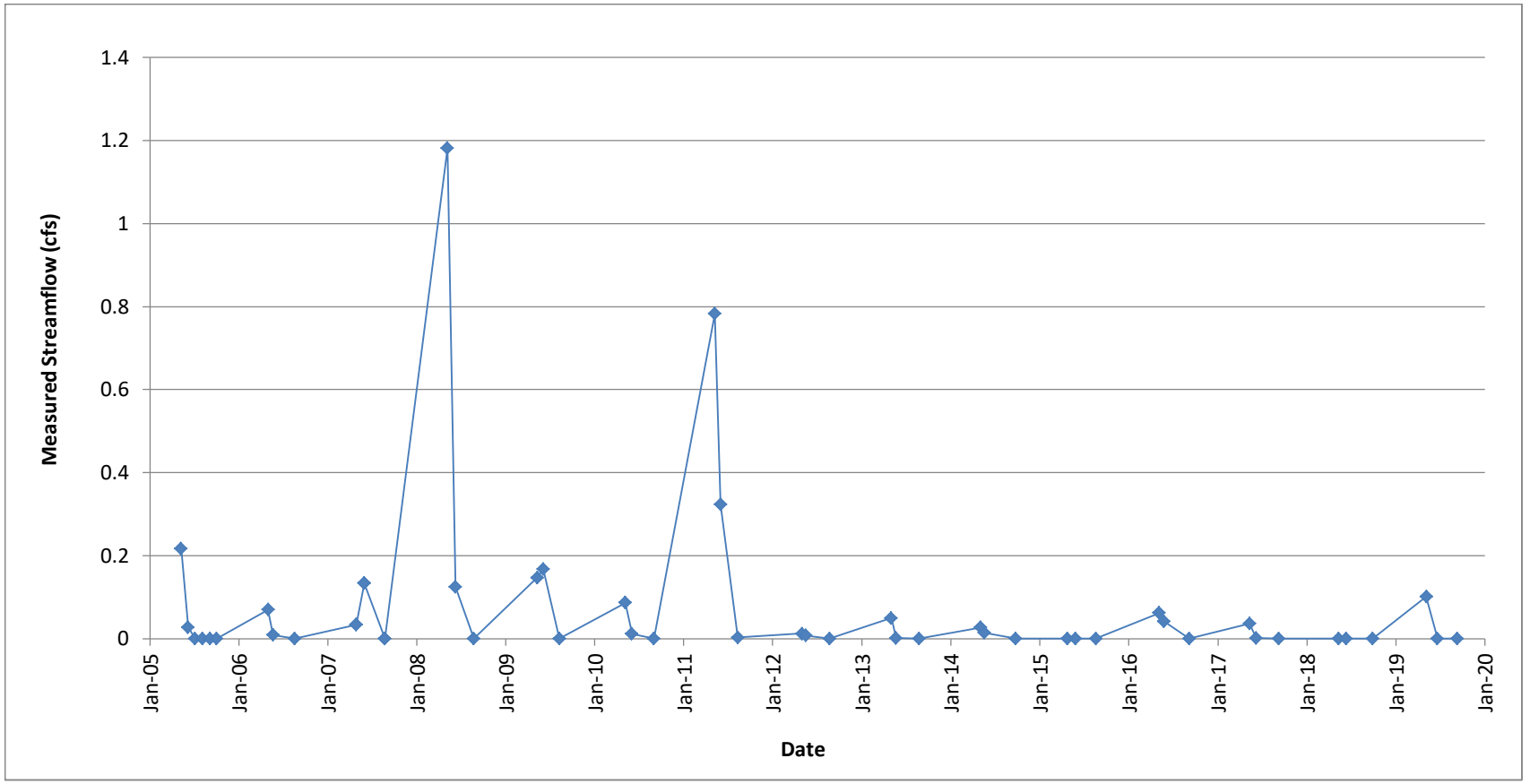
Box Canyon
Hydrograph



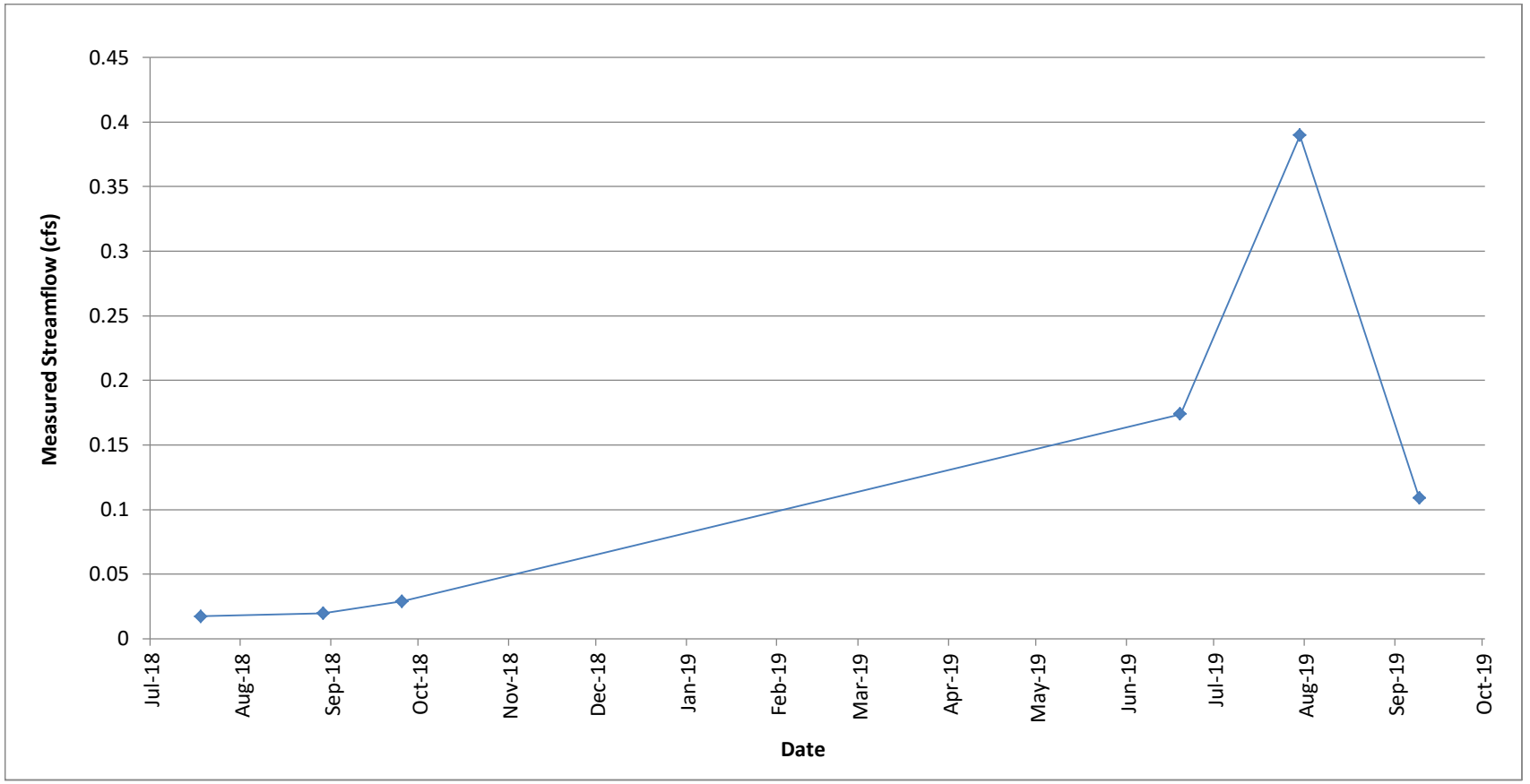
Deer Creek
Hydrograph



Poison Gulch
Hydrograph



Stream ST-SW-1
Hydrograph



APPENDIX C

SURFACE WATER - LABORATORY AND FIELD WATER QUALITY DATA

Upper North Fork (USGS)
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Upper North Fork (USGS)		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/18/2019	Q[4]	6/18/2019 (Duplicate)	Q[4]	9/10/2019	Q[4]
Field Parameters											
Flow	staff gage				NA	NA		--		NA	
Conductivity (Field)	µmhos/cm				147	86.1		--			
pH (Field)	SU				8.43	8.17		--			
Temperature (Field)	°C				5.4	9.4		--			
Comment											
Laboratory Parameters [2]											
Name of Certified Lab [3]						ACZ		ACZ		ACZ	
Lab Reference #						L52582-02		L52582-04		L54524-03	
Sample Date						6/18/2019		6/18/2019		9/10/2019	
Lab Test Date						6/19-7/9		6/19-7/9		9/13-9/25	
Sampled By						PH		PH		PH	
Alkalinity (Total CaCO3)	mg/L					39.9		44.5		65.9	
Aluminum, dissolved	mg/L					-0.05	U	-0.05	U	-0.05	U
Arsenic, dissolved	meq/L					-0.0002	U	-0.0002	U	0.0003	B
Arsenic, total recoverable	mg/L	0.001	0.001	0.001		0.0008	B	0.0008	B	0.0003	B
Bicarbonate as CaCO3	mg/L	40.9	167	81.3		39.9		44.5		65.9	
Boron, dissolved	mg/L					-0.02	U	-0.02	U	-0.02	U
Boron, total	mg/L					-0.02	U	-0.02	U	-0.02	U
Cadmium, dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Cadmium, potentially dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Calcium, dissolved	mg/L					12.1		12.2		20.6	
Carbonate as CaCO3	mg/L					-10	U	-10	U	-2	U
Cation - Anion Balance	mg/L					-11.2		-5.7		3.4	
Chloride	%		10	3		0.9	B	0.9	B	1.0	B
Chromium, total	meq/L					-0.01	U	-0.01	U	0.01	B
Conductivity @25C	mg/L	76	241	169		91		91		143	
Copper, dissolved	mg/L	0.01	0.01	0.01		-0.01	U	-0.01	U	-0.01	U
Cyanide, total	µmhos/cm					-0.003	U	-0.003	U	-0.003	U
Hardness as CaCO3	mg/L	40	107	70		37		38		64	
Hydroxide as CaCO3	mg/L					-10	U	-10	U	-2	U
Iron, dissolved	mg/L		0.38	0.09		-0.03	U	-0.03	U	-0.03	U
Iron, total	mg/L		26.3	1.6		2.78		3.05		0.19	
Iron, total recoverable	mg/L					2.99		3.13		0.17	
Lead, dissolved	mg/L		0.02	0.01		-0.03	U	-0.03	U	-0.03	U
Magnesium, dissolved	mg/L	2	3.4	2.9		1.6		1.7		3.0	
Manganese, dissolved	mg/L		0.009	0.006		-0.01	U	-0.01	U	-0.01	U
Manganese, total	mg/L		0.19	0.04		0.05		0.05		0.02	B
Mercury, total	mg/L					-0.0002	U	-0.0002	U	-0.0002	U
Molybdenum, dissolved	mg/L					-0.02	U	-0.02	U	-0.02	U
Nickel, dissolved or potentially dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Nickel, total	mg/L					0.008	B	-0.008	U	-0.008	U
Nitrate/Nitrite (as N)	mg/L		0.19	0.06		0.04	B	0.04	B	-0.02	U
Nitrogen, ammonia	mg/L					-0.05	U	-0.05	U	-0.05	U
pH	mg/L	6.7	9.0	7.8		8.1	H	8.1	H	8.2	H
Phosphate	mg/L					0.12	B	0.12	B	0.09	B
Phosphorus, ortho dissolved	SU		1.61	0.12		0.04	B	0.04	B	0.03	BH
Potassium, dissolved	mg/L					0.4	B	0.4	B	0.7	B
Residue, Filterable (TDS) @180C	mg/L	30	650	109		70		64		82	
Residue, Non-Filterable (TSS) @105C	mg/L		636	55		72.0		68.0		-5	U
Silver, total	mg/L					-0.0001	U	-0.0001	U	-0.0001	U
Sodium Adsorption Ratio (SAR)	mg/L	0.2	1.62	0.5		0.22		0.22		0.27	
Sodium, dissolved	calc.	3.4	5.7	4.6		3.0		3.0		4.9	
Sulfate	mg/L		70	10		14.7		5.8		-1	U
Sum of Anions	mg/L					1.1		1.0		1.4	
Sum of Cations	mg/L					0.879		0.892		1.5	
TDS (calculated)	calc.					57		51.1		70.4	
TDS (ratio - measured/calculated)	mg/L					1.23		1.25		1.16	
Zinc, dissolved	mg/L					-0.01	U	-0.01	U	-0.01	U

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower North Fork
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Lower North Fork		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/18/2019	Q [4]	9/10/2019	Q [4]	9/10/2019 (Duplicate)	Q [4]
Field Parameters											
Flow	staff gage				not measured	not measured		not measured		not measured	
Conductivity (Field)	µmhos/cm				146.7	86.1		140.3		--	
pH (Field)	SU				8.27	8.27		8.31		--	
Temperature (Field)	°C				4.7	9.3		10.9		--	
Comment											
Laboratory Parameters 2											
Name of Certified Lab 3						ACZ		ACZ		ACZ	
Lab Reference #						L52582-03		L54524-02		L54524-04	
Sample Date						6/18/2019		9/10/2019		9/10/2019	
Lab Test Date						6/19-7/9		9/13-9/25		9/13-9/25	
Sampled By						PH		PH		PH	
Alkalinity (Total CaCO3)	mg/L					40.5		67.3		65.9	
Aluminum, dissolved	mg/L					-0.05	U	-0.05	U	-0.05	U
Arsenic, dissolved	mg/L					-0.0002	U	0.0003	B	0.0004	B
Arsenic, total recoverable	mg/L					0.0008	B	0.0003	B	0.0003	B
Bicarbonate as CaCO3	mg/L	41	138	78		40.5		67.3		65.9	
Boron, dissolved	mg/L					-0.02	U	-0.02	U	-0.02	U
Boron, total	mg/L					-0.02	U	-0.02	U	-0.02	U
Cadmium, dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Cadmium, potentially dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Calcium, dissolved	mg/L					12.3		19.9		19.8	
Carbonate as CaCO3	mg/L					-10	U	-2	U	-2	U
Cation - Anion Balance	%					-5.4		3.4		3.4	
Chloride	mg/L	1.6	8	3.8		0.9	B	1.1	B	1.2	B
Chromium, total	mg/L					-0.01	U	0.01	B	-0.01	U
Conductivity @25C	µmhos/cm					90		146		141	
Copper, dissolved	mg/L					-0.01	U	-0.01	U	-0.01	U
Cyanide, total	mg/L					-0.003	U	-0.003	U	-0.003	U
Hardness as CaCO3	mg/L	39.3	109	68.7		38		62		61	
Hydroxide as CaCO3	mg/L					-10	U	-2	U	-2	U
Iron, dissolved	mg/L		0.126	0.065		-0.03	U	-0.03	U	-0.03	U
Iron, total	mg/L	0.09	3.8	0.92		3.11		0.19		0.22	
Iron, total recoverable	mg/L					2.64		0.16		0.17	
Lead, dissolved	mg/L					-0.03	U	-0.03	U	-0.03	U
Magnesium, dissolved	mg/L					1.7		3.0		2.9	
Manganese, dissolved	mg/L	0.0002	0.05	0.01		-0.01	U	-0.01	U	-0.01	U
Manganese, total	mg/L					0.06		0.02	B	0.02	B
Mercury, total	mg/L					-0.0002	U	-0.0002	U	-0.0002	U
Molybdenum, dissolved	mg/L					-0.02	U	-0.02	U	-0.02	U
Nickel, dissolved or potentially dissolved	mg/L					-0.008	U	-0.008	U	-0.008	U
Nickel, total	mg/L					-0.008	U	-0.008	U	-0.008	U
Nitrate/Nitrite (as N)	mg/L					0.04	B	-0.02	U	-0.02	U
Nitrogen, ammonia	mg/L					-0.05	U	-0.05	U	-0.05	U
pH	SU	7	8.8	8.1		8.1	H	8.2	H	8.1	H
Phosphate	mg/L					0.09	B	0.09	B	0.06	B
Phosphorus, ortho dissolved	mg/L		2.74	0.25		0.03	B	0.03	BH	0.02	BH
Potassium, dissolved	mg/L					0.4	B	0.7	B	0.7	B
Residue, Filterable (TDS) @180C	mg/L	36	180	101		64		88		84	
Residue, Non-Filterable (TSS) @105C	mg/L	6.4	107	36		72.0		5.0	B	-5	U
Selenium, total recoverable	mg/L					-0.0001	U	-0.0001	U	-0.0001	U
Silver, total	mg/L					-0.0001	U	-0.0001	U	-0.0001	U
Sodium Adsorption Ratio (SAR)	calc.					0.21		0.27		0.26	
Sodium, dissolved	mg/L					3		4.8		4.6	
Sulfate	mg/L	4	25	12		6.4		-1	U	-1	U
Sum of Anions	meq/L					1		1.4		1.4	
Sum of Cations	meq/L					0.897		1.5		1.5	
TDS (calculated)	calc.					49.4		70.6		69.4	
TDS (ratio - measured/calculated)	mg/L					1.3		1.25		1.21	
Zinc, dissolved	mg/L					-0.01	U	-0.01	U	-0.01	U

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Upper Sylvester Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Upper Sylvester Gulch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q [4]	9/12/2019
Field Parameters								
Flow	staff gage	0.26'	0.64'	0.45'	0.08'	0.01'		dry
Conductivity (Field)	µmhos/cm	300	380	340	657	720		
pH (Field)	SU	8.1	8.3	8.2	8.08	8.62		
Temperature (Field)	°C	8.4	9.5	9.0	8.8	10.7		
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]								
Lab Reference #								
Sample Date								
Lab Test Date								
Sampled By								
Alkalinity (Total CaCO3)	mg/L	212	212	212				
Aluminum, dissolved	mg/L	0.03	0.03	0.03				
Bicarbonate as CaCO3	mg/L	204	204	204				
Cadmium, dissolved	mg/L	0.003	0.003	0.003				
Calcium, dissolved	mg/L	35.1	35.1	35.1				
Carbonate as CaCO3	mg/L	8	8	8				
Cation - Anion Balance	%	-4.1	-4.1	-4.1				
Chloride	mg/L	2	2	2				
Conductivity @25C	µmhos/cm	462	462	462		657		
Copper, dissolved	mg/L	0.01	0.01	0.01				
Hardness as CaCO3	mg/L	124	124	124				
Hydroxide as CaCO3	mg/L	2	2	2				
Iron, dissolved	mg/L	0.01	0.01	0.01		-0.03	U	
Iron, total	mg/L	0.07	0.07	0.07		0.17		
Lead, dissolved	mg/L	0.04	0.04	0.04				
Magnesium, dissolved	mg/L	8.8	8.8	8.8				
Manganese, dissolved	mg/L	0.005	0.005	0.005				
Manganese, total	mg/L	0.005	0.005	0.005				
Mercury, total	mg/L	0.0002	0.0002	0.0002				
Molybdenum, dissolved	mg/L	0.01	0.01	0.01				
pH	SU					8.6	H	
Phosphate	mg/L	0.03	0.03	0.03				
Phosphorus, ortho dissolved	mg/L	0.005	0.005	0.005				
Potassium, dissolved	mg/L	1.4	1.4	1.4				
Residue, Filterable (TDS) @180C	mg/L	250	260	255		426		
Residue, Non-Filterable (TSS) @105C	mg/L	8	20	14		7.0	B	
Selenium, total recoverable	mg/L	0.04	0.04	0.04				
Sodium Adsorption Ratio (SAR)	calc.	2.03	2.03	2.03				
Sodium, dissolved	mg/L	51.4	51.4	51.4				
Sulfate	mg/L	40	40	40				
Sum of Anions	meq/L	5.1	5.1	5.1				
Sum of Cations	meq/L	4.7	4.7	4.7				
Zinc, dissolved	mg/L	0.01	0.01	0.01				

[1] Baseline and WY 2000 data adapted from WWE (2001).
[2] Negative values denote readings below lab detection levels.
[3] ACZ Laboratory, Steamboat Springs, CO.
[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Middle Sylvester Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Middle Sylvester Gulch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/18/2019	Q[4]	9/10/2019
Field Parameters					873	898		
Flow	staff gage				9.11	9.05		dry
Conductivity (Field)	µmhos/cm				12	13		
pH (Field)	SU							
Temperature (Field)	°C							
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52582-01		
Sample Date						6/18/2019		
Lab Test Date						6/19-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L					351		
Aluminum, dissolved	mg/L					-0.05	U	
Arsenic, dissolved	mg/L					0.0	B	
Arsenic, total recoverable	mg/L					0.0004	B	
Bicarbonate as CaCO3	mg/L		448	310		317		
Boron, dissolved	mg/L					0.13		
Boron, total	mg/L					0.13		
Cadmium, dissolved	mg/L					-0.008	U	
Cadmium, potentially dissolved	mg/L					-0.008	U	
Calcium, dissolved	mg/L					49.9		
Carbonate as CaCO3	mg/L					34.1		
Cation - Anion Balance	%					2.6		
Chloride	mg/L	3	10	5		26		
Chromium, total	mg/L					-0.01	U	
Conductivity @25C	µmhos/cm	480	800	606		859		
Copper, dissolved	mg/L					-0.01	U	
Cyanide, total	mg/L					0	U	
Hardness as CaCO3	mg/L	159	234	194		222		
Hydroxide as CaCO3	mg/L					-10	U	
Iron, dissolved	mg/L		0.4	0.1		0.03	B	
Iron, total	mg/L	0.05	10.5	2.0		0.17		
Iron, total recoverable	mg/L					0.18		
Lead, dissolved	mg/L					-0.03	U	
Magnesium, dissolved	mg/L					23.7		
Manganese, dissolved	mg/L					0.02	B	
Manganese, total	mg/L		0.56	0.05		0.02	B	
Mercury, total	mg/L					-0.0002	U	
Molybdenum, dissolved	mg/L					-0.02	U	
Nickel, dissolved or potentially dissolved	mg/L					0.009	B	
Nickel, total	mg/L					-0.008	U	
Nitrate/Nitrite (as N)	mg/L		0.08	0.02		-0.02	U	
Nitrogen, ammonia	mg/L					-0.05	U	
pH	SU	7.35	8.70	8.08		8.6	H	
Phosphate	mg/L					-0.03	U	
Phosphorus, ortho dissolved	mg/L		0.875	0.110		-0.01	U	
Potassium, dissolved	mg/L					2.9		
Residue, Filterable (TDS) @180C	mg/L	3.68	584	381		508		
Residue, Non-Filterable (TSS) @105C	mg/L	4.2	5,740	419		7.0	B	
Selenium, total recoverable	mg/L					0.0003		
Silver, total	mg/L					-0.0001	U	
Sodium Adsorption Ratio (SAR)	calc.	2.29	3.02	2.70		3.5		
Sodium, dissolved	mg/L					120		
Sulfate	mg/L	28.2	80	46.1		72.5		
Sum of Anions	meq/L					9.3		
Sum of Cations	meq/L					9.8		
TDS (calculated)	calc.					509		
TDS (ratio - measured/calculated)	mg/L					1.0		
Zinc, dissolved	mg/L					-0.01	U	

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower Sylvester Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Lower Sylvester Gulch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/18/2019	Q[4]	9/12/2019
Field Parameters								
Flow	staff gage	0.07	0.07	0.07	not measured	not measured		dry
Conductivity (Field)	µmhos/cm	620	700	653	880	881		
pH (Field)	SU	8.50	9.70	8.90	9.13	9.06		
Temperature (Field)	°C	7.9	10.2	9	11.1	13.0		
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-03		
Sample Date						6/18/2019		
Lab Test Date						6/21-7/9		
Sampled By								
Alkalinity (Total CaCO3)	mg/L	323	323	323				
Aluminum, dissolved	mg/L	0.03	0.03	0.03				
Arsenic, total recoverable	mg/L	0.001	0.001	0.001				
Bicarbonate as CaCO3	mg/L	315	315	315				
Cadmium, dissolved	mg/L	0.003	0.003	0.003				
Calcium, dissolved	mg/L	41	41	41				
Carbonate as CaCO3	mg/L	8	8	8				
Cation - Anion Balance	%	-3.2	-3.2	-3.2				
Chloride	mg/L	4	4	4				
Conductivity @25C	µmhos/cm	597	597	597		824		
Copper, dissolved	mg/L	0.01	0.01	0.01				
Hardness as CaCO3	mg/L	179	179	179				
Hydroxide as CaCO3	mg/L	2	2	2				
Iron, dissolved	mg/L	0.05	0.05	0.05		0.03	B	
Iron, total	mg/L	0.17	0.17	0.17		0.09		
Lead, dissolved	mg/L	0.04	0.04	0.04				
Magnesium, dissolved	mg/L	18.7	18.7	18.7				
Manganese, dissolved	mg/L	0.007	0.007	0.007				
Manganese, total	mg/L	0.005	0.005	0.005				
Mercury, total	mg/L	0.0002	0.0002	0.0002				
Molybdenum, dissolved	mg/L	0.01	0.01	0.01				
Nitrate/Nitrite (as N)	mg/L	0.05	0.05	0.05				
pH	SU	8.3	8.3	8.3		8.5	H	
Phosphate	mg/L	0.09	0.09	0.09				
Phosphorus, ortho dissolved	mg/L	0.031	0.031	0.031				
Potassium, dissolved	mg/L	2.2	2.2	2.2				
Residue, Filterable (TDS) @180C	mg/L	400	430	410		502		
Residue, Non-Filterable (TSS) @105C	mg/L	5	120	74		7.0	B	
Selenium, total recoverable	mg/L	0.04	0.04	0.04				
Sodium Adsorption Ratio (SAR)	calc.	2.89	2.89	2.89				
Sodium, dissolved	mg/L	87.8	87.8	87.8				
Sulfate	mg/L	70	70	70				
Sum of Cations	meq/L	7.5	7.5	7.5				
Zinc, dissolved	mg/L	0.01	0.01	0.01				

[1] Baseline and WY 2000 data adapted from WWE (2001).
[2] Negative values denote readings below lab detection levels.
[3] ACZ Laboratory, Steamboat Springs, CO.
[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower Minnesota Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Lower Minnesota Creek		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/17/2019	Q[4]	6/17/2019 (Duplicate)	Q[4]	9/9/2019
Field Parameters										
Flow	staff gage				1.35'	1.57'		--		0.69'
Conductivity (Field)	µmhos/cm				414	175.5		--		145.8
pH (Field)	SU				7.87	7.33		--		8.52
Temperature (Field)	°C				5.4	10.8		--		14.6
Comment										
Laboratory Parameters [2]										
Name of Certified Lab [3]						ACZ		ACZ		
Lab Reference #						L52582-09		L52582-09		
Sample Date						6/17/2019		6/17/2019		
Lab Test Date						6/21-7/5		6/21-7/1		
Sampled By						PH		PH		
Bicarbonate as CaCO3	mg/L	46	75	60						
Calcium, dissolved	mg/L	19.6	19.6	19.6						
Chloride	mg/L		2	1						
Conductivity @25C	µmhos/cm	152	803	350		174		175		
Hardness as CaCO3	mg/L	65	106	82						
Iron, dissolved	mg/L	0.23	0.58	0.41		-0.03	U	-0.03	U	
Iron, total	mg/L	0.45	82	8.9		13.0		13.0		
Magnesium, dissolved	mg/L	6.1	8.7	7.4						
Manganese, dissolved	mg/L	0.013	0.015	0.014						
Manganese, total	mg/L	0.018	1.83	0.188						
pH	SU					8.2	H	8.2	H	
Residue, Filterable (TDS) @180C	mg/L	100	584	231		116		114		
Residue, Non-Filterable (TSS) @105C	mg/L	16	1,300	292		536	H	474		
Sodium Adsorption Ratio (SAR)	calc.	0.3	0.5	0.4						
Sodium, dissolved	mg/L	7.7	7.7	7.7						
Sulfate	mg/L	20	50	40						

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Upper Minnesota Creek Flume (USFS)
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: U. Minnesota Ck Flume (USFS)		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/19/2019	Q[4]	9/9/2019
Field Parameters								
Flow	staff gage				1.80'	2.00'		1.20'
Conductivity (Field)	µmhos/cm				371	151.7		122.4
pH (Field)	SU				8.68	8.45		8.47
Temperature (Field)	°C				5.9	12.1		15.2
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-07		
Sample Date						6/19/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Conductivity @25C	µmhos/cm					157		
Iron, dissolved	mg/L					-0.03	U	
Iron, total	mg/L					6.3		
pH	SU					8.2	H	
Residue, Filterable (TDS) @180C	mg/L					120		
Residue, Non-Filterable (TSS) @105C	mg/L					195		

[1] No baseline data.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower Dry Fork Flume
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019										
Monitoring Location: Lower Dry Fork Flume		**Baseline [1]**			**Water Year 2019**					
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/20/2019	Q[4]	6/20/2019 (Duplicate)	Q[4]	9/9/2019
Field Parameters										
Flow	staff gage				0.22'	0.28'		--		0.32'
Conductivity (Field)	µmhos/cm				567	535		--		337
pH (Field)	SU				8.69	8.83		--		8.44
Temperature (Field)	°C				7.9	15.3		--		15.2
Comment										
Laboratory Parameters [2]										
Name of Certified Lab [3]						ACZ		ACZ		
Lab Reference #						L52785-07		L52785-09		
Sample Date						6/20/2019		6/20/2019		
Lab Test Date						6/26-7/11		6/26-7/11		
Sampled By						PH		PH		
Bicarbonate as CaCO3	mg/L	118	324	220						
Calcium, dissolved	mg/L	87.9	87.9	87.9						
Chloride	mg/L		8.4	4.2						
Conductivity @25C	µmhos/cm	207	1,920	755		512		513		
Hardness as CaCO3	mg/L	125	726	360						
Iron, dissolved	mg/L		0.178	0.049		0.04	B	0.05	B	
Iron, total	mg/L	0.02	84	5.6		0.90		1.04		
Magnesium, dissolved	mg/L	9.8	49	29						
Manganese, dissolved	mg/L	0.008	0.013	0.011						
Manganese, total	mg/L		46.4	1.4						
Nitrate/Nitrite (as N)	mg/L	0.1	0.3	0.2						
pH	SU	6.9	9	8.2		8.5	H	8.5	H	
Phosphorus, ortho dissolved	mg/L		0.763	0.048						
Sodium Adsorption Ratio (SAR)	calc.	0.71	1.48	1.11						
Sodium, dissolved	mg/L	69	69	69						
Sulfate	mg/L	35	613	249						
Residue, Filterable (TDS) @180C	mg/L	158	1,388	581		346		348		
Residue, Non-Filterable (TSS) @105C	mg/L	1.2	1,098	144		21.0		21.0		

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Middle Dry Fork Flume
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Middle Dry Fork Flume		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	staff gage				0.90'	0.33'		0.27'
Conductivity (Field)	µmhos/cm	30	480	213	216	316		168.2
pH (Field)	SU	7.80	8.50	8.20	8.47	8.68		8.79
Temperature (Field)	°C	3.6	19.8	12	5.2	14.4		9.9
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-20		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	34	270	142				
Aluminum, dissolved	mg/L	0.07	0.07	0.07				
Arsenic, total recoverable	mg/L	0.002	0.002	0.002				
Bicarbonate as CaCO3	mg/L	34	270	142				
Calcium, dissolved	mg/L	6.6	56.6	31.96				
Cation - Anion Balance	%	-22.2	-22.2	-22.2				
Chloride	mg/L		4	1				
Conductivity @25C	µmhos/cm	76	76	76		299		
Hardness as CaCO3	mg/L	23	208	115				
Iron, dissolved	mg/L	0.11	0.11	0.11		0.11		
Iron, total	mg/L	0.16	14.2	3.14		2.01		
Magnesium, dissolved	mg/L	1.5	17.6	8.7				
Manganese, dissolved	mg/L	0.029	0.029	0.029				
Manganese, total	mg/L	0.01	0.432	0.11				
Nitrate (as N), dissolved	mg/L		0.57	0.10				
Nitrate/Nitrite (as N)	mg/L		0.57	0.12				
Nitrite (as N), dissolved	mg/L		0.1	0.02				
pH	SU	6.7	6.7	6.7		8.4	H	
Phosphate	mg/L	0.33	0.33	0.33				
Phosphorus, ortho dissolved	mg/L		0.166	0.041				
Potassium, dissolved	mg/L	0.5	0.5	0.5				
Residue, Filterable (TDS) @180C	mg/L	50	300	172		218		
Residue, Non-Filterable (TSS) @105C	mg/L		278	72		46.0		
Sodium Adsorption Ratio (SAR)	calc.	0.47	1.19	0.78				
Sodium, dissolved	mg/L	5.9	38.8	19.9				
Sulfate	mg/L		50	25				
Sum of Anions	meq/L	1.1	1.1	1.1				
Sum of Cations	meq/L	0.7	0.7	0.7				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Upper Dry Fork Flume
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Upper Dry Fork Flume		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	staff gage	0.08'	0.58'	0.28'	0.66'	0.37'		0.39'
Conductivity (Field)	µmhos/cm	114	699	310	101.6	102		59.2
pH (Field)	SU	7.01	8.42	7.76	7.82	7.96		8.28
Temperature (Field)	°C	11.9	16.0	13.5	6.7	11.9		10.4
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-06		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	24	100	57				
Aluminum, dissolved	mg/L	0.04	0.34	0.13				
Arsenic, total recoverable	mg/L	0.0005	0.0012	0.0008				
Bicarbonate as CaCO3	mg/L	24	100	57				
Boron, dissolved	mg/L	-0.01	-0.01	-0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	4.6	20.1	11.5				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	%	-11.1	4.3	-5.2				
Chloride	mg/L	1	8	3				
Conductivity @25C	µmhos/cm	47	246	135		106		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	16	67	39				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.06	0.32	0.20		-0.03	U	
Iron, total	mg/L	1.70	3.64	2.75		0.98		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	1.1	4.0	2.4				
Manganese, dissolved	mg/L	0.007	0.035	0.017				
Manganese, total	mg/L	0.047	0.103	0.078				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.15	0.04				
pH	SU	7.8	8.2	8.0		8.1	H	
Phosphate	mg/L	0.06	0.12	0.08				
Phosphorus, ortho dissolved	mg/L	0.02	0.04	0.03				
Potassium, dissolved	mg/L	-0.3	1.1	0.6				
Residue, Filterable (TDS) @180C	mg/L	40	160	105		82		
Residue, Non-Filterable (TSS) @105C	mg/L	24	88	42		18.0	B	
Selenium, total recoverable	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	0.20	1.36	0.80				
Sodium, dissolved	mg/L	1.9	25.2	12.5				
Sulfate	mg/L	-10	20	3				
Sum of Anions	meq/L	0.5	2.2	1.4				
Sum of Cations	meq/L	0.4	2.4	1.3				
TDS (calculated)	calc.	23	123	73				
TDS (ratio - measured/calculated)	mg/L	1.22	1.74	1.52				
Zinc, dissolved	mg/L	0.01	0.02	0.02				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lick Creek Flume
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Lick Creek Flume		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/19/2019	Q[4]	9/9/2019
Field Parameters								
Flow	staff gage				0.41'	0.32'		dry
Conductivity (Field)	µmhos/cm				198	174.9		
pH (Field)	SU				7.10	8.92		
Temperature (Field)	°C				4.0	8.1		
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-08		
Sample Date						6/19/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Aluminum, dissolved	mg/L	0.12	0.12	0.12				
Arsenic, dissolved	mg/L	0.001	0.001	0.001				
Bicarbonate as CaCO3	mg/L	56	229	111				
Calcium, dissolved	mg/L	25.5	25.5	25.5				
Chloride	mg/L		8	4				
Conductivity @25C	µmhos/cm	118	481	238		177		
Hardness as CaCO3	mg/L	45	169	87				
Iron, dissolved	mg/L		0.56	0.13		-0.03	U	
Iron, total	mg/L	0.49	11.3	4.06		2.39		
Magnesium, dissolved	mg/L	5.3	6.9	6.1				
Manganese, dissolved	mg/L	0.007	0.015	0.012				
Manganese, total	mg/L	0.003	0.39	0.11				
Molybdenum, dissolved	mg/L		0.01	0.005				
Nitrate/Nitrite (as N)	mg/L		0.13	0.04				
pH	SU	7.1	8.75	7.85		8.3	H	
Phosphorus, ortho dissolved	mg/L		1.67	0.19				
Residue, Filterable (TDS) @180C	mg/L	90	552	169		138		
Residue, Non-Filterable (TSS) @105C	mg/L	4	614	157		74.0		
Sodium Adsorption Ratio (SAR)	calc.	0.59	1.08	0.86				
Sodium, dissolved	mg/L	23.6	23.6	23.6				
Sulfate	mg/L	8.5	47.2	21.03				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Horse Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Horse Gulch		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/20/2019	9/11/2019
Field Parameters							
Flow	gpm				dry	dry	dry
Conductivity (Field)	µmhos/cm	240	740	542			
pH (Field)	SU	8.2	8.5	8.3			
Temperature (Field)	°C	5.1	14.7	10.0			
Comment							
Laboratory Parameters [2]							
Name of Certified Lab [3]							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/L	128	332	270			
Aluminum, dissolved	mg/L	0.04	0.04	0.04			
Arsenic, total recoverable	mg/L	0.001	0.001	0.001			
Bicarbonate as CaCO3	mg/L	128	331	268			
Calcium, dissolved	mg/L		0.004	0.000			
Carbonate as CaCO3	mg/L		9	2			
Cation - Anion Balance	%	-4.8	-4.8	-4.8			
Chloride	mg/L	1	5	3			
Conductivity @25C	µmhos/cm	780	780	780			
Hardness as CaCO3	mg/L	89	324	255			
Iron, dissolved	mg/L	0.05	0.05	0.05			
Iron, total	mg/L	0.1	3.09	0.83			
Magnesium, dissolved	mg/L	7	29.4	22.7			
Manganese, dissolved	mg/L	0.007	0.007	0.007			
Manganese, total	mg/L		0.34	0.04			
Nitrate/Nitrite (as N)	mg/L		0.36	0.12			
pH	SU	8.3	8.3	8.30			
Phosphate	mg/L	0.11	0.11	0.11			
Phosphorus, ortho dissolved	mg/L		0.037	0.011			
Potassium, dissolved	mg/L	3.6	3.6	3.6			
Residue, Filterable (TDS) @180C	mg/L	170	440	354			
Residue, Non-Filterable (TSS) @105C	mg/L						
Sodium Adsorption Ratio (SAR)	calc.	0.72	1.35	1.2			
Sodium, dissolved	mg/L	15.5	54	41.1			
Sulfate	mg/L	10	90	66			
Sum of Anions	meq/L	6.5	6.5	6.5			
Sum of Cations	meq/L	5.9	5.9	5.9			

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

East Gulch, East of Horse Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: E. Gulch, E. of Horse Gulch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/1/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm				119	dry		dry
Conductivity (Field)	µmhos/cm	260	480	402	308			
pH (Field)	SU	7.7	8.4	8.0	8.35			
Temperature (Field)	°C	4.8	14.8	10.0	7.2			
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]								
Lab Reference #								
Sample Date								
Lab Test Date								
Sampled By								
Alkalinity (Total CaCO3)	mg/L	135	245	202				
Aluminum, dissolved	mg/L	0.03	0.03	0.03				
Bicarbonate as CaCO3	mg/L	135	245	202				
Calcium, dissolved	mg/L	26.8	53.6	42.6				
Carbonate as CaCO3	mg/L		6	0.5				
Chloride	mg/L	1	4	2				
Conductivity @25C	µmhos/cm	453	453	453				
Hardness as CaCO3	mg/L	95	190	156				
Iron, dissolved	mg/L	0.05	0.05	0.05				
Iron, total	mg/L	0.41	3.59	1.07				
Magnesium, dissolved	mg/L	6.9	13.7	11.6				
Manganese, dissolved	mg/L	0.012	0.012	0.012				
Manganese, total	mg/L	0.01	0.094	0.068				
Nitrate/Nitrite (as N)	mg/L	0.04	0.23	0.13				
pH	SU	8	8	8				
Phosphate	mg/L	0.2	0.2	0.2				
Phosphorus, ortho dissolved	mg/L		0.066	0.018				
Potassium, dissolved	mg/L	1.8	1.8	1.8				
Residue, Filterable (TDS) @180C	mg/L	170	290	252				
Residue, Non-Filterable (TSS) @105C	mg/L		50	17				
Sodium Adsorption Ratio (SAR)	calc.	0.94	1.65	1.5				
Sodium, dissolved	mg/L	20.9	47.8	40.2				
Sum of Anions	meq/L	4.9	4.9	4.9				
Sum of Cations	meq/L	4.9	4.9	4.9				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Upper Deep Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Upper Deep Creek		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm				3,214	1,585		53.9
Conductivity (Field)	µmhos/cm	80	310	192	264	148.7		535
pH (Field)	SU	8.10	8.80	8.50	8.17	8.33		8.87
Temperature (Field)	°C	0.2	18.6	10.0	6.7	10.4		10.0
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-02		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L		160	103.4				
Bicarbonate as CaCO3	mg/L	53	153	106.3				
Calcium, dissolved	mg/L	14	44.4	28.7				
Carbonate as CaCO3	mg/L		9	1.3				
Cation - Anion Balance	%	-3.4	-2	-2.7				
Chloride	mg/L		2	0.2				
Conductivity @25C	µmhos/cm	139	242	191		156		
Hardness as CaCO3	mg/L	47	138	91				
Iron, dissolved	mg/L	0.02	0.04	0		-0.03	U	
Iron, total	mg/L	0.14	9.43	2.63		5.32		
Magnesium, dissolved	mg/L	2.6	6.6	4.6				
Manganese, dissolved	mg/L		0.007	0.004				
Manganese, total	mg/L	0.005	0.282	0				
Nitrate/Nitrite (as N)	mg/L		0.05	0.01				
pH	SU	6.9	8	7.5		8.3	H	
Phosphate	mg/L	0.12	0.2	0.16				
Phosphorus, ortho dissolved	mg/L		0.065	0.013				
Potassium, dissolved	mg/L	0.7	1.2	1.0				
Residue, Filterable (TDS) @180C	mg/L	60	210	133		136		
Residue, Non-Filterable (TSS) @105C	mg/L					225		
Sodium Adsorption Ratio (SAR)	calc.	0.32	0.77	0.6				
Sodium, dissolved	mg/L	7.9	20	13.8				
Sulfate	mg/L		30	10.8				
Sum of Anions	meq/L	1.5	2.6	2.1				
Sum of Cations	meq/L	1.4	2.5	2.0				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower Deep Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Lower Deep Creek		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm				5,840	2,222		149
Conductivity (Field)	µmhos/cm	120	380	246	284	167.7		490
pH (Field)	SU	8.10	8.80	8.50	8.12	8.49		8.89
Temperature (Field)	°C	0.1	16.4	10.0	6.5	11.6		9.6
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52655-11		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/3		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	61	183	126				
Aluminum, dissolved	mg/L		0.03	0.02				
Bicarbonate as CaCO3	mg/L	65	173	132				
Calcium, dissolved	mg/L	18.6	46.8	31.9				
Carbonate as CaCO3	mg/L		12	2				
Cation - Anion Balance	%	-6.7	-2.9	-4.8				
Chloride	mg/L		2	1				
Conductivity @25C	µmhos/cm	162	270	216		177		
Iron, dissolved	mg/L	0.03	0.43	0.23		0.06	B	
Iron, total	mg/L	0.11	5.83	1.68		4.02		
Magnesium, dissolved	mg/L	3.1	7.5	5.4				
Manganese, dissolved	mg/L		0.009	0.005				
Manganese, total	mg/L		0.16	0.04				
Nitrate/Nitrite (as N)	mg/L		0.10	0.03				
pH	SU	6.5	8.20	7.4		8.3	H	
Phosphate	mg/L	0.08	0.09	0.09				
Phosphorus, ortho dissolved	mg/L		0.32	0.007				
Potassium, dissolved	mg/L	0.8	1.1	1.0				
Residue, Filterable (TDS) @180C	mg/L	90	250	165		132		
Residue, Non-Filterable (TSS) @105C	mg/L		448	93		140		
Sodium Adsorption Ratio (SAR)	calc.	0.59	1.32	0.94				
Sodium, dissolved	mg/L	12.3	31.4	21.6				
Sulfate	mg/L		30	19				
Sum of Anions	meq/L	1.8	3.2	2.5				
Sum of Cations	meq/L	1.7	2.8	2.25				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Box Canyon
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Box Canyon		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/22/2019	9/10/2019
Field Parameters							
Flow	gpm				dry	dry	dry
Conductivity (Field)	µmhos/cm	840	1020	916			
pH (Field)	SU	7.9	8.9	8.3			
Temperature (Field)	°C	2.0	15.9	10.0			
Comment							
Laboratory Parameters [2]							
Name of Certified Lab [3]							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/L	401	447	427			
Aluminum, dissolved	mg/L	0[(4)]	0.07[(4)]	0.03[(4)]			
Arsenic, dissolved	mg/L	0	0	0			
Arsenic, total recoverable	mg/L	0	0.006	0.001			
Bicarbonate as CaCO3	mg/L	398	447	425			
Cadmium, dissolved	mg/L	0	0.003	0.0008			
Calcium, dissolved	mg/L	40.2	67.9	58.0			
Carbonate as CaCO3	mg/L	0	12	2			
Cation - Anion Balance	%	-4	3.6	0.02			
Chloride	mg/L	2	6	5			
Conductivity @25C	µmhos/cm	868	968	921			
Hardness as CaCO3	mg/L	195	283	255			
Hydroxide as CaCO3	mg/L	0	0	0			
Iron, dissolved	mg/L	0	0.02	0.01			
Iron, total	mg/L	0.02	0.44	0.16			
Magnesium, dissolved	mg/L	23	28	27			
Manganese, total	mg/L	0	0.009	0.002			
Nitrate (as N), dissolved	mg/L	0.13	0.48	0.30			
Nitrate/Nitrite (as N)	mg/L	0.13	0.48	0.30			
pH	SU	8	8.2	8.1			
Phosphate	mg/L	0	0.03	0.01			
Phosphorus, ortho dissolved	mg/L	0	0.007	0.002			
Potassium, dissolved	mg/L	2.6	3.3	3.0			
Residue, Filterable (TDS) @180C	mg/L	540	620	586			
Residue, Non-Filterable (TSS) @105C	mg/L	0	38	19			
Selenium, dissolved	mg/L	0.001	0.002	0.002			
Selenium, total recoverable	mg/L	0	0.003	0.001			
Sodium Adsorption Ratio (SAR)	calc.	3.43	4.26	3.91			
Sodium, dissolved	mg/L	127	154	141			
Sulfate	mg/L	100	140	118			
Sum of Anions	meq/L	10.3	12.1	11.1			
Sum of Cations	meq/L	9.5	12.23	11.1			
Zinc, dissolved	mg/L	0	0.01	0.002			

[1] Baseline and WY 2000 data adapted from WWE (2001). Shaded cells indicate value different from AHR 2000 baseline value due to rounding.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] Baseline value is for total Aluminum.

Deer Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Deer Creek		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/1/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.72	114	44.7	269	0.25		dry
Conductivity (Field)	µmhos/cm	537	796	659	356	1,550		
pH (Field)	SU	8.3	8.4	8.4	8.76	8.13		
Temperature (Field)	°C	11.2	16.9	13.1	9.1	23.9		
Comment						flow estimated, water muddy from cows		
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-18		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	247	274	263				
Aluminum, dissolved	mg/L	-0.03	-0.03	-0.03				
Arsenic, dissolved	mg/L	-0.0005	-0.0005	-0.0005				
Arsenic, total recoverable	mg/L	-0.0005	0.0009	0.0006				
Bicarbonate as CaCO3	mg/L	218	249	235				
Boron, dissolved	mg/L	0.03	0.03	0.03				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	47.0	64.5	56.5				
Carbonate as CaCO3	mg/L	25	30	28				
Cation - Anion Balance	%	-5.7	4.6	3.7				
Chloride	mg/L	3	3	3				
Conductivity @25C	µmhos/cm	487	547	517		1,680		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	176	245	211				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.09	0.11	0.10		-0.2	U	
Iron, total	mg/L	0.36	2.92	1.64		13.4		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	14.3	20.4	18.3				
Manganese, dissolved	mg/L	-0.005	0.009	0.005				
Manganese, total	mg/L	-0.005	0.049	0.026				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	0.88	2.07	1.50				
pH	SU	8.5	8.6	8.6		8.4	H	
Phosphate	mg/L	0.03	0.12	0.08				
Phosphorus, ortho dissolved	mg/L	0.01	0.04	0.03				
Potassium, dissolved	mg/L	3.2	3.6	3.4				
Residue, Filterable (TDS) @180C	mg/L	280	330	310		1,190		
Residue, Non-Filterable (TSS) @105C	mg/L	16	68	42		390		
Selenium, total recoverable	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	1.09	1.21	1.15				
Sodium, dissolved	mg/L	32.8	43.9	39.9				
Sulfate	mg/L	30	50	40				
Sum of Anions	meq/L	5.6	6.2	5.9				
Sum of Cations	meq/L	5.0	6.8	5.9				
TDS (calculated)	calc.	292	346	319				
TDS (ratio - measured/calculated)	mg/L	0.92	0.96	0.94				
Zinc, dissolved	mg/L	-0.01	0.02	0.01				

[1] Baseline 2005.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Poison Gulch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Poison Gulch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm				45.2	dry		dry
Conductivity (Field)	µmhos/cm	271	479	383	553			
pH (Field)	SU	6.56	7.08	6.74	8.13			
Temperature (Field)	°C	10.9	12.9	12.2	8.6			
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]								
Lab Reference #								
Sample Date								
Lab Test Date								
Sampled By								
Alkalinity (Total CaCO3)	mg/L	119	152	136				
Aluminum, dissolved	mg/L	-0.03	-0.03	-0.03				
Arsenic, total recoverable	mg/L	-0.0005	0.0007	0.0005				
Bicarbonate as CaCO3	mg/L	119	152	136				
Boron, dissolved	mg/L	0.02	0.03	0.03				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	22.0	35.5	28.8				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	%	-2.1	7.7	4.4				
Chloride	mg/L	1	1	1				
Conductivity @25C	µmhos/cm	240	295	268				
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	78	124	101				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.07	0.11	0.09				
Iron, total	mg/L	0.41	0.43	0.42				
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	5.6	8.6	7.1				
Manganese, dissolved	mg/L	-0.005	-0.005	-0.005				
Manganese, total	mg/L	-0.005	0.010	0.006				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
pH	SU	7.8	8.1	8.0				
Phosphate	mg/L	0.21	0.21	0.21				
Phosphorus, ortho dissolved	mg/L	0.07	0.07	0.07				
Potassium, dissolved	mg/L	2.9	2.9	2.9				
Residue, Filterable (TDS) @180C	mg/L	130	170	150				
Residue, Non-Filterable (TSS) @105C	mg/L	-5	28	15				
Selenium, total recoverable	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	0.82	0.92	0.87				
Sodium, dissolved	mg/L	16.6	23.3	20.0				
Sulfate	mg/L	-10	-10	-10				
Sum of Anions	meq/L	2.4	3.0	2.7				
Sum of Cations	meq/L	2.3	3.5	2.9				
TDS (calculated)	calc.	120	163	142				
TDS (ratio - measured/calculated)	mg/L	1.04	1.08	1.06				
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01				

[1] Baseline 2005.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Deep Creek Ditch
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Deep Creek Ditch		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm / staff	69.77	1527.27	562.69	0.45'	0.25'		0.28'
Conductivity (Field)	µmhos/cm	75.9	131	107	71.5	58.6		50.9
pH (Field)	SU	6.32	8.20	7.27	8.14	8.47		8.86
Temperature (Field)	°C	5.0	11.9	9.6	4.1	9.3		8.9
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-04		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	25	60	45				
Aluminum, dissolved	mg/L	0.05	0.15	0.10				
Arsenic, total recoverable	mg/L	-0.0005	0.0006	0.0003				
Bicarbonate as CaCO3	mg/L	25	60	45				
Boron, dissolved	mg/L	-0.01	-0.01	-0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	4.6	13.7	10.1				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	%	-11.1	6.7	-3.0				
Chloride	mg/L	1	9	3				
Conductivity @25C	µmhos/cm	50	113	88		60		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	16	47	35				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.04	0.14	0.09		0.03	B	
Iron, total	mg/L	1.19	2.59	1.83		0.89		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	1.1	3.1	2.3				
Manganese, dissolved	mg/L	-0.005	0.013	0.005				
Manganese, total	mg/L	0.032	0.090	0.064				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	3.39	0.90				
pH	SU	7.8	8.1	8.0		8.0	H	
Phosphate	mg/L	0.06	0.09	0.08				
Phosphorus, ortho dissolved	mg/L	0.02	0.03	0.03				
Potassium, dissolved	mg/L	-0.3	0.7	0.5				
Residue, Filterable (TDS) @180C	mg/L	40	100	75		52		
Residue, Non-Filterable (TSS) @105C	mg/L	8	76	32		23.0		
Selenium, total recoverable	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	0.19	0.33	0.28				
Sodium, dissolved	mg/L	1.8	5.2	3.9				
Sulfate	mg/L	-10	-10	-10				
Sum of Anions	meq/L	0.5	1.4	0.9				
Sum of Cations	meq/L	0.4	1.2	0.9				
TDS (calculated)	calc.	24	68	47				
TDS (ratio - measured/calculated)	mg/L	1.38	2.05	1.64				
Zinc, dissolved	mg/L	-0.01	0.03	0.02				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Minnesota Reservoir Flume
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Minnesota Reservoir Flume		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/1/2019	6/20/2019	Q[4]	9/12/2019
Field Parameters								
Flow	gpm / staff	83	3,591	1,364	1.00'	0.31'		0.27'
Conductivity (Field)	µmhos/cm	114	682	360	245	347		168.2
pH (Field)	SU	7.97	8.75	8.29	8.36	8.72		8.79
Temperature (Field)	°C	14.8	24.1	18.5	4.8	14.8		9.9
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-01		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/12		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	46	230	140				
Aluminum, dissolved	mg/L	-0.03	0.08	0.05				
Arsenic, dissolved	mg/L	-0.001	0.001	0.001				
Bicarbonate as CaCO3	mg/L	46	213	134				
Boron, dissolved	mg/L	-0.01	0.02	0.01				
Cadmium, dissolved	mg/L	-0.01	-0.01	-0.01				
Calcium, dissolved	mg/L	8.9	53.7	31.2		25.1		
Carbonate as CaCO3	mg/L	-2	18	8				
Cation - Anion Balance	%	-5.9	2.1	-1.1				
Chloride	mg/L	1.00	3.00	1.86				
Conductivity @25C	µmhos/cm	95	456	295		324		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	31	192	111		87		
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.03	0.26	0.10		0.13		
Iron, total	mg/L	0.36	3.62	1.58		1.80		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	2.1	14.1	8.1		5.8		
Manganese, dissolved	mg/L	-0.01	0.09	0.03				
Manganese, total	mg/L	0.031	0.397	0.136				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate (as N), dissolved	mg/L	-0.02	0.64	0.22				
pH	SU	8.0	8.5	8.3		8.4	H	
Phosphate	mg/L	-0.03	0.40	0.12				
Phosphorus, ortho dissolved	mg/L	-0.01	0.13	0.04				
Potassium, dissolved	mg/L	0.6	2.0	1.3				
Residue, Filterable (TDS) @180C	mg/L	70	250	176		234		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	60	26		31.0		
Selenium, dissolved	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	0.38	1.16	0.72				
Sodium, dissolved	mg/L	4.8	32.4	17.3				
Sulfate	mg/L	-10	30	6				
Sum of Anions	meq/L	0.90	4.80	3.06				
Sum of Cations	meq/L	0.8	4.7	3.0				
TDS (calculated)	calc.	46	244	158				
TDS (ratio - measured/calculated)	mg/L	0.99	1.74	1.24				
Zinc, dissolved	mg/L	-0.01	0.02	0.01				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

South Prong Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019													
Monitoring Location: South Prong Creek		**Baseline [1]**			**Water Year 2019**								
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	6/19/2019	Q[4]	6/19/2019 (Duplicate)	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters													
Flow	gpm/staff	--	--	--	0.65'		1.5'		--		0.57'		0.24'
Conductivity (Field)	µmhos/cm	64.9	178	109.2	178.0		64.9		--		73.6		98.2
pH (Field)	SU	7.5	9	8.5	7.53		9.25		--		8.63		8.67
Temperature (Field)	°C	4.9	16	10.6	4.9		5.5		--		13.6		11.6
Comment							flooding, flume over full						
Laboratory Parameters [2]													
Name of Certified Lab [3]					ACZ		ACZ		ACZ		ACZ		
Lab Reference #					L51688-07		L52655-08		L52655-04		L53580-09		
Sample Date					5/8/2019		6/19/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	31.9	64.6	50.4	64.6		31.9		31.5		40.7		
Aluminum, dissolved	mg/L	-0.05	0.04	0.03	-0.05	U	-0.05	U	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	0.0003	0.0011	0.0005	0.0006	B	0.0003	B	0.0004	B	0.0011		
Bicarbonate as CaCO3	mg/L	31.9	63.6	50.3	63.6		31.9		31.5		40.7		
Boron, dissolved	mg/L	-0.02	0.01	0.01	-0.02	U	-0.02	U	-0.02	U	-0.02	U	
Cadmium, dissolved	mg/L	-0.008	-0.005	-0.005	-0.008	U	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	7.7	14.4	11.5	14.4		7.7		7.7		9.3		
Carbonate as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-10	U	-2	U	
Cation-Anion Balance	calc.	-4.8	0.0	-2.7	-3.4		-3.1		-2.7		-4.7		
Chloride	mg/L	-0.5	1.0	0.4	1	B	0.6	B	0.6	B	-0.5	U	
Conductivity @25C	umhos/cm	66	146	103	146		66		68		86		
Copper, dissolved	mg/L	-0.01	0.03	0.01	-0.01	U	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	25.0	50.0	39.3	50.0		25.0		25.0		31.0		
Hydroxide as CaCO3	mg/L	-10	-2	-2.0	-10	U	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	-0.03	0.05	0.03	-0.03	U	-0.03	U	0.03	B	-0.03	U	
Iron, total	mg/L	0.60	4.01	1.64	1.66		1.07		1.09		4.01		
Lead, dissolved	mg/L	-0.03	0.04	0.02	-0.03	U	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	1.5	3.5	2.6	3.5		1.5		1.5		1.9		
Manganese, dissolved	mg/L	-0.01	0.01	0.00	-0.01	U	-0.01	U	-0.01	U	-0.01	U	
Manganese, total	mg/L	0.02	0.08	0.04	0.05		0.02	B	0.02	B	0.08		
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	0.15	0.04	0.05	B	0.15		0.15		-0.02	U	
pH	units	7.8	8.3	8.1	8.3	H	8.0	H	8.0	H	7.8	H	
Phosphate	mg/L	-0.06	0.12	0.08	0.09	B	0.09	B	0.09	B	0.12	B	
Phosphorus, ortho dissolved	mg/L	-0.02	0.04	0.03	0.03	BH	0.03	B	0.03	B	0.04	B	
Potassium, dissolved	mg/L	0.2	0.9	0.5	0.6	B	0.2	B	-0.2	U	0.4	B	
Residue, Filterable (TDS) @180C	mg/L	52	128	82	128		52		54		74		
Residue, Non-Filterable (TSS) @105C	mg/L	18.0	140.0	57.5	87.0		30.0	H	33.0	H	140.0		
Selenium, total recoverable	mg/L	-0.0001	0.0003	0.0001	0.0003		-0.0001	U	0.0001	B	0.0001	B	
Sodium Adsorption Ratio in Water	calc.	0.26	0.58	0.32	0.58		0.29		0.29		0.26		
Sodium, dissolved	mg/L	3.3	9.4	4.6	9.4		3.3		3.3		3.3		
Sulfate	mg/L	-1	7.7	2.0	7.7		1.2	B	2.1	B	1.8	B	
Sum of Anions	meq/L	0.7	1.5	1.059	1.5		0.7		0.691		0.852		
Sum of Cations	meq/L	0.658	1.4	1.006	1.4		0.658		0.655		0.776		
TDS (calculated)	mg/L	34.0	75.4	52.0	75.4		34.0		34.4		41.5		
TDS (ratio - measured/calculated)	calc.	1.36	1.78	1.57	1.70		1.53		1.57		1.78		
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is July 2018 through July 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limits.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

South Fork of South Prong Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: South Fork of South Prong Creek		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters											
Flow	gpm	--	--	--	1,603		5,147		1,322		345.5
Conductivity (Field)	µmhos/cm	55.9	144.0	96.7	144.0		55.9		66.6		92.9
pH (Field)	SU	7.5	8.4	8.0	7.5		7.53		8.1		8.51
Temperature (Field)	°C	4.5	13.0	9.8	4.5		9.1		12.1		11.2
Comment											
Laboratory Parameters [2]											
Name of Certified Lab [3]					ACZ		ACZ		ACZ		
Lab Reference #					L51688-06		L52655-02		L53580-07		
Sample Date					5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	28.9	56.1	45.5	56.1		28.9		38.5		
Aluminum, dissolved	mg/L	-0.05	-0.03	-0.03	-0.05	U	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	0.0002	0.0003	0.0002	0.0002	B	0.0002	B	0.0002	B	
Bicarbonate as CaCO3	mg/L	28.9	56.1	45.5	56.1		28.9		38.5		
Boron, dissolved	mg/L	-0.02	0.01	0.01	-0.02	U	-0.02	U	-0.02	U	
Cadmium, dissolved	mg/L	-0.008	-0.005	-0.005	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	6.6	14.1	10.6	12.5		6.6		8.1		
Carbonate as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Cation-Anion Balance	calc.	-10.8	9.1	-2.1	0.0		-10.8		-7.9		
Chloride	mg/L	-0.5	0.6	0.4	-0.5	U	0.6	B	-0.5	U	
Conductivity @25C	umhos/cm	58	120	90	120		58		73		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	22	47	37	44		22		27		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	-0.03	0.04	0.03	-0.03	U	-0.03	U	-0.03	U	
Iron, total	mg/L	0.33	0.62	0.49	0.51		0.55		0.33		
Lead, dissolved	mg/L	-0.03	0.03	0.02	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	1.3	3.0	2.4	3.0		1.3		1.7		
Manganese, dissolved	mg/L	-0.01	0.01	0.004	-0.01	U	-0.01	U	-0.01	U	
Manganese, total	mg/L	0.01	0.02	0.02	0.02	B	0.01	B	0.01	B	
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	0.14	0.05	0.02	B	0.14		-0.02	U	
pH	units	7.6	8.2	8.0	8.2	H	7.9	H	7.6	H	
Phosphate	mg/L	-0.06	0.06	0.05	0.06	B	0.06	B	0.06	B	
Phosphorus, ortho dissolved	mg/L	-0.02	0.02	0.02	0.02	BH	0.02	B	0.02	B	
Potassium, dissolved	mg/L	-0.2	0.7	0.4	0.4	B	-0.2	U	0.2	B	
Residue, Filterable (TDS) @180C	mg/L	46	104	69	104		46		46		
Residue, Non-Filterable (TSS) @105C	mg/L	8.0	17.0	14.2	17.0	B	17.0	BH	8.0	B	
Selenium, total recoverable	mg/L	-0.0001	0.0002	0.0001	0.0002	B	-0.0001	U	-0.0001	U	
Sodium Adsorption Ratio in Water	calc.	0.24	0.45	0.30	0.45		0.24		0.24		
Sodium, dissolved	mg/L	2.6	6.7	4.1	6.7		2.6		2.9		
Sulfate	mg/L	-1.0	5.2	2.0	5.2		4.3	B	1.1	B	
Sum of Anions	meq/L	0.685	1.2	0.946	1.2		0.685		0.793		
Sum of Cations	meq/L	0.551	1.2	0.926	1.200		0.551		0.677		
TDS (calculated)	mg/L	33.0	62.0	47.1	62.0		33.0		37.5		
TDS (ratio - measured/calculated)	calc.	1.23	1.68	1.44	1.68		1.39		1.23		
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is July 2018 through July 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

North Fork of South Prong Creek
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019													
Monitoring Location: North Fork of South Prong Creek		**Baseline [1]**			**Water Year 2019**								
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	5/8/2019 (Duplicate)	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters													
Flow	gpm	--	--	--	27.99		--		134.14		9.95		dry
Conductivity (Field)	µmhos/cm	301	460	356	301		--		308		460		
pH (Field)	SU	8	9	8	7.50		--		8.21		8.88		
Temperature (Field)	°C	6	16	12	5.7		--		13.3		15.5		
Comment													
Laboratory Parameters [2]													
Name of Certified Lab [3]					ACZ		ACZ		ACZ		ACZ		
Lab Reference #					L51688-05		L51688-08		L52655-03		L53580-08		
Sample Date					5/8/2019		5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	120	199	152	120		130		136		199		
Aluminum, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	U	-0.05	U	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	0.0003	0.0004	0.0004	0.0004	B	0.0004	B	0.0003	B	0.0004	B	
Bicarbonate as CaCO3	mg/L	115	187	144	115		110		129		187		
Boron, dissolved	mg/L	-0.02	0.04	0.02	-0.02	U	-0.02	U	-0.02	U	0.04	B	
Cadmium, dissolved	mg/L	-0.008	-0.008	-0.008	-0.008	U	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	23.1	40.5	29.5	23.1		23.0		24.9		40.5		
Carbonate as CaCO3	mg/L	-10	11.7	7.2	-10	U	20.1		-10	U	11.7	B	
Cation-Anion Balance	calc.	0.0	1.6	0.9	0.0		-4.9		1.6		1.1		
Chloride	mg/L	1.7	2.3	2.1	2.2		2.5		1.7	B	2.3		
Conductivity @25C	umhos/cm	282	405	328	282		283		296		405		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	82	145	105	82		82		88		145		
Hydroxide as CaCO3	mg/L	-10	-2	4	-10	U	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	-0.03	U	
Iron, total	mg/L	0.33	0.65	0.47	0.65		0.66		0.33		0.44		
Lead, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	6.0	10.6	7.6	6.0		5.9		6.3		10.6		
Manganese, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	-0.01	U	
Manganese, total	mg/L	-0.01	-0.01	-0.01	-0.01	U	0.01	B	-0.01	U	-0.01	U	
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	0.01	-0.02	U	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	0.18	0.07	0.18		0.17		-0.02	U	-0.02	U	
pH	units	8.4	8.4	8.4	8.4	H	8.4	H	8.4	H	8.4	H	
Phosphate	mg/L	0.12	0.12	0.12	0.12	B	0.12	B	0.12	B	0.12	B	
Phosphorus, ortho dissolved	mg/L	0.04	0.04	0.04	0.04	BH	0.04	BH	0.04	B	0.04	B	
Potassium, dissolved	mg/L	1.2	1.8	1.4	1.3		1.3		1.2		1.8		
Residue, Filterable (TDS) @180C	mg/L	174	254	207	194		190		174		254		
Residue, Non-Filterable (TSS) @105C	mg/L	10.0	23.0	15.0	23.0		21.0		12.0	BH	10.0	B	
Selenium, total recoverable	mg/L	0.0002	0.0005	0.0003	0.0005		0.0005		0.0002	B	0.0002	B	
Sodium Adsorption Ratio in Water	calc.	1.3	1.5	1.4	1.3		1.3		1.4		1.5		
Sodium, dissolved	mg/L	27.2	41.1	32.6	27.2		27.0		29.4		41.1		
Sulfate	mg/L	19.6	30.9	24.8	23.8		23.5		19.6		30.9		
Sum of Anions	meq/L	2.9	4.7	3.5	2.9		3.2		3.0		4.7		
Sum of Cations	meq/L	2.9	4.8	3.6	2.9		2.9		3.1		4.8		
TDS (calculated)	mg/L	154	248	188	154		162		162		248		
TDS (ratio - measured/calculated)	calc.	1.02	1.26	1.12	1.26		1.17		1.07		1.02		
Zinc, dissolved	mg/L	-0.01	0.01	0.01	-0.01	U	-0.01	U	0.01	B	-0.01	U	

[1] Baseline period is July 2018 through July 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Stream ST-SW-1
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Stream ST-SW-1		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean [5]	6/19/2019	Q[4]	7/30/2019	Q[4]	7/30/2019 (Duplicate)	Q[4]	9/9/2019
Field Parameters											
Flow	gpm	--	--	--	77.97		174.7		174.7		48.87
Conductivity (Field)	µmhos/cm	97.6	118.1	108.4	108.3		97.6		97.6		115.8
pH (Field)	SU	8.0	8.8	8.4	8.70		8.21		8.21		8.38
Temperature (Field)	°C	7.3	14.1	10.8	14.1		10.7		10.7		11.9
Comment											
Laboratory Parameters [2]											
Name of Certified Lab [3]					ACZ		ACZ		ACZ		
Lab Reference #					L52655-01		L53580-05		L53580-06		
Sample Date					6/19/2019		7/30/2019		7/30/2019		
Lab Test Date					6/20-7/9		7/31-8/20		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	45.8	53.4	49.2	53.4		51.9		58.4		
Aluminum, dissolved	mg/L	-0.05	-0.03	-0.04	-0.05	U	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	0.0002	0.0005	0.0003	0.0003	B	0.0003	B	0.0005	B	
Bicarbonate as CaCO3	mg/L	45.8	53.4	49.2	53.4		51.9		58.4		
Boron, dissolved	mg/L	-0.02	0.02	0.01	-0.02	U	-0.02	U	-0.02	U	
Cadmium, dissolved	mg/L	-0.008	-0.005	-0.006	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	10.9	12.6	11.6	12.6		12.6		12.6		
Carbonate as CaCO3	mg/L	-10.0	-2.0	-3.6	-10.0	U	-2.0	U	-2.0	U	
Cation-Anion Balance	calc.	-12.0	24.6	0.2	-12.0		-4.3		-4.3		
Chloride	mg/L	-0.5	0.9	0.5	0.9	B	0.6	B	-0.5	U	
Conductivity @25C	umhos/cm	98	111	104	110		111		111		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	38	61	44	41		42		42		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-2	U	-2	U	
Iron, dissolved	mg/L	-0.03	0.07	0.04	0.05	B	-0.03	U	0.05	B	
Iron, total	mg/L	0.64	2.71	1.29	0.64		1.04		1.16		
Lead, dissolved	mg/L	-0.03	0.03	0.01	-0.03	U	0.03	B	-0.03	U	
Magnesium, dissolved	mg/L	2.4	8.1	3.6	2.4		2.6		2.6		
Manganese, dissolved	mg/L	-0.010	-0.005	-0.005	-0.010	U	-0.010	U	-0.010	U	
Manganese, total	mg/L	0.02	0.08	0.04	0.02	B	0.04	B	0.04	B	
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	0.11	0.05	-0.02	U	-0.02	U	-0.02	U	
pH	units	7.9	8.1	8.0	8.1	H	7.9	H	7.9	H	
Phosphate	mg/L	0.06	0.16	0.09	0.16	B	0.06	B	0.06	B	
Phosphorus, ortho dissolved	mg/L	0.02	0.05	0.03	0.05		0.02	B	0.02	B	
Potassium, dissolved	mg/L	0.4	1.0	0.6	0.4	B	0.4	B	0.4	B	
Residue, Filterable (TDS) @180C	mg/L	70	86	79	86		74		78		
Residue, Non-Filterable (TSS) @105C	mg/L	13.0	72.0	31.8	13.0	BH	25.0		23.0		
Selenium, total recoverable	mg/L	-0.0001	0.0001	0.0001	-0.0001	U	-0.0001	U	-0.0001	U	
Sodium Adsorption Ratio in Water	calc.	0.32	0.41	0.36	0.40		0.35		0.35		
Sodium, dissolved	mg/L	4.5	7.3	5.5	5.9		5.2		5.2		
Sulfate	mg/L	-1.0	15.7	5.8	15.7		4.5	B	1.9	B	
Sum of Anions	meq/L	1.0	1.4	1.1	1.4		1.2		1.2		
Sum of Cations	meq/L	0.964	1.6	1.1	1.1		1.1		1.1		
TDS (calculated)	mg/L	51.1	70.5	57.9	70.5		57.6		58.4		
TDS (ratio - measured/calculated)	calc.	1.22	1.57	1.37	1.22		1.28		1.34		
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is July 2018 through August 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Pond ST-P-1
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Pond ST-P-1		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/11/2019
Field Parameters											
Water Depth	feet	--	--	--	2.25		3.4		2.3		1.0
Conductivity (Field)	µmhos/cm	164.3	314	222	175		164.3		261		184.7
pH (Field)	SU	7.88	8.99	8.27	7.88		8.18		8.26		7.88
Temperature (Field)	°C	9.8	22.3	18.0	9.8		17.4		18.1		16.0
Comment					depth estimated		depth estimated, spillway flowing about 20 gpm		depth estimated		depth estimated
Laboratory Parameters [2]											
Name of Certified Lab [3]					ACZ		ACZ		ACZ		
Lab Reference #					L51688-01		L52655-07		L53580-01		
Sample Date					5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	47.9	103	81	47.9		85.4		101		
Aluminum, dissolved	mg/L	-0.05	0.12	0.05	-0.05	U	0.12	B	-0.05	U	
Arsenic, total recoverable	mg/L	0.0003	0.0080	0.0037	0.0003	B	0.0012		0.0039		
Bicarbonate as CaCO3	mg/L	47.9	103	81	47.9		85.4		101		
Boron, dissolved	mg/L	-0.02	0.06	0.03	-0.02	U	-0.02	U	0.03	B	
Cadmium, dissolved	mg/L	-0.008	-0.005	-0.005	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	9.8	22.3	16.0	14.3		20.0		22.3		
Carbonate as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Cation-Anion Balance	calc.	-2.2	12.0	3.4	12.0		0.0		2.2		
Chloride	mg/L	1.7	17.4	6.9	3.3		1.7	B	2.7		
Conductivity @25C	umhos/cm	148	217	187	148		172		217		
Copper, dissolved	mg/L	-0.01	0.02	0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	38	74	53	46		63		74		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	0.04	1.52	0.65	0.04	B	0.33		1.52		
Iron, total	mg/L	0.18	13.6	4.5	0.18		1.00		3.29		
Lead, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	2.4	4.4	3.2	2.4		3.2		4.4		
Manganese, dissolved	mg/L	-0.01	0.32	0.16	-0.01	U	0.02	B	0.26		
Manganese, total	mg/L	-0.01	0.65	0.30	-0.01	U	0.06		0.31		
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	3.85	0.78	3.85		-0.02	U	-0.02	U	
pH	units	7.8	8.1	7.9	8.1	H	8.0	H	7.8	H	
Phosphate	mg/L	-0.06	0.22	0.13	0.12	B	0.09	B	0.22		
Phosphorus, ortho dissolved	mg/L	-0.02	0.07	0.04	0.04	BH	0.03	B	0.07		
Potassium, dissolved	mg/L	3.6	7.1	5.5	5.1		3.6		7.0		
Residue, Filterable (TDS) @180C	mg/L	122	420	200	122		128		136	H	
Residue, Non-Filterable (TSS) @105C	mg/L	5.0	300.0	78.8	5.0	B	7.0	BH	30.0		
Selenium, total recoverable	mg/L	0.0002	0.0007	0.0004	0.0002	B	0.0002	B	0.0003		
Sodium Adsorption Ratio in Water	calc.	0.49	1.90	1.03	0.49		0.55		0.60		
Sodium, dissolved	mg/L	7.5	26.7	16.0	7.5		9.9		11.7		
Sulfate	mg/L	-1	6.1	3.1	4.1	B	2.9	B	6.1		
Sum of Anions	meq/L	1.1	2.3	1.9	1.1		1.8		2.2		
Sum of Cations	meq/L	1.4	2.3	2.0	1.4		1.8		2.3		
TDS (calculated)	mg/L	66	121	101	66		94		118		
TDS (ratio - measured/calculated)	calc.	1.15	3.96	1.98	1.85		1.36		1.15		
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is August 2018 through August 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Pond ST-P-2
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Pond ST-P-2		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters											
Water Depth	feet	--	--	--	2.15		2.10		1.70		dry
Conductivity (Field)	µmhos/cm	111.0	190.8	103.4	111.0		8.27		190.8		
pH (Field)	SU	6.6	8.3	42.2	6.55		112.40		7.53		
Temperature (Field)	°C	7.5	22.7	15.6	7.5		22.7		16.7		
Comment							spillway flowing about 1 gpm				
Laboratory Parameters [2]											
Name of Certified Lab [3]					ACZ		ACZ		ACZ		
Lab Reference #					L51688-04		L52655-09		L53580-04		
Sample Date					5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	42.6	91.8	64.6	42.6		59.5		91.8		
Aluminum, dissolved	mg/L	-0.05	0.19	0.08	0.19	B	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	0.000	0.001	0.000	0.000	B	0.000	B	0.001		
Bicarbonate as CaCO3	mg/L	42.6	91.8	64.6	42.6		59.5		91.8		
Boron, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Cadmium, dissolved	mg/L	-0.008	-0.008	-0.008	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	10.2	25.8	17.1	10.2		15.4		25.8		
Carbonate as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Cation-Anion Balance	calc.	2.1	4.8	3.6	2.1		4.0		4.8		
Chloride	mg/L	1.0	4.9	2.4	1.3	B	1.0	B	4.9		
Conductivity @25C	umhos/cm	90	201	136	90		118		201		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	36	89	59	36		53		89		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	0.05	0.85	0.35	0.14		0.05	B	0.85		
Iron, total	mg/L	0.13	1.68	0.72	0.34		0.13		1.68		
Lead, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	2.6	5.9	4.0	2.6		3.5		5.9		
Manganese, dissolved	mg/L	-0.01	0.04	0.02	-0.01	U	-0.01	U	0.04	B	
Manganese, total	mg/L	-0.01	0.11	0.04	-0.01	U	-0.01	U	0.11		
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
pH measured at	C	7.7	7.9	7.8	7.8	H	7.9	H	7.7	H	
Phosphate	mg/L	0.06	2.23	0.83	0.19	B	0.06	B	2.23		
Phosphorus, ortho dissolved	mg/L	0.02	0.72	0.27	0.06	H	0.02	B	0.72		
Potassium, dissolved	mg/L	0.6	7.0	2.9	1.1		0.6	B	7.0		
Residue, Filterable (TDS) @180C	mg/L	88	172	121	88		104		172		
Residue, Non-Filterable (TSS) @105C	mg/L	-20	7.0	5.7	-20	U	0.0	UH	7.0	B	
Selenium, total recoverable	mg/L	-0.0001	0.0006	0.0003	0.0003		-0.0001	U	0.0006		
Sodium Adsorption Ratio in Water	calc.	0.22	0.24	0.23	0.24		0.24		0.22		
Sodium, dissolved	mg/L	3.3	4.7	4.0	3.3		3.9		4.7		
Sulfate	mg/L	-1	-1	-1	-1	U	-1	U	-1	U	
Sum of Anions	meq/L	0.9	2.0	1.4	0.9		1.2		2.0		
Sum of Cations	meq/L	0.9	2.2	1.5	0.9		1.3		2.2		
TDS (calculated)	mg/L	45	105	70	45		61		105		
TDS (ratio - measured/calculated)	calc.	1.64	1.96	1.77	1.96		1.71		1.64		
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is August 2018 through August 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Pond ST-P-3
Surface Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Pond ST-P-3		**Baseline [1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters											
Water Depth	feet	--	--	--	2.97		3.0		1.83		0.95
Conductivity (Field)	µmhos/cm	95.0	124.0	111.8	95.0		116.5		124.0		252
pH (Field)	SU	7.2	7.3	7.2	7.19		7.29		7.23		7.19
Temperature (Field)	°C	7.3	20.4	15.6	7.3		20.4		19.0		16.4
Comment							spillway flowing about 2 gpm				
Laboratory Parameters [2]											
Name of Certified Lab [3]					ACZ		ACZ		ACZ		
Lab Reference #					L51688-03		L52655-05		L53580-03		
Sample Date					5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	38.9	64.1	54.4	38.9		60.2		64.1		
Aluminum, dissolved	mg/L	-0.05	0.19	0.07	0.19	B	-0.05	U	-0.05	U	
Arsenic, total recoverable	mg/L	-0.0002	0.0004	0.0003	-0.0002	U	0.0004	B	0.0004	B	
Bicarbonate as CaCO3	mg/L	38.9	64.1	54.4	38.9		60.2		64.1		
Boron, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Cadmium, dissolved	mg/L	-0.008	-0.008	-0.008	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	8.9	15.1	12.7	8.9		15.1		14.1		
Carbonate as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Cation-Anion Balance	calc.	0.8	4.0	2.8	0.8		4.0		3.7		
Chloride	mg/L	1.0	1.0	1.0	1.0	B	1.0	B	1.0	B	
Conductivity @25C	umhos/cm	80	133	112	80		122		133		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	32	56	47	32		53		56		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	0.13	0.84	0.37	0.14		0.13		0.84		
Iron, total	mg/L	0.43	1.33	0.73	0.44		0.43		1.33		
Lead, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	2.4	5.0	3.7	2.4		3.8		5.0		
Manganese, dissolved	mg/L	-0.01	0.04	0.02	-0.01	U	0.04	B	0.01	B	
Manganese, total	mg/L	-0.01	0.07	0.04	-0.01	U	0.07		0.04	B	
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
pH	units	7.4	7.9	7.7	7.8	H	7.9	H	7.4	H	
Phosphate	mg/L	0.12	0.40	0.28	0.12	B	0.31		0.40		
Phosphorus, ortho dissolved	mg/L	0.04	0.13	0.09	0.04	BH	0.10		0.13		
Potassium, dissolved	mg/L	0.8	1.4	1.1	0.8	B	1.0		1.4		
Residue, Filterable (TDS) @180C	mg/L	94	110	102	94		102		110		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	15.0	6	-5	U	-5	UH	15.0	B	
Selenium, total recoverable	mg/L	0.0001	0.0003	0.0002	0.0003		0.0001	B	0.0002	B	
Sodium Adsorption Ratio in Water	calc.	0.23	0.27	0.25	0.23		0.24		0.27		
Sodium, dissolved	mg/L	2.9	4.5	3.8	2.9		4.0		4.5		
Sulfate	mg/L	-1	-1	-1	-1	U	-1	U	-1	U	
Sum of Anions	meq/L	0.8	1.3	1.1	0.8		1.2		1.3		
Sum of Cations	meq/L	0.8	1.4	1.2	0.8		1.3		1.4		
TDS (calculated)	mg/L	40	66	56	40		62		66		
TDS (ratio - measured/calculated)	calc.	1.65	2.34	1.89	2.34		1.65		1.67		
Zinc, dissolved	mg/L	-0.01	0.01	0.01	-0.01	U	0.01	B	-0.01	U	

[1] Baseline period is August 2018 through August 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

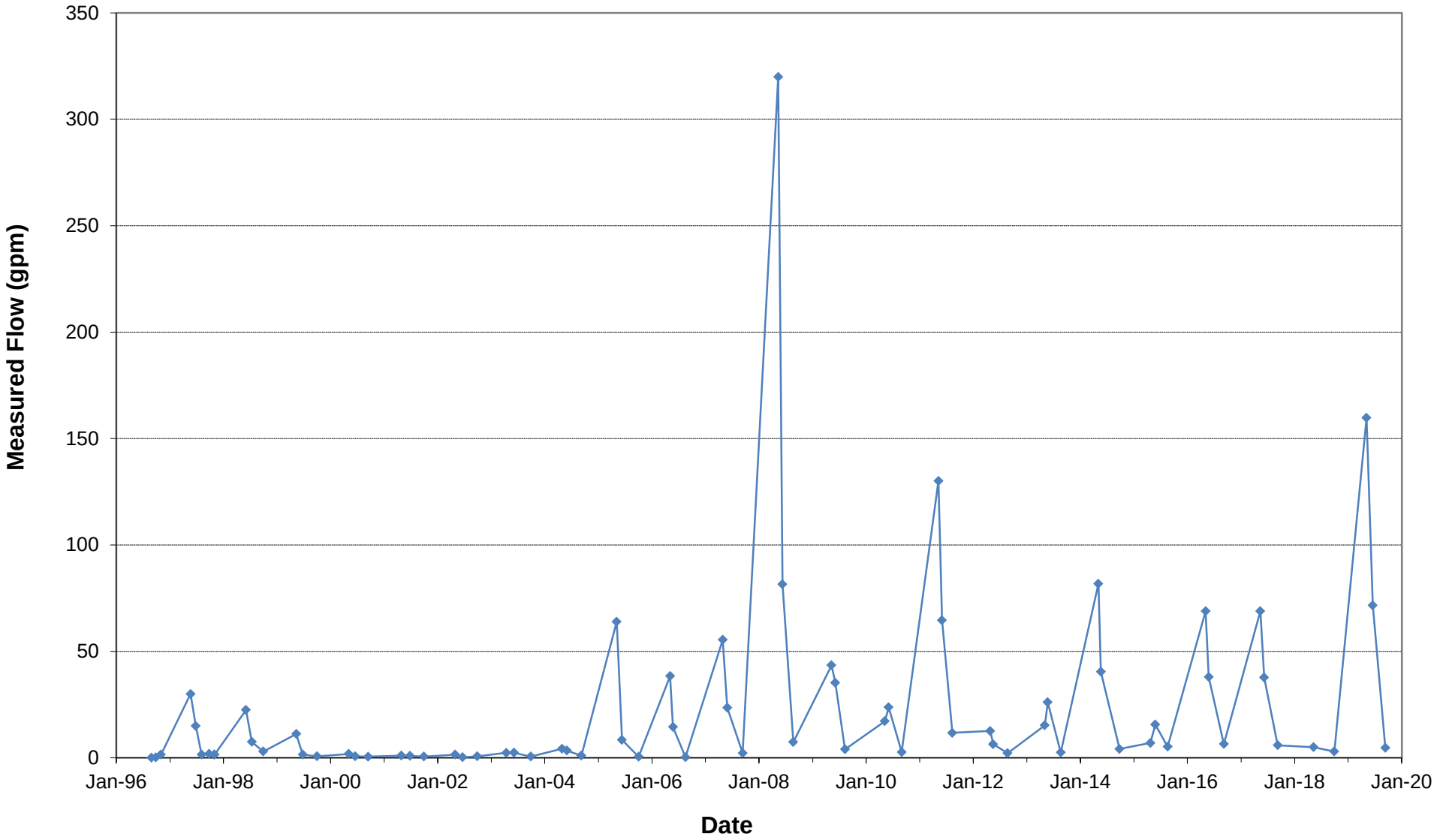
[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

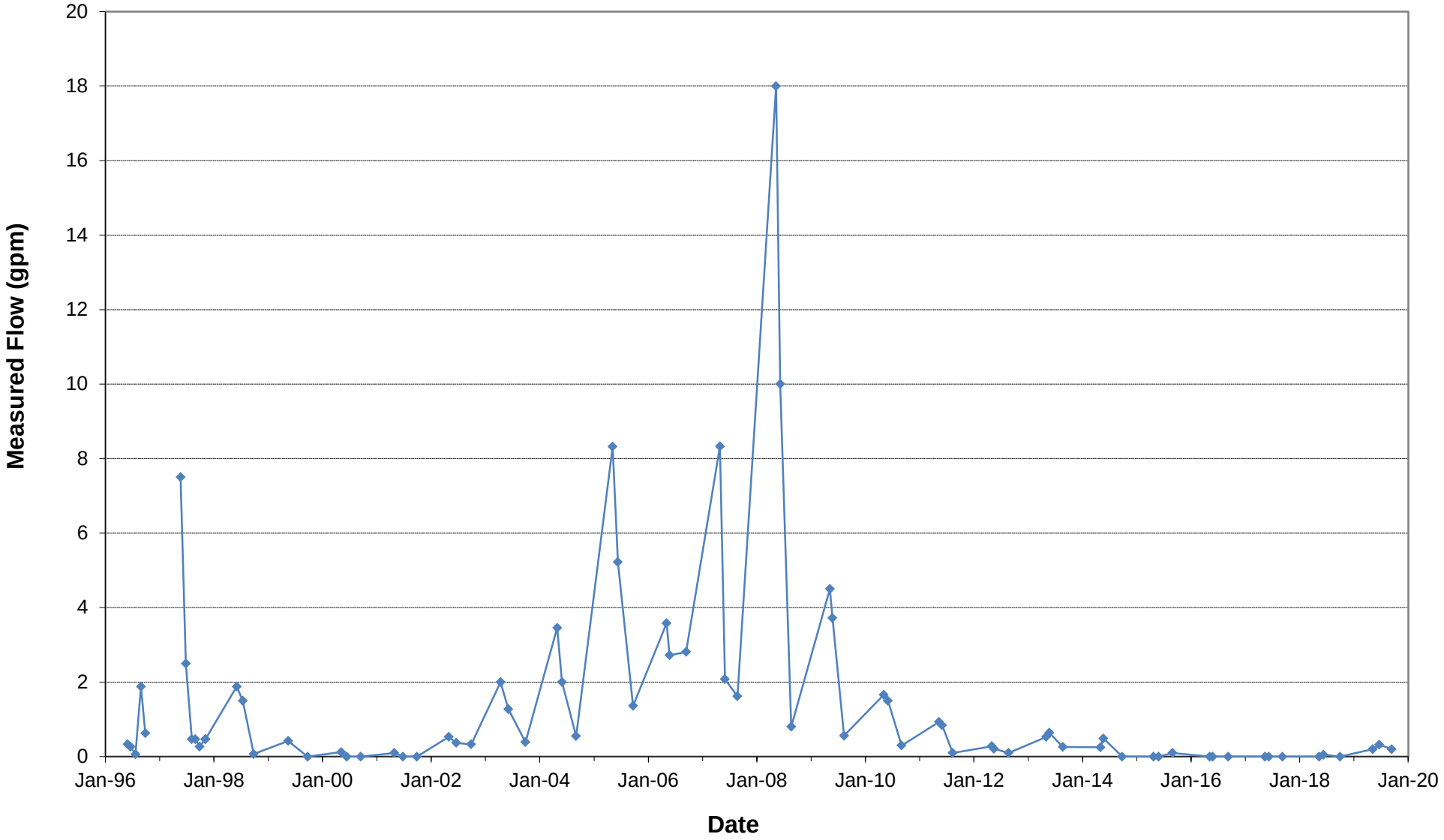
APPENDIX D

SPRINGS - HYDROGRAPHS

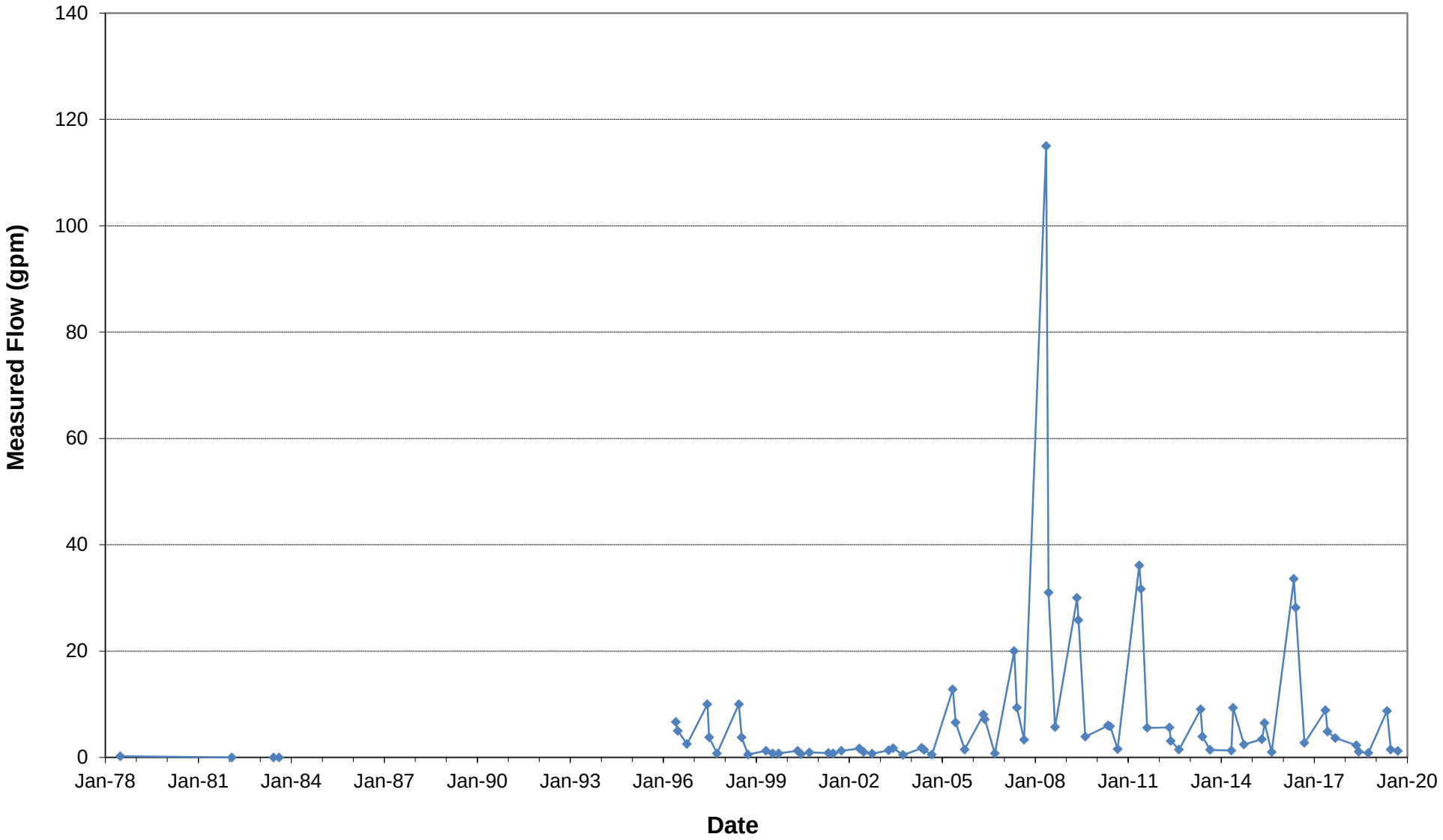
Spring 26-1
Source: Above F-Seam



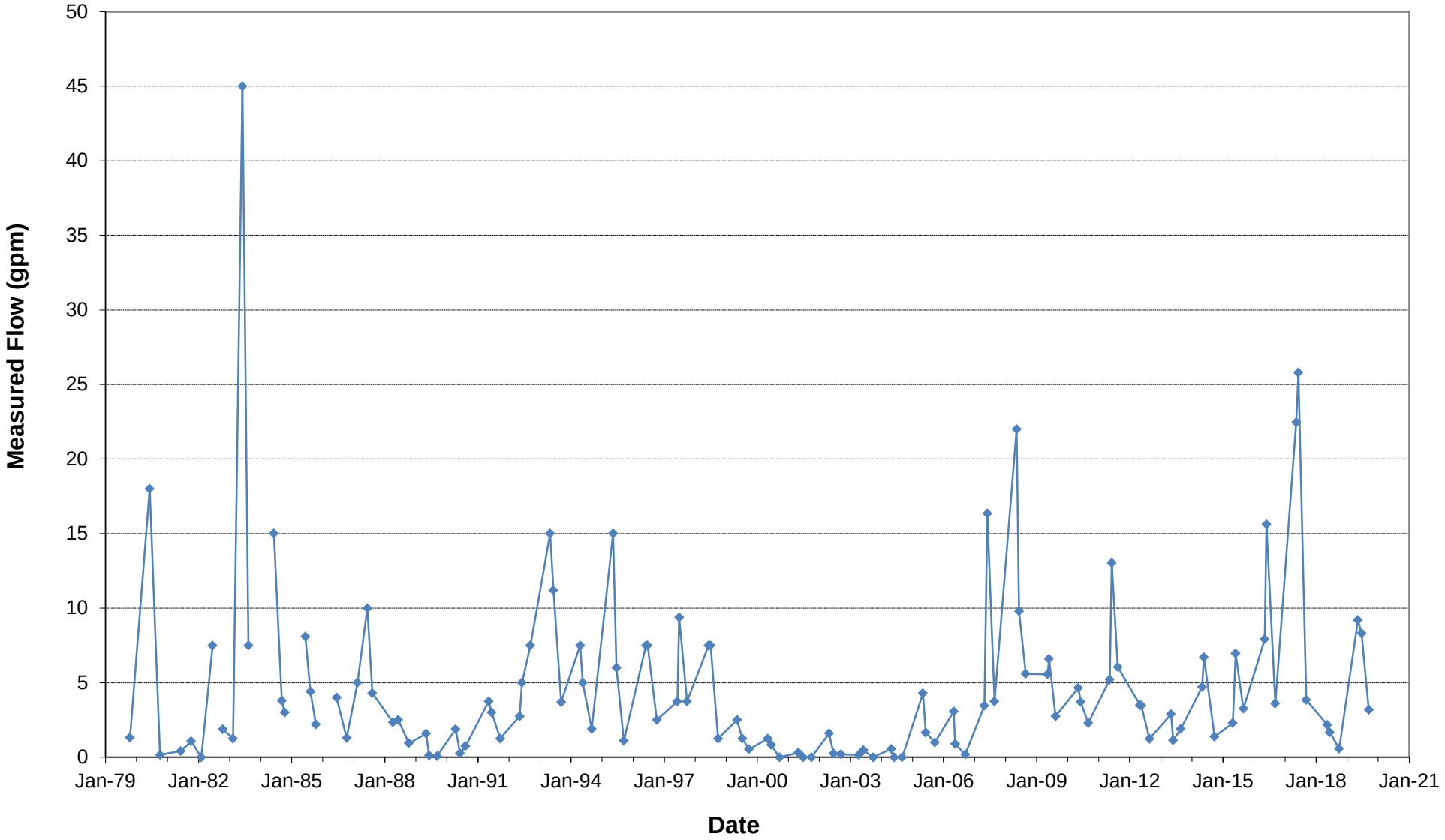
Spring 27-1
Source: Above F-Seam



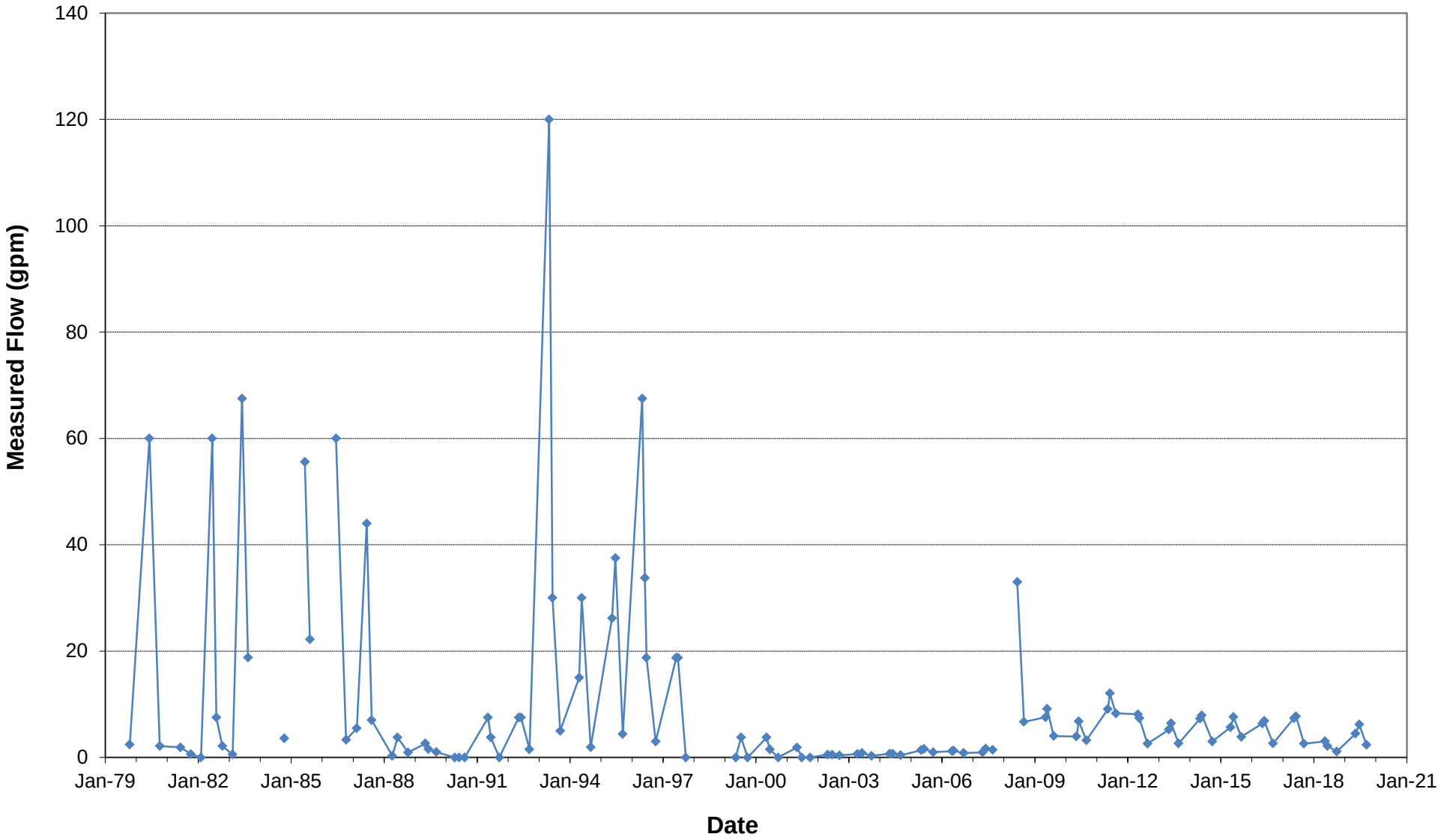
Spring G-7
Source: Above F-Seam



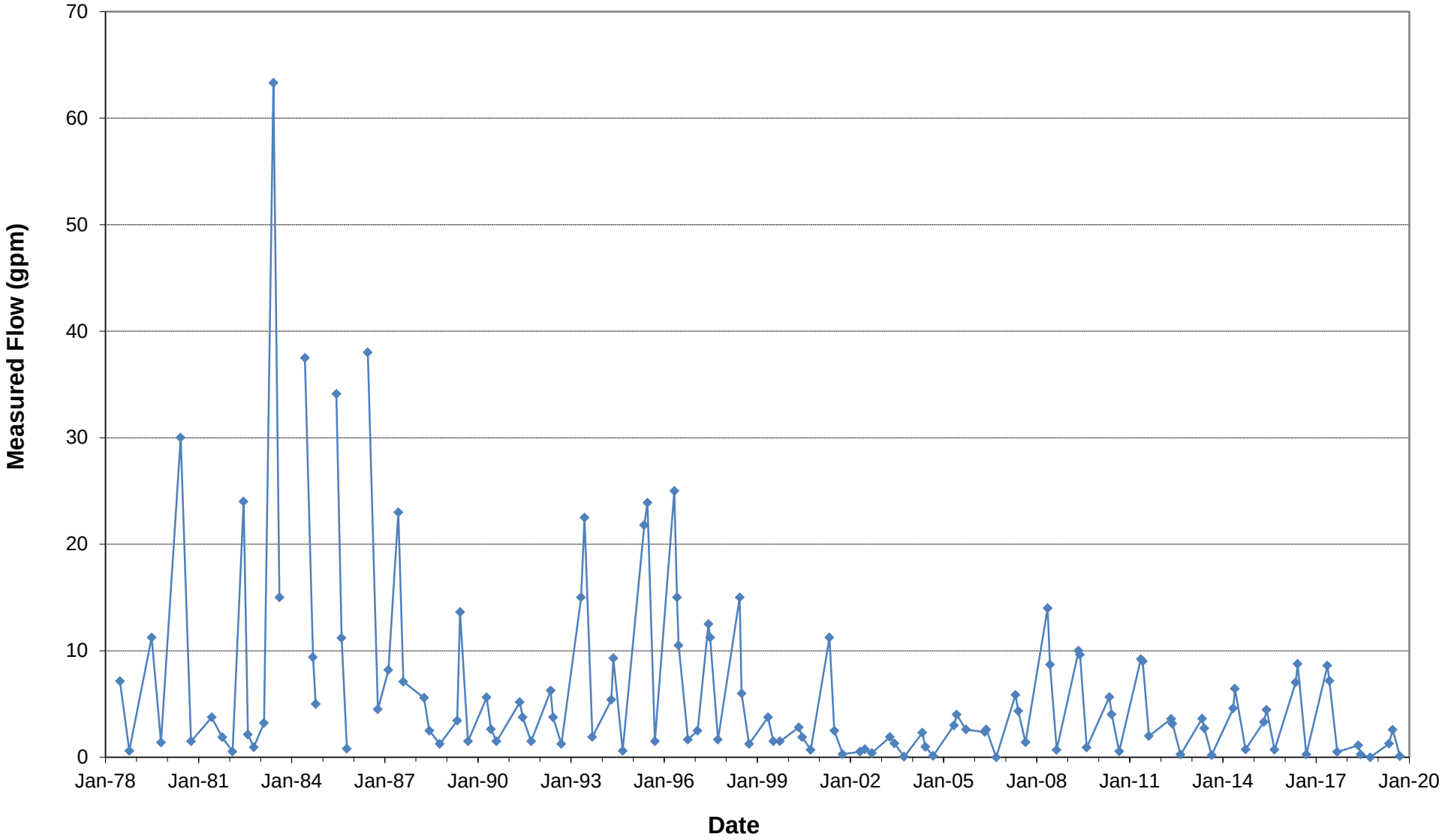
Spring G-16
Source: Above F-Seam



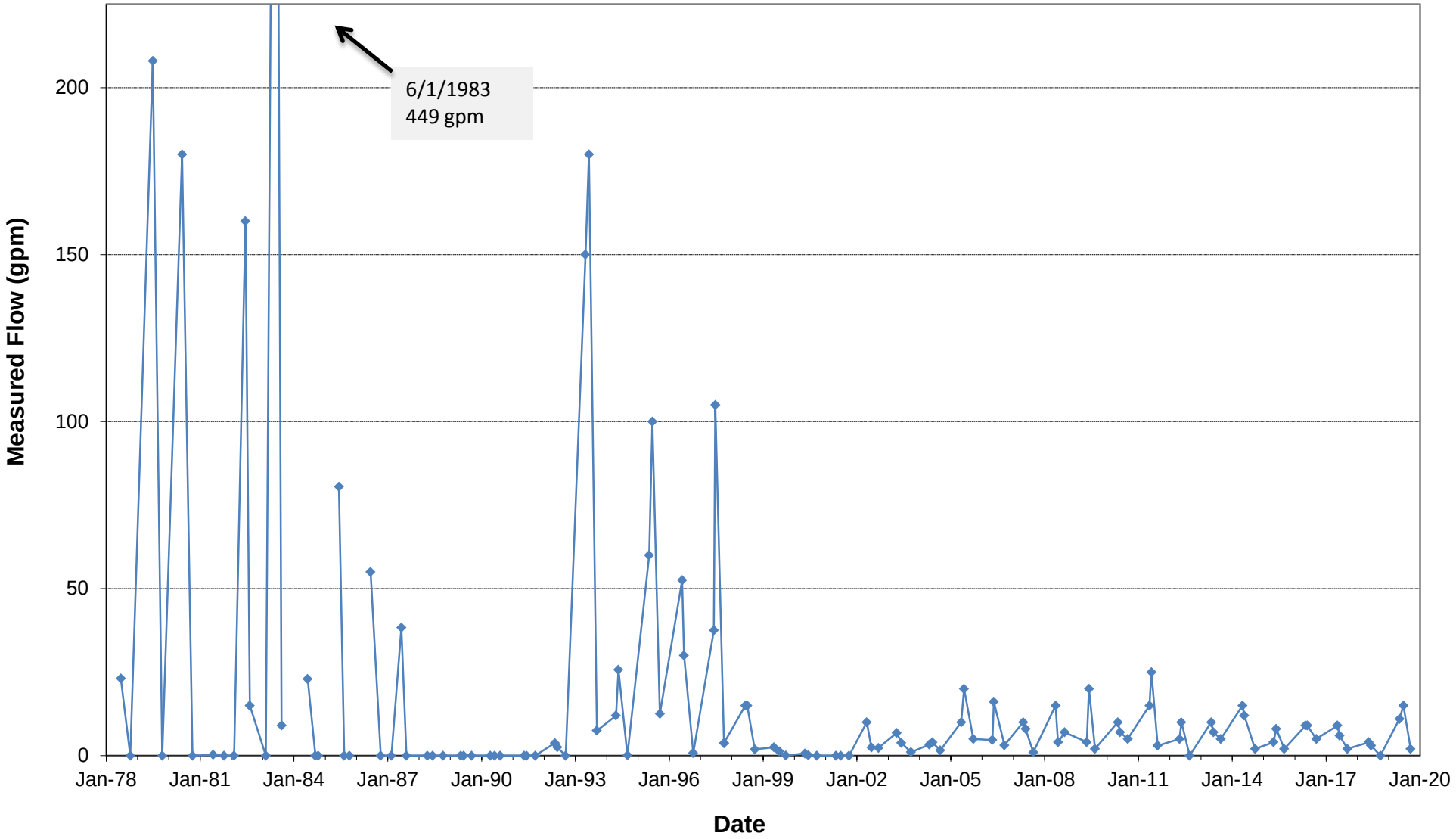
Spring G-24
Source: Above F-Seam



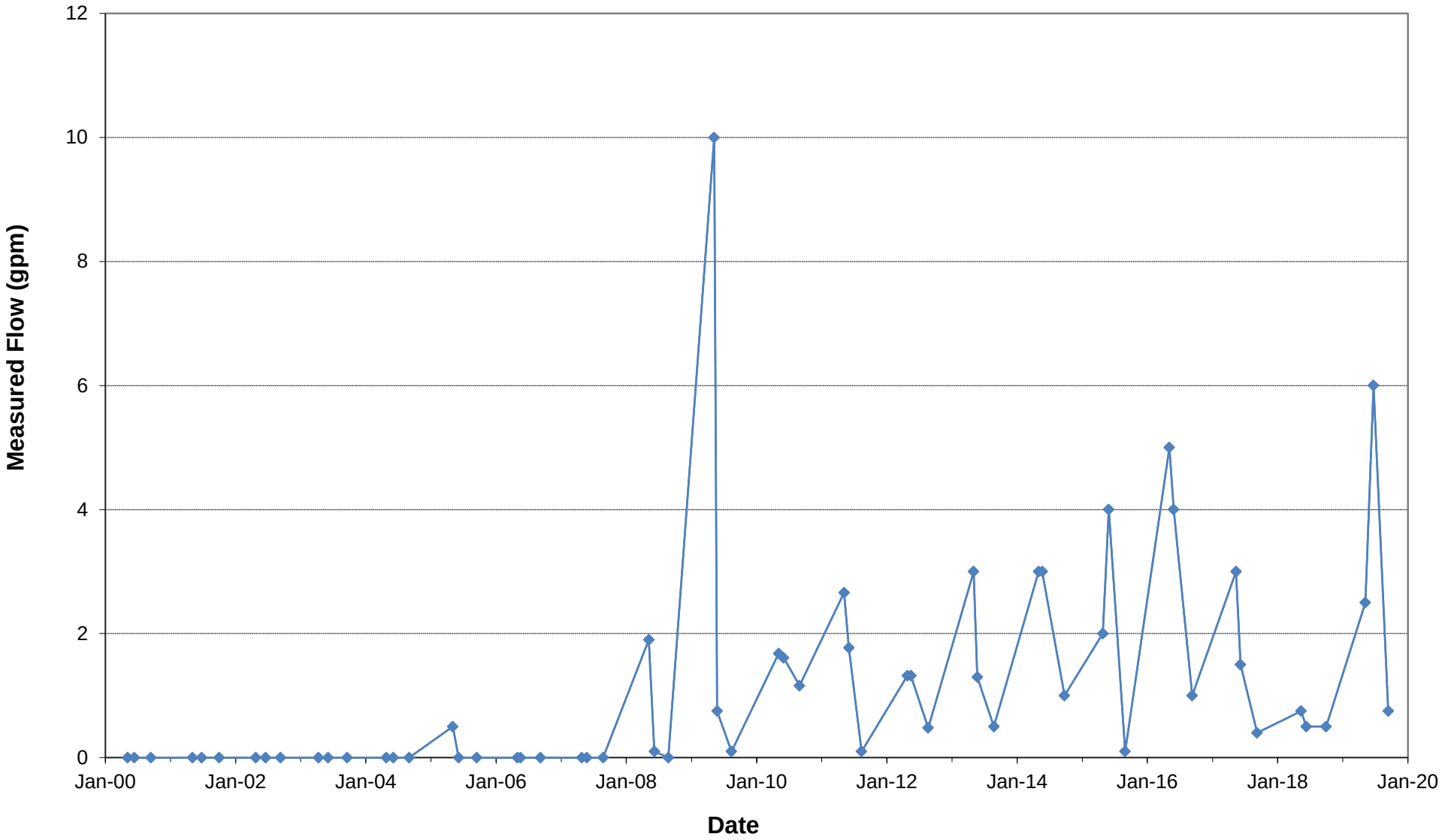
Spring G-14
Source: Above F-Seam



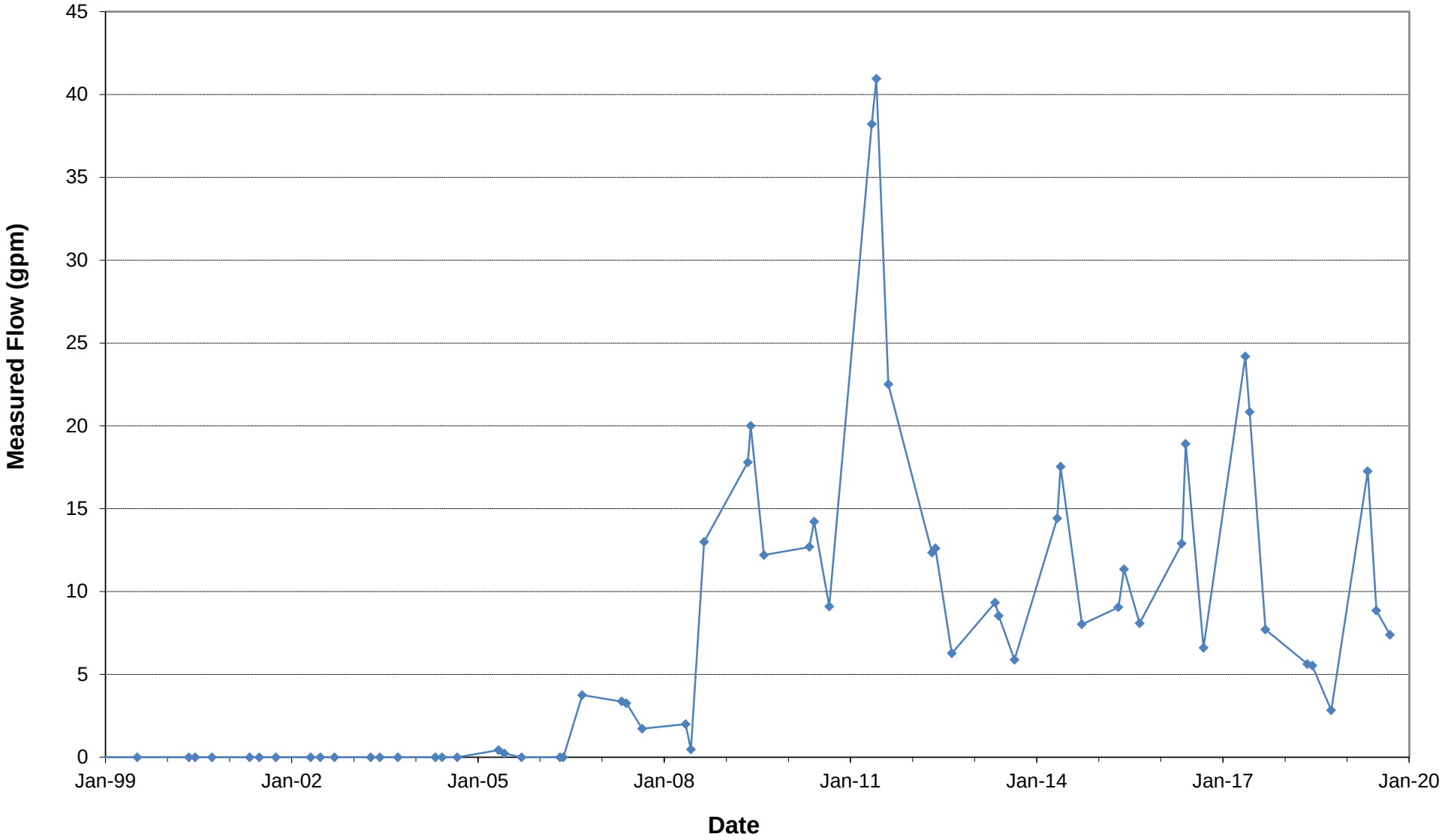
Spring G-22
Source: Above F-Seam



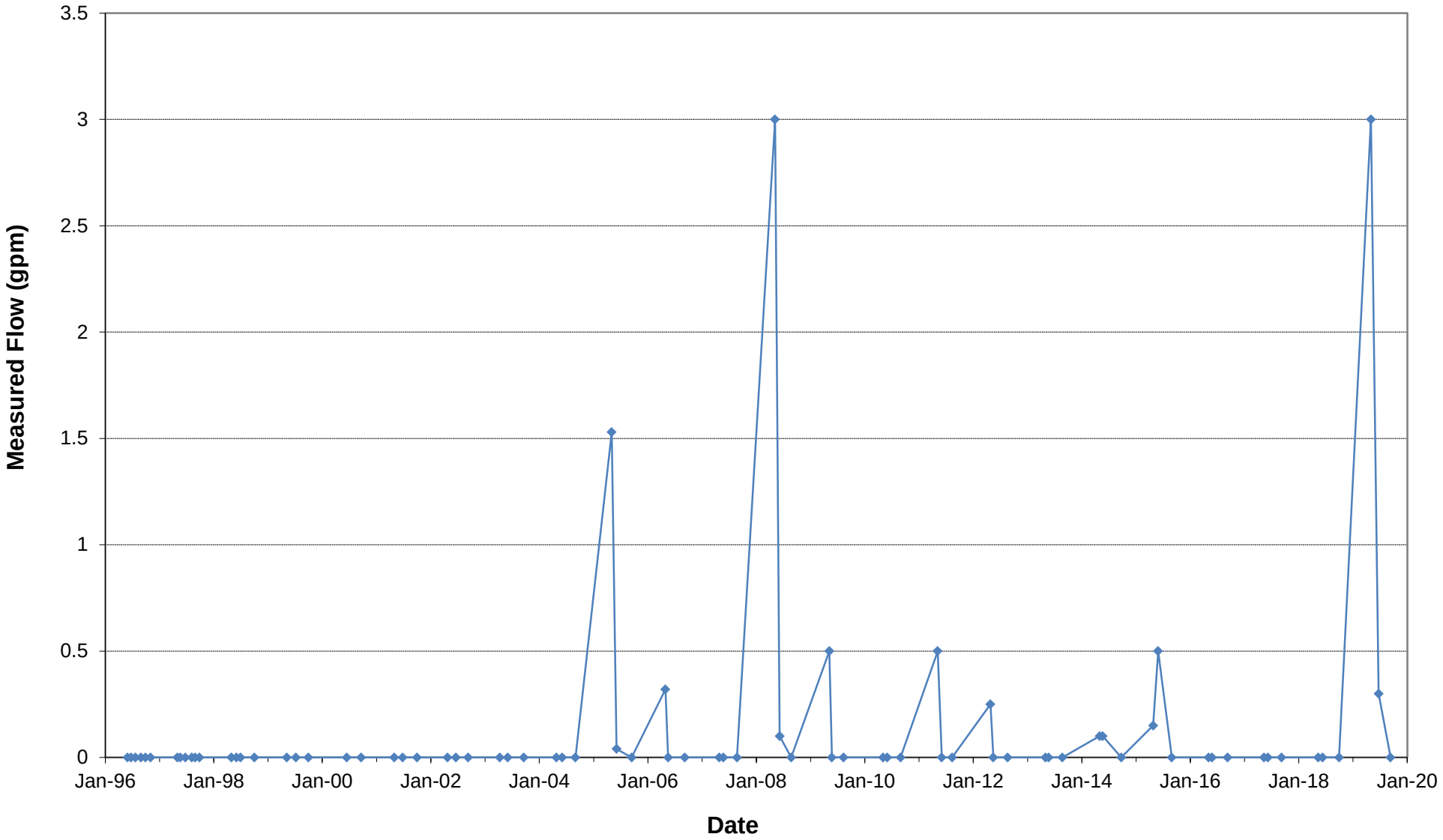
Spring 11-2
Source: Below F-Seam



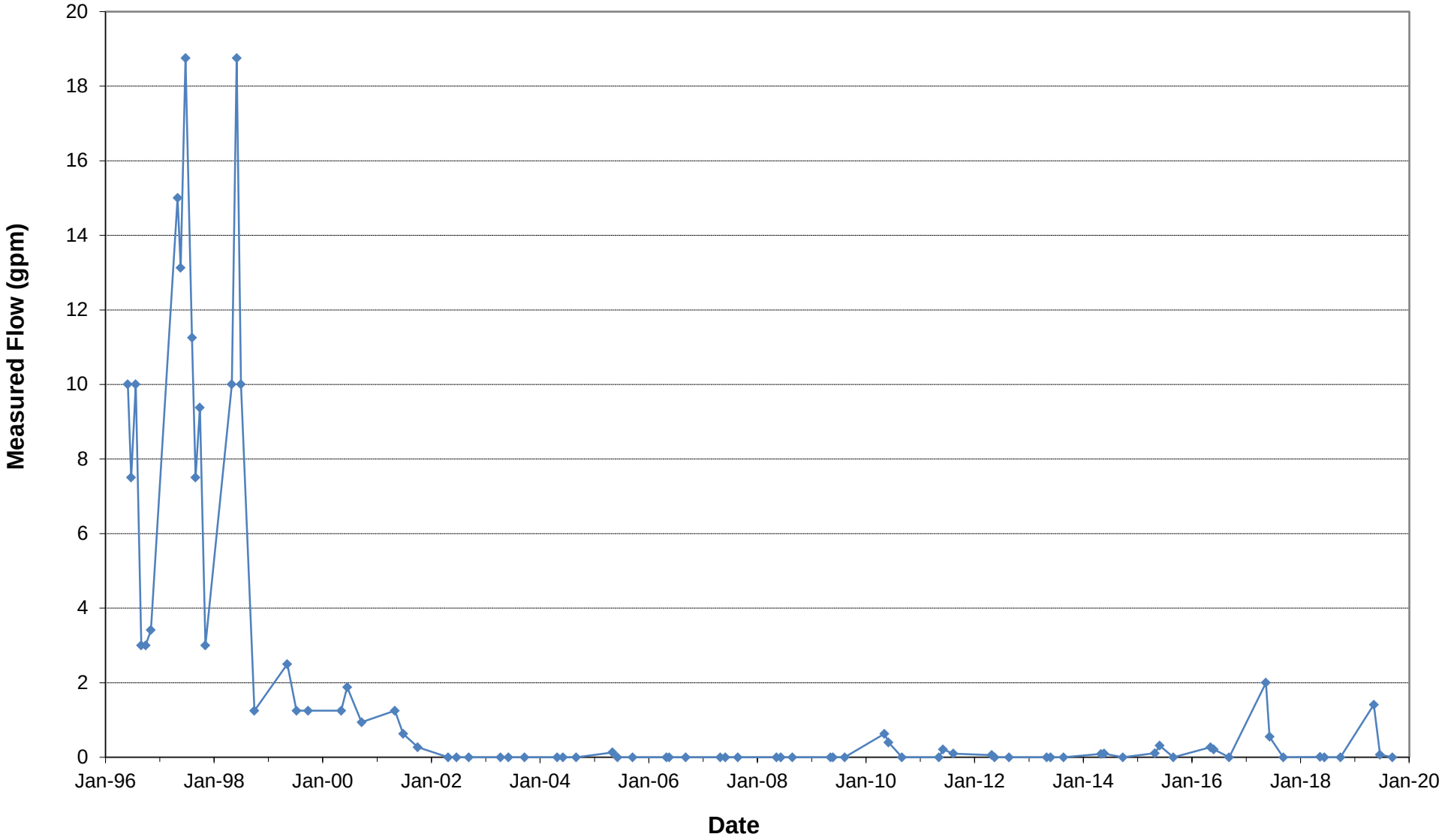
Spring 10-1
Source: Below F-Seam



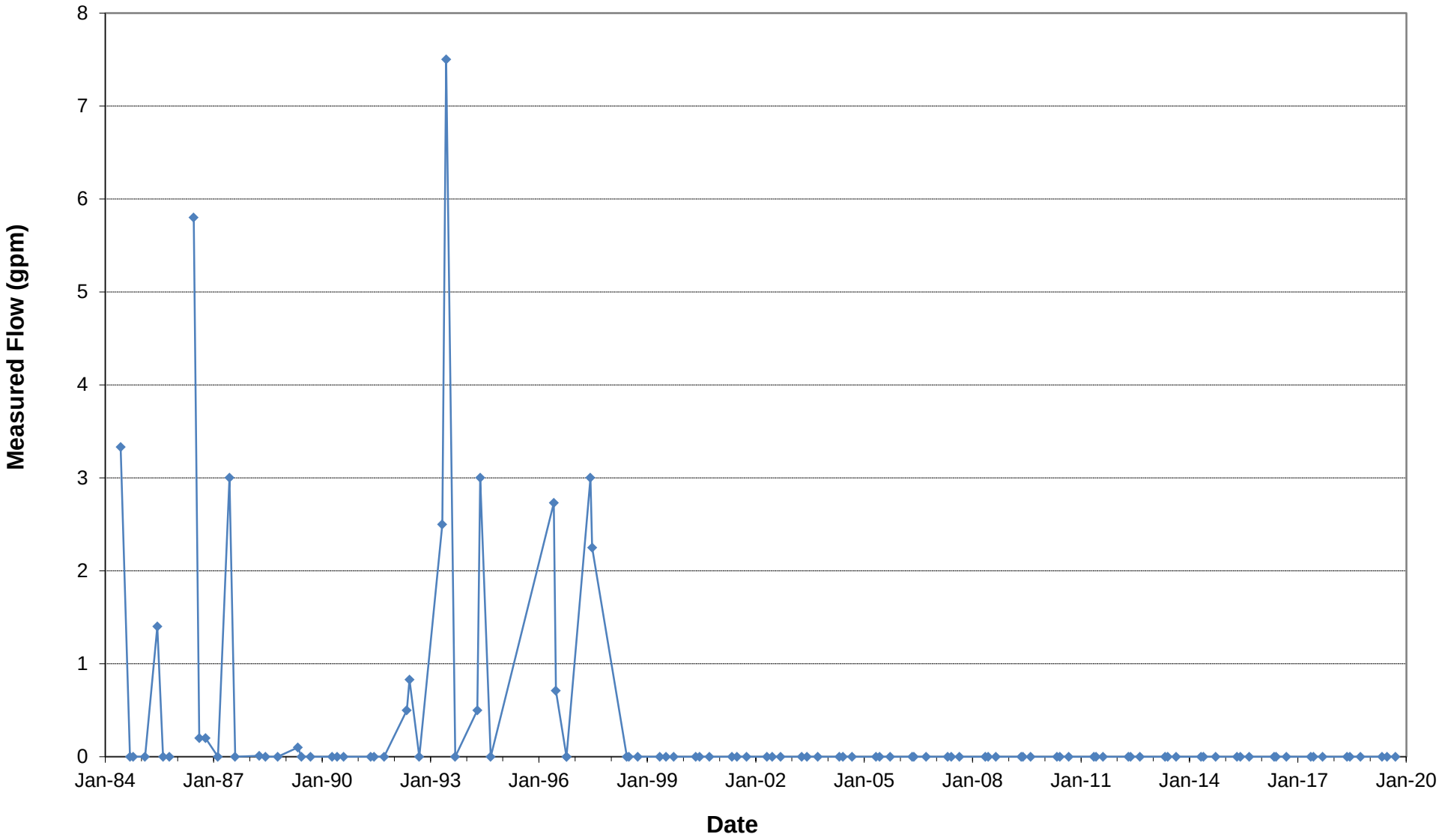
Spring E10-2
Source: Below F-Seam



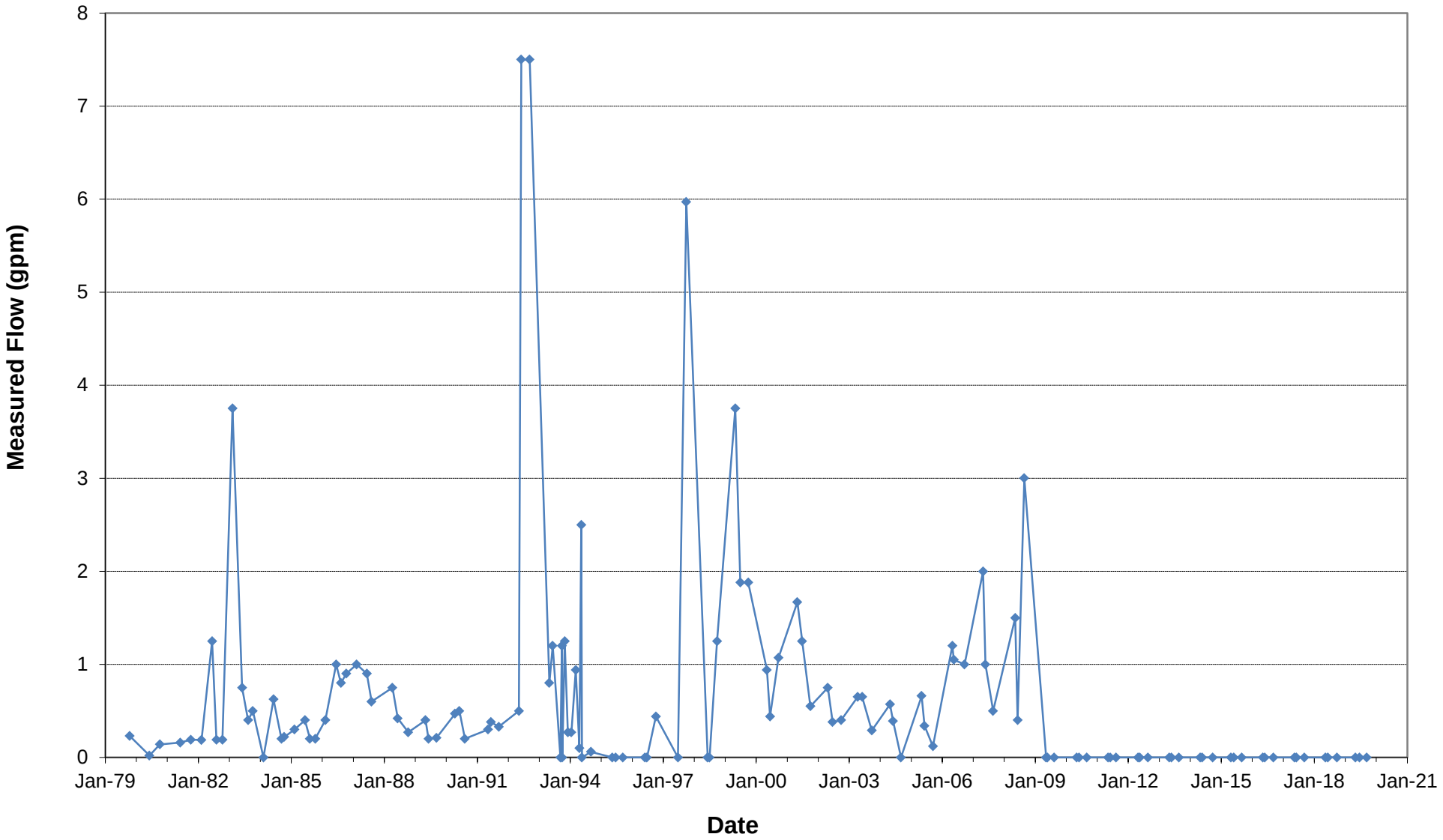
Spring 15-1
Source: Below F-Seam



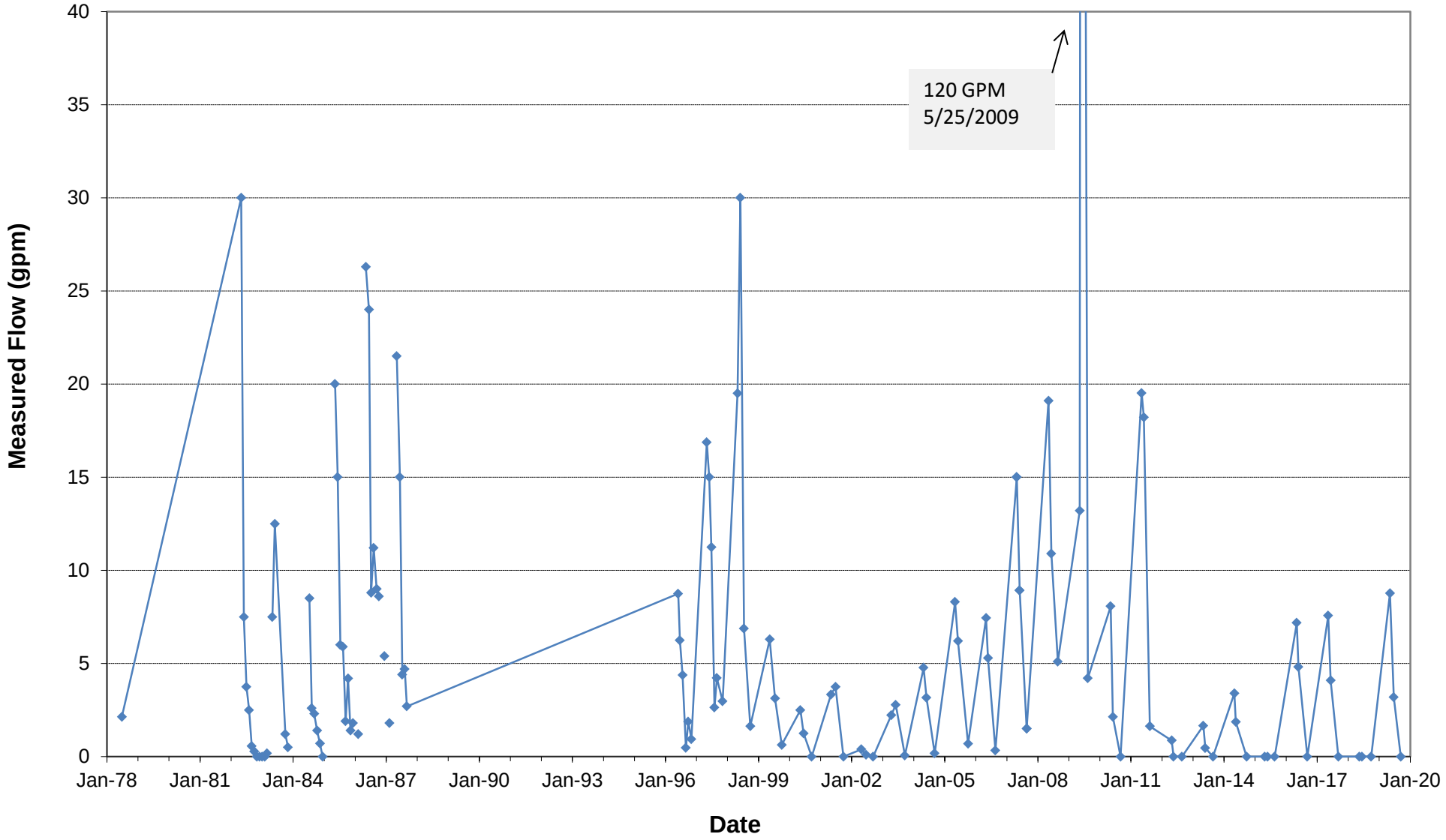
Spring G-1a
Source: Below F-Seam



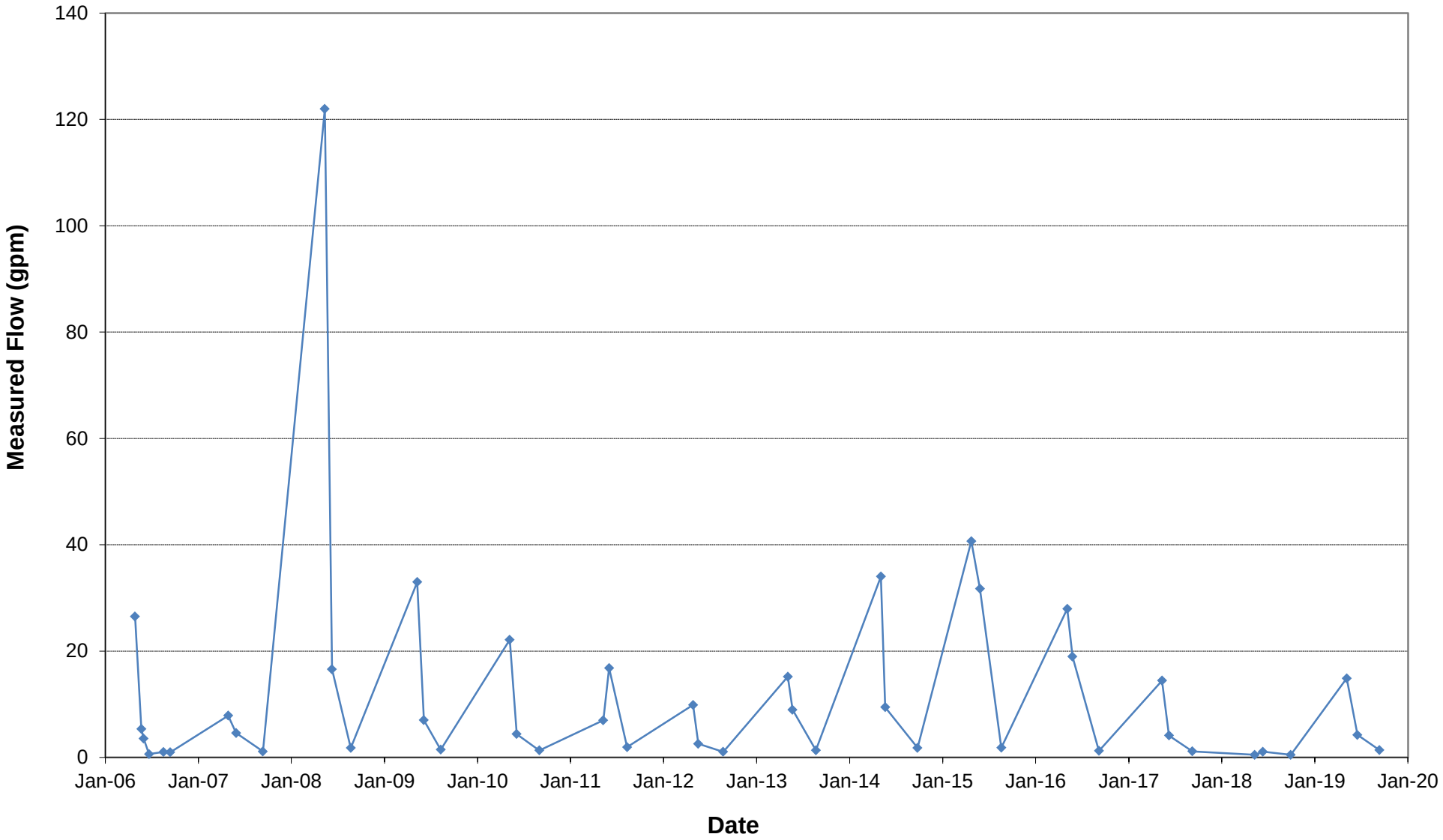
Spring G-20
Source: Below F-Seam



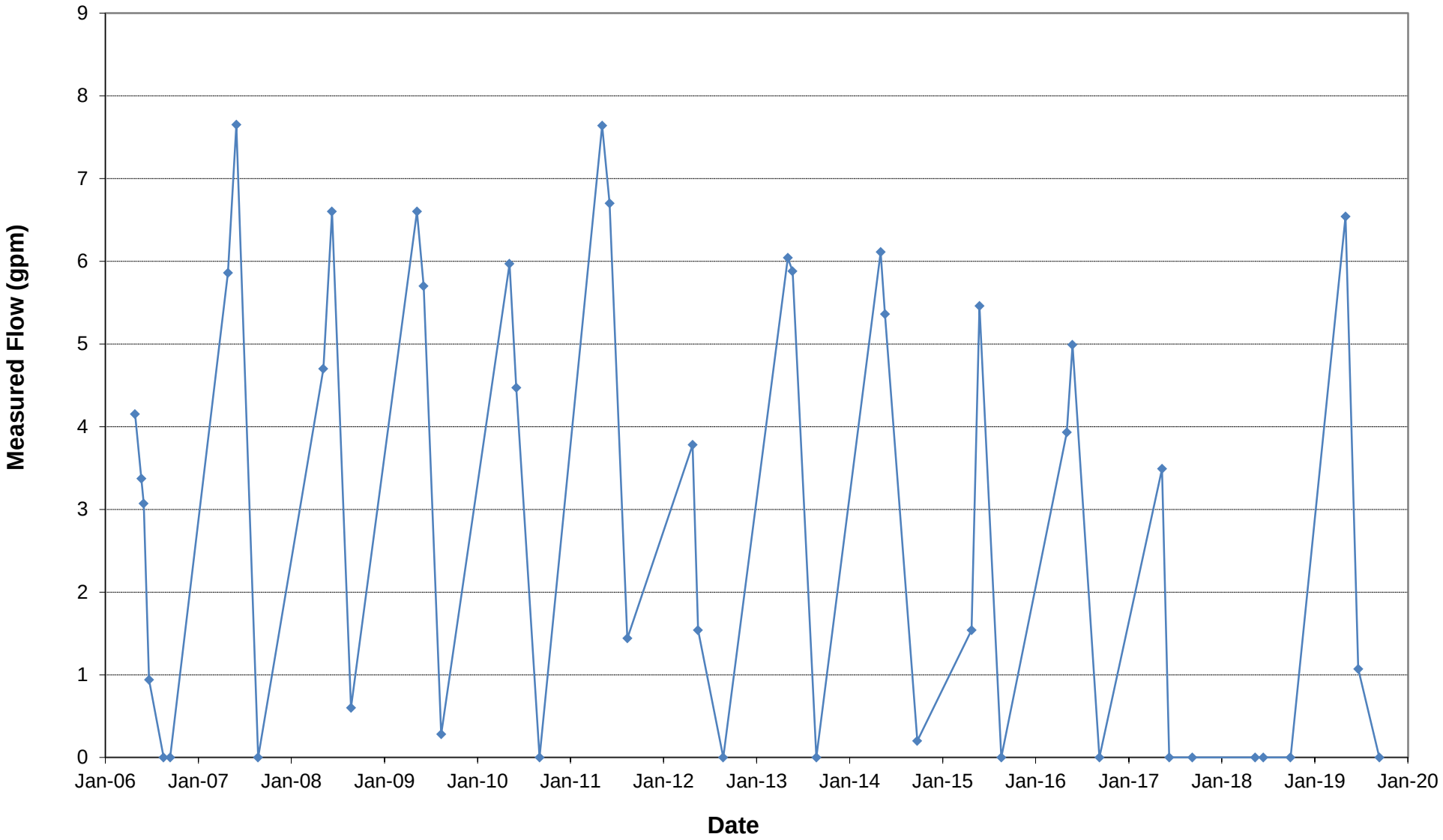
Spring J-4
Source: Above E-Seam



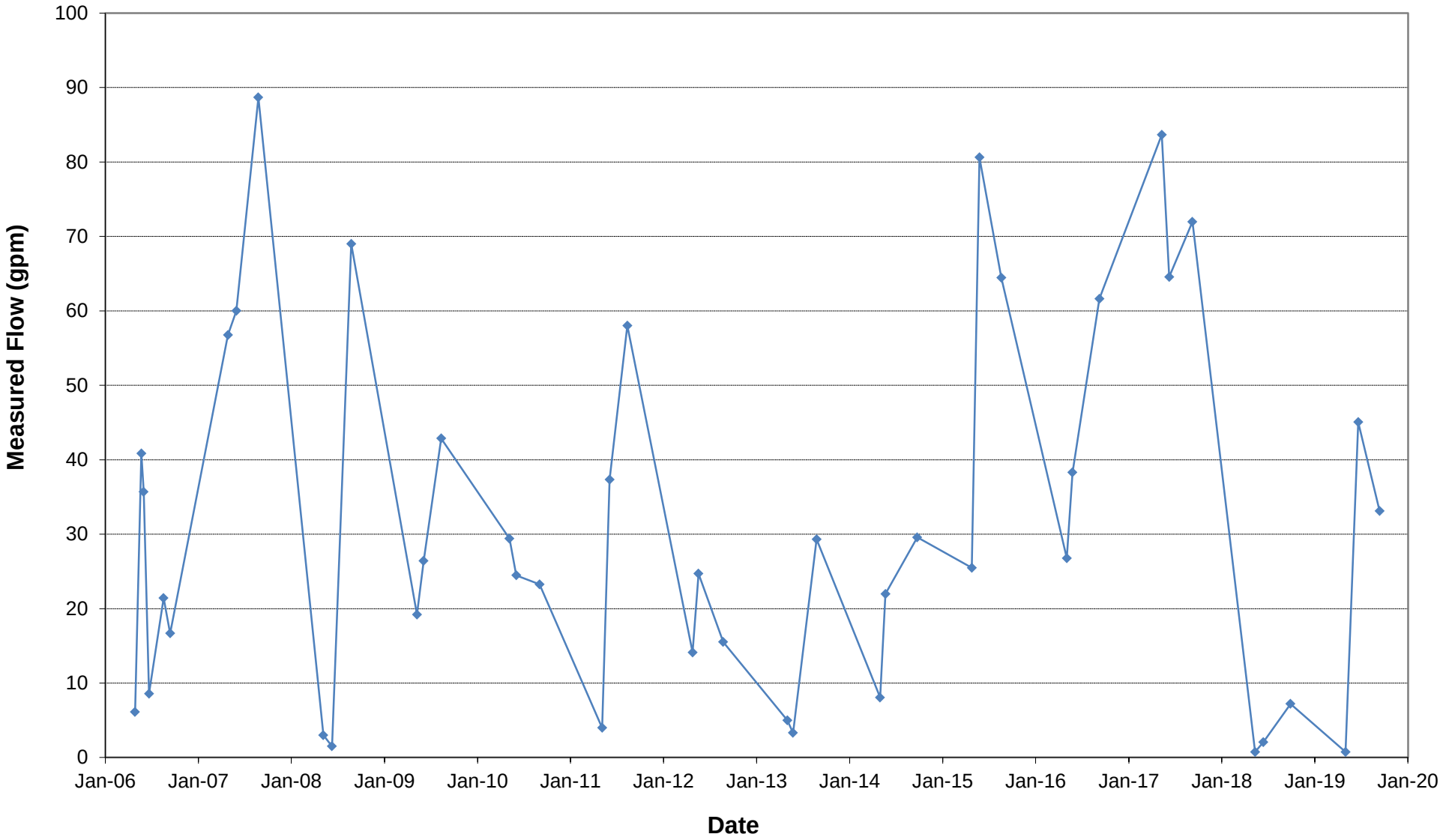
Spring 35-3
Source: Above F-Seam



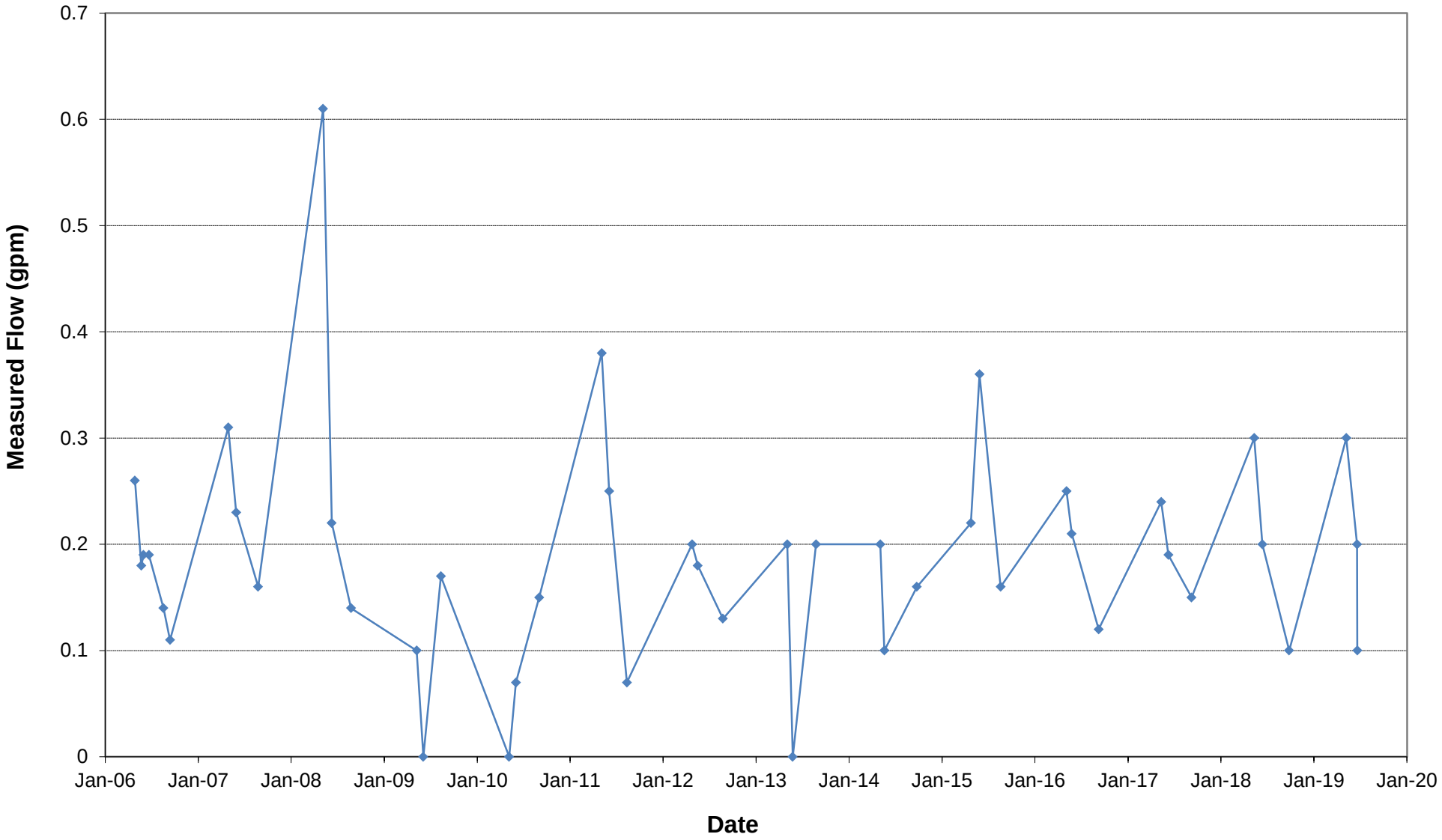
Deer Creek Spring
Source: Above E-Seam



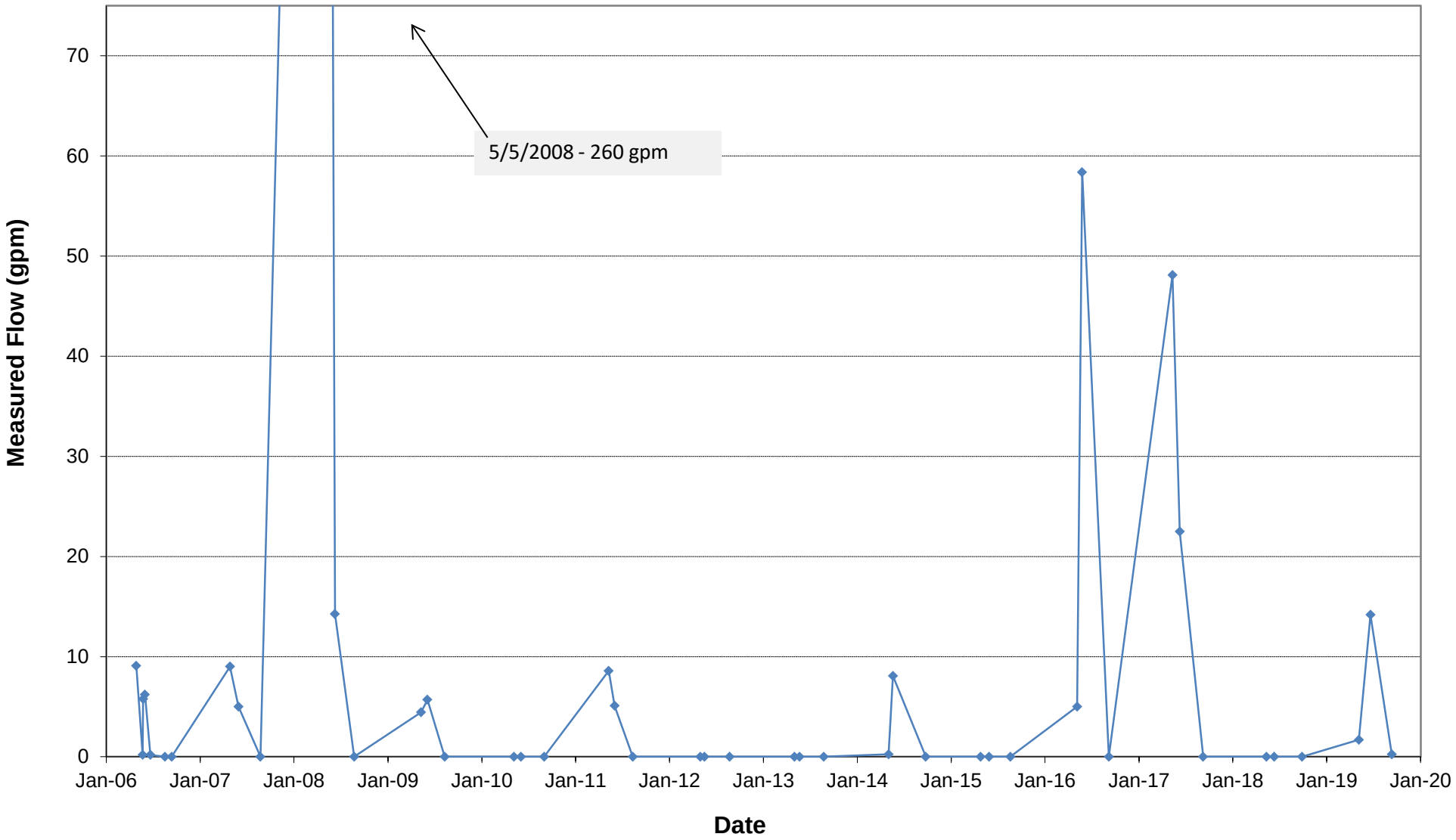
Spring WCC-24
Source: Above E-Seam



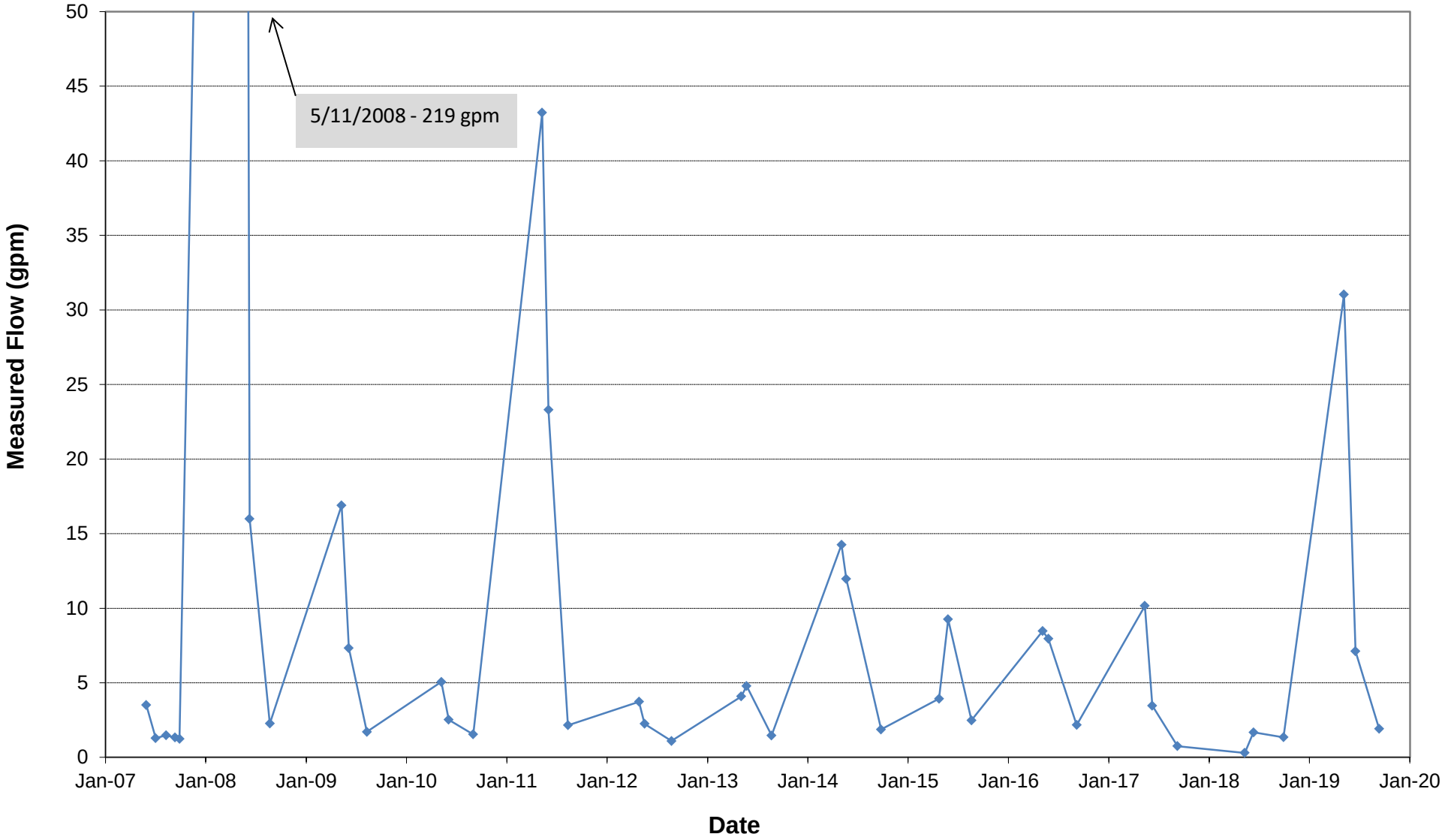
Spring J-2
Source: Above E-Seam



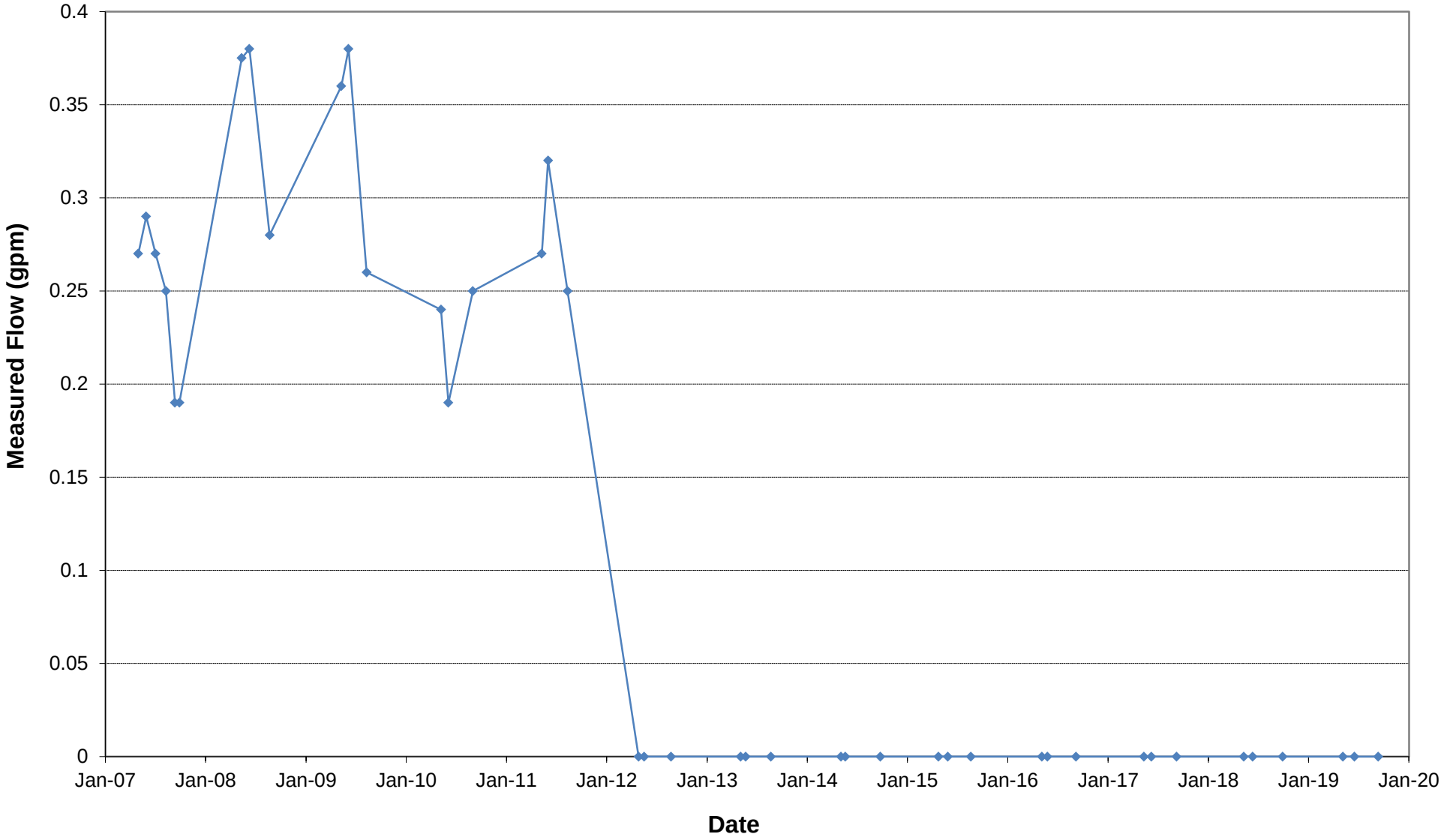
Spring J-7
Source: Above E-Seam



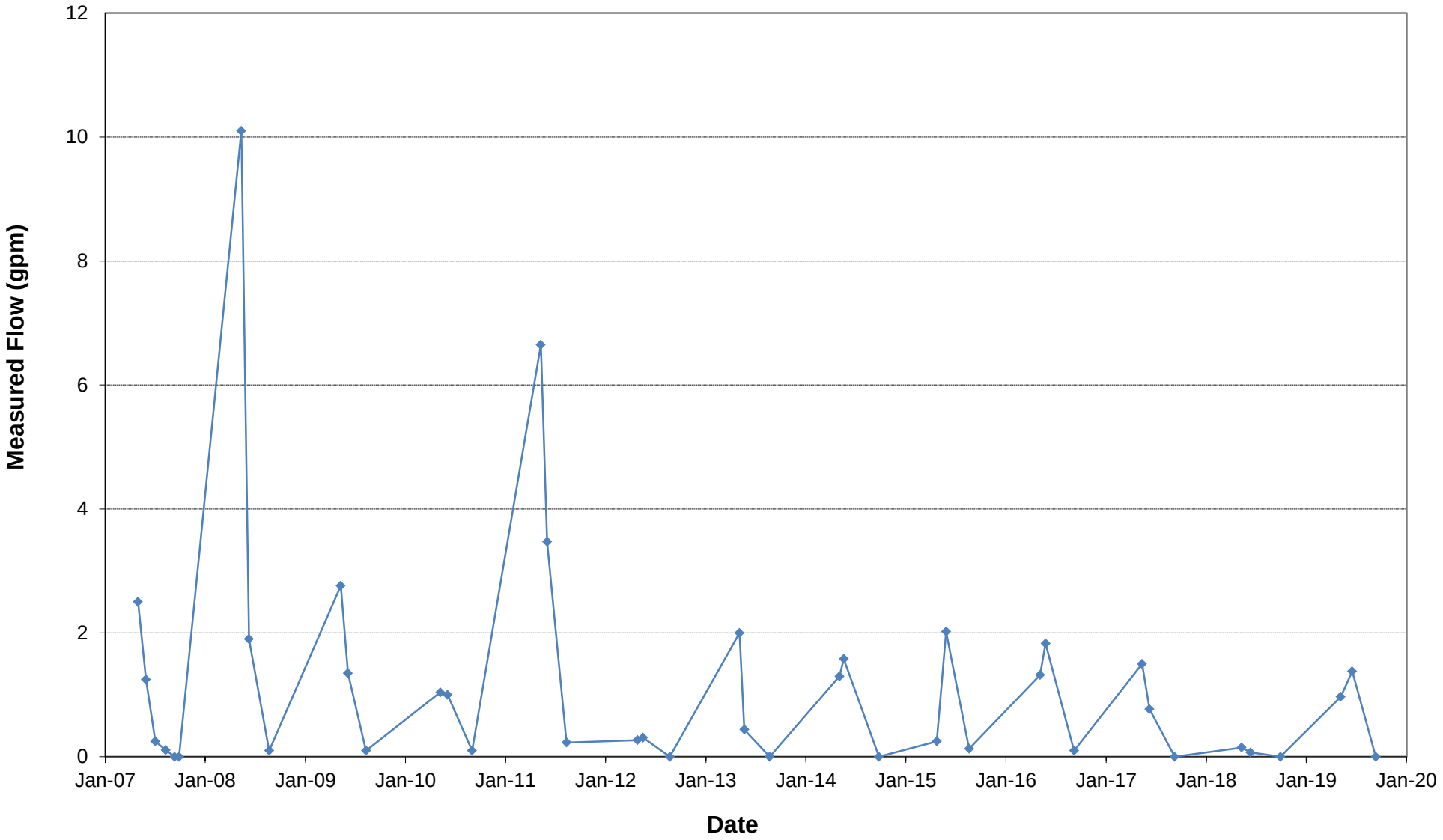
Deep Creek Trail Spring
Source: Above F-Seam



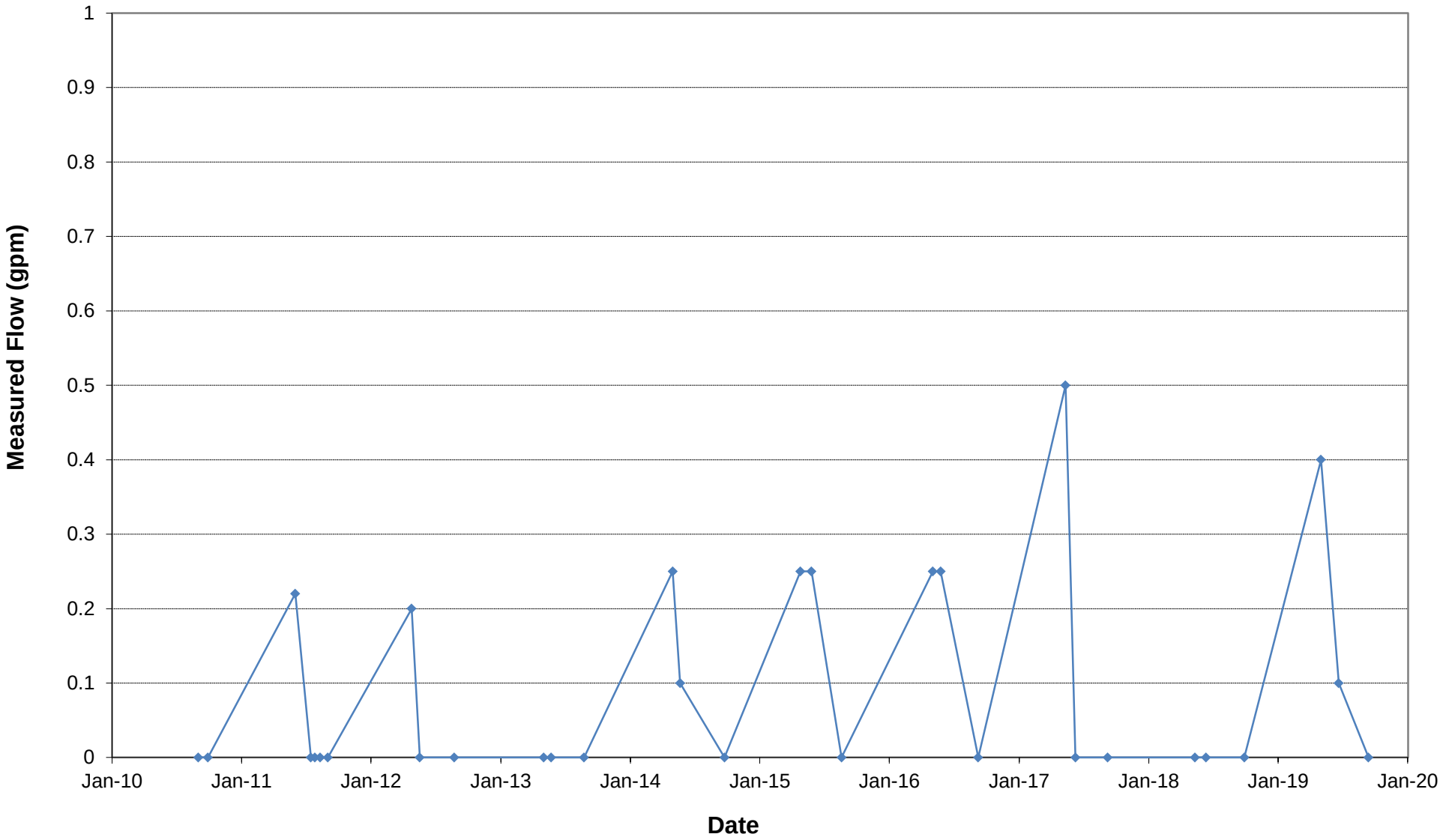
Deep Creek Spring #2
Source: Above F-Seam

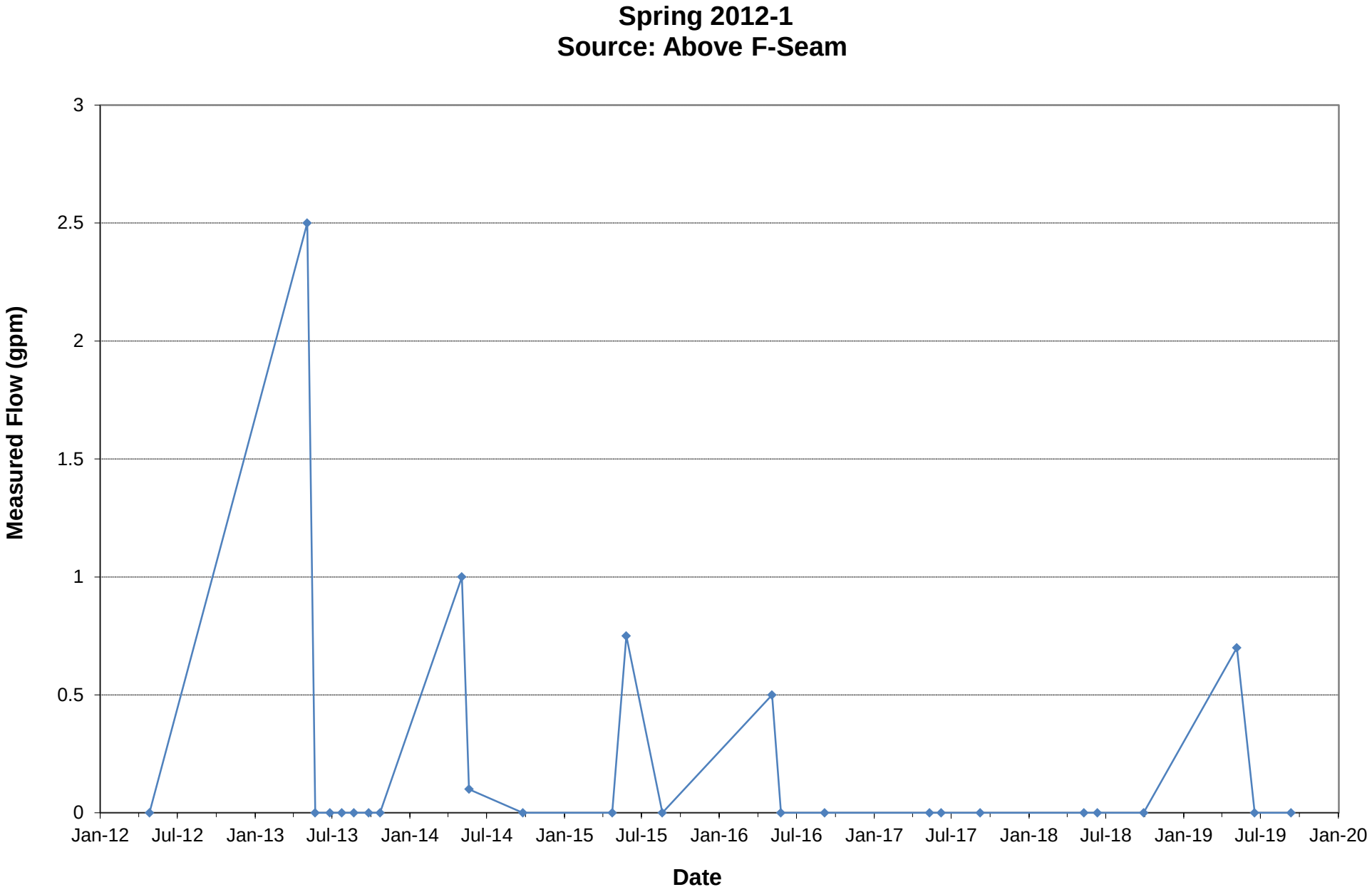


96-2-2 Area Spring
Source: Above F-Seam

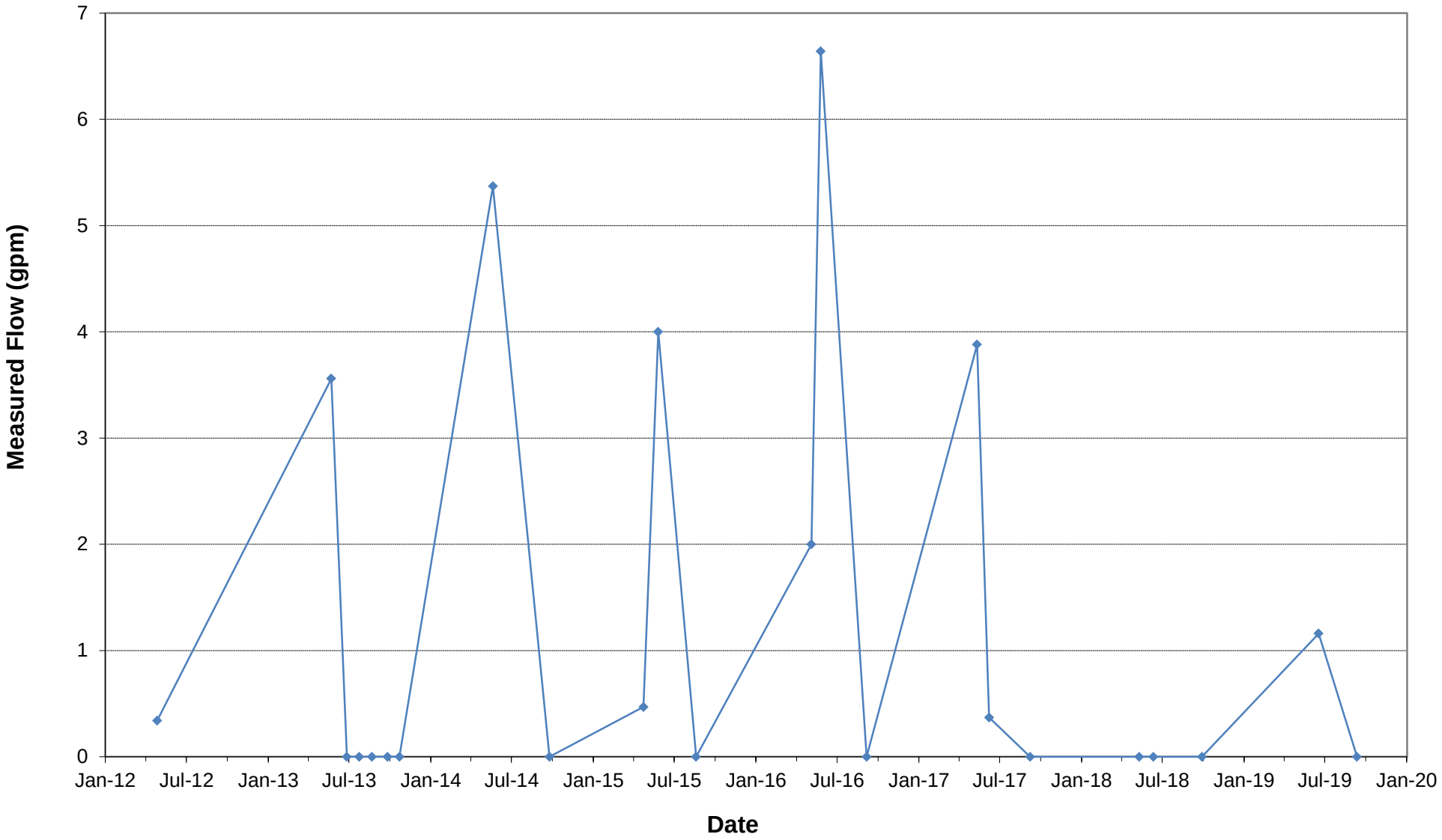


Spring J-10
Source: Above E-Seam

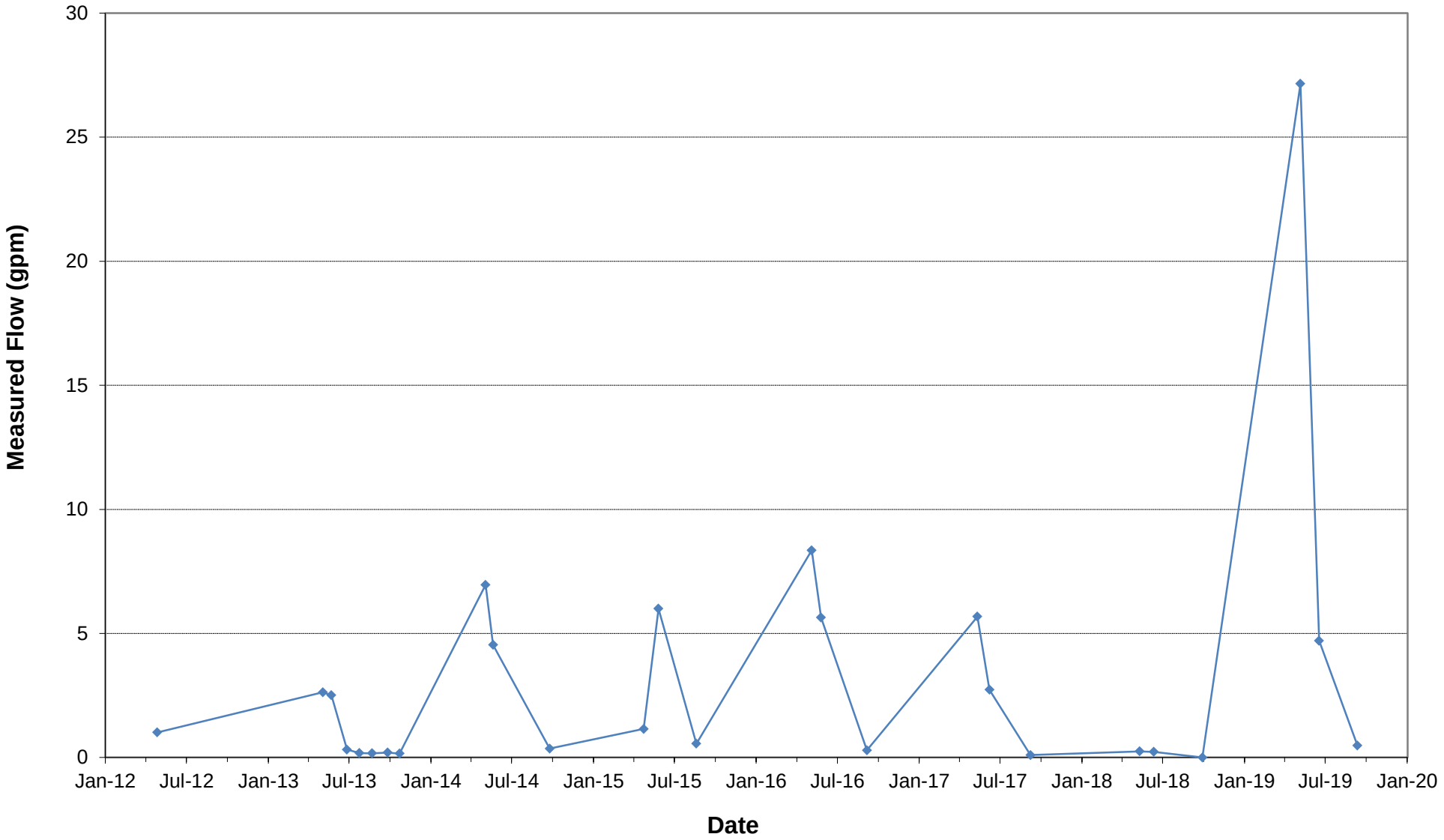



Spring 2012-1
Source: Above F-Seam
Measured Flow (gpm)
3
2.5
2
1.5
1
0.5
0
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Date

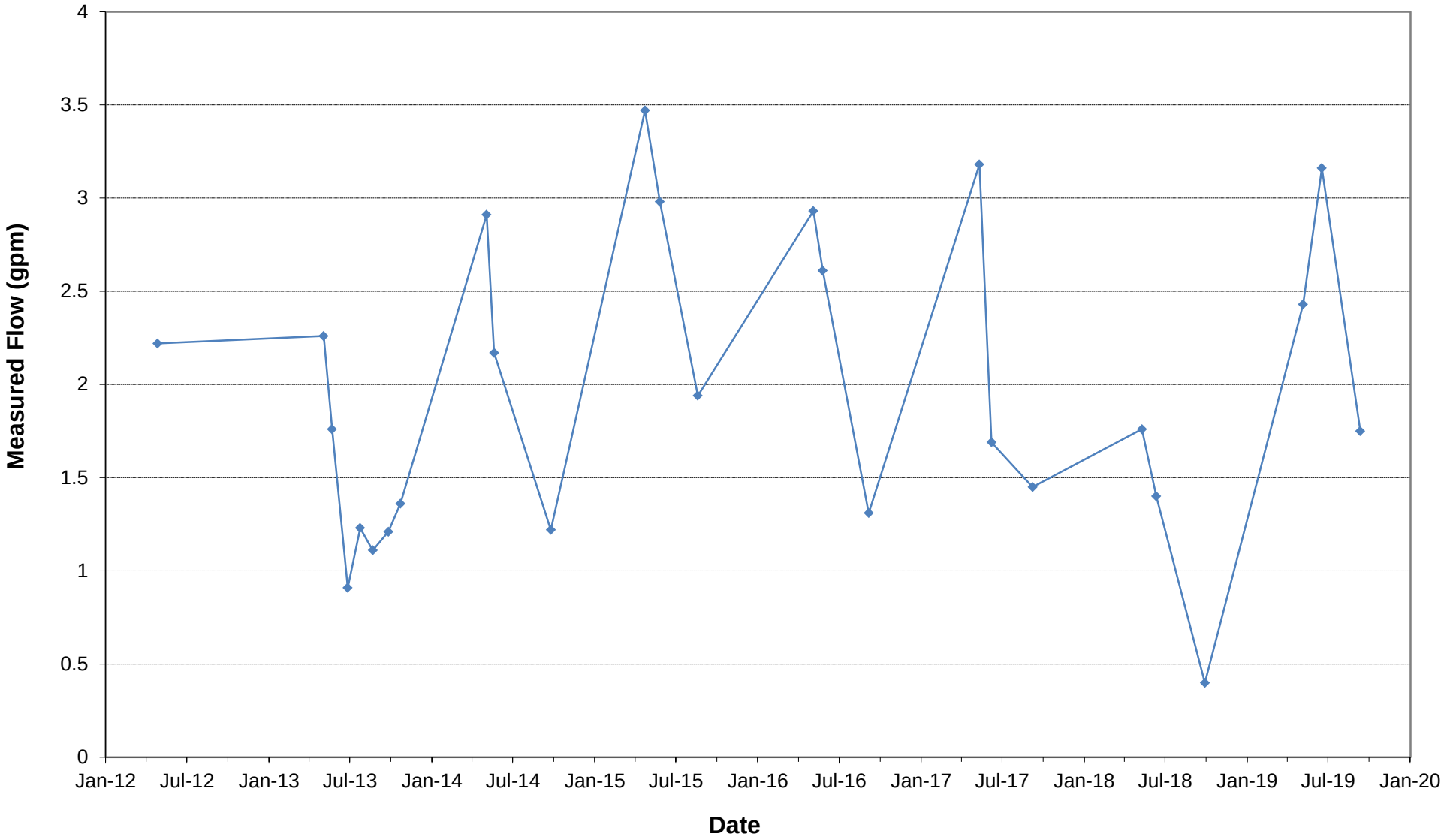
Spring 2012-2
Source: Above F-Seam



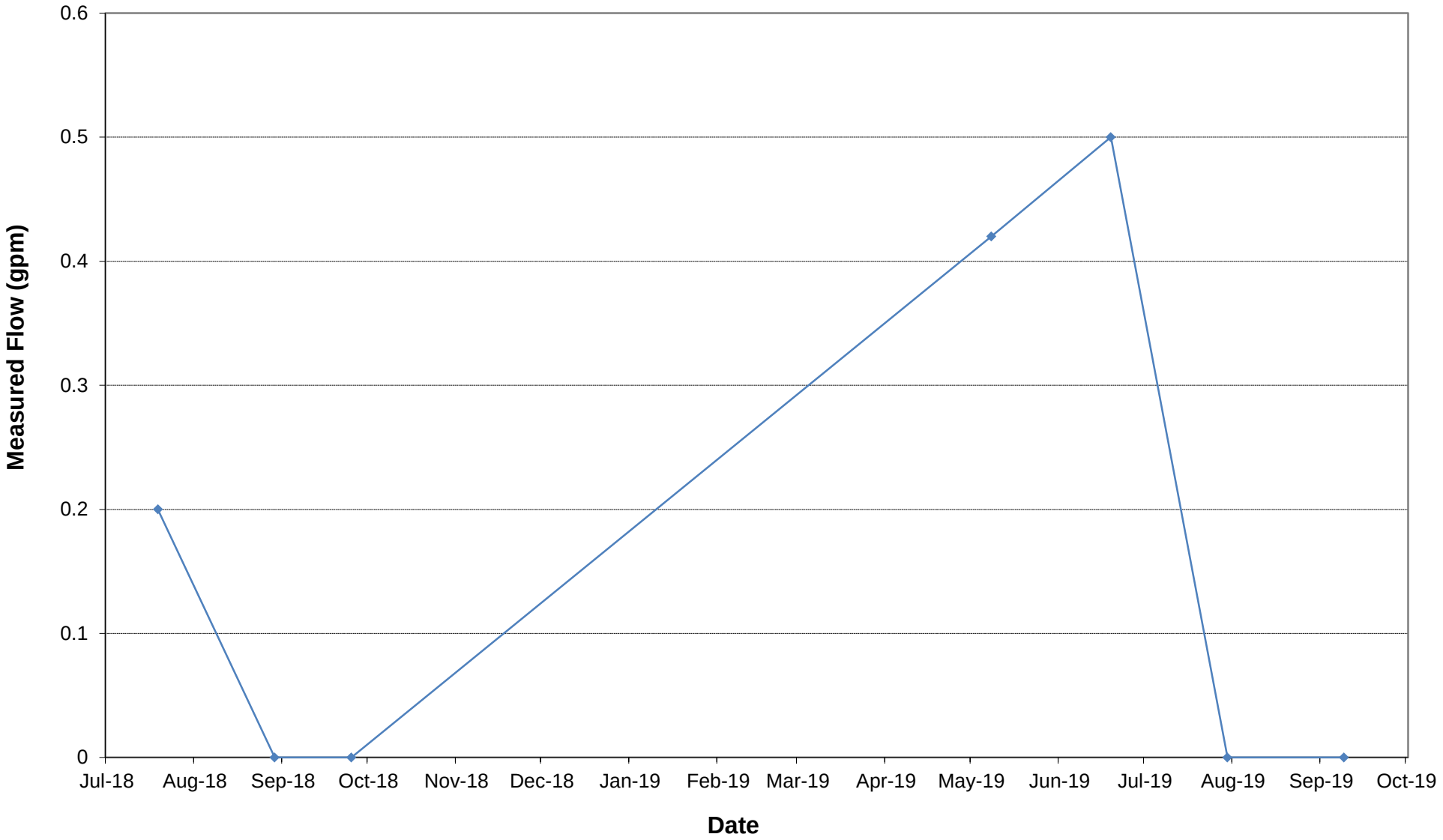
Spring 2012-3
Source: Above F-Seam



Spring 2012-4
Source: Above F-Seam



Spring ST-S-1


0.6
0.5
0.4
0.3
0.2
0.1
0
Measured Flow (gpm)
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Sep-19
Oct-19
Date

APPENDIX E

SPRINGS - LABORATORY AND FIELD WATER QUALITY DATA

Spring 26-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 26-1		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm				159.8	71.7		4.71
Conductivity (Field)	µmhos/cm	240	640	482	468	597		883
pH (Field)	SU	7.3	8.1	7.7	7.96	7.88		8.33
Temperature (Field)	°C				6.3	7.0		8.1
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52685-01		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	151	284	222				
Bicarbonate as CaCO3	mg/L	151	284	222				
Calcium, dissolved	mg/L	24	37.2	31.5				
Cation - Anion Balance	mg/L	1	3.3	2.15				
Chloride	mg/L	2	6	4.4				
Conductivity @25C	µmhos/cm	480	548	514		597		
Hardness as CaCO3	mg/L	81	126	105				
Iron, dissolved	mg/L					-0.03	U	
Iron, total	mg/L		1.45	0.24		-0.03	U	
Magnesium, dissolved	mg/L	5.1	8	6.7				
Manganese, total	mg/L		0.028	0.004				
Nitrate/Nitrite (as N)	mg/L	0.14	0.31	0.19				
pH	SU	7.1	7.7	7.4		8.3	H	
Phosphorus, ortho dissolved	mg/L		0.007	0.001				
Potassium, dissolved	mg/L	1.2	1.4	1.3				
Residue, Filterable (TDS) @180C	mg/L	220	410	327		366		
Residue, Non-Filterable (TSS) @105C	mg/L		16	4		-5	U	
Selenium, total	mg/L		0.001	0.001				
Sodium Adsorption Ratio (SAR)	calc.	2.8	4.96	3.96				
Sodium, dissolved	mg/L	57.2	125	94.5				
Sulfate	mg/L	40	80	63.1				
Sum of Anions	meq/L	5.1	5.9	5.5				
Sum of Cations	meq/L	5.2	6.3	5.75				
Zinc, dissolved	mg/L		0.02	0.01				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 27-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 27-1		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/12/2019
Field Parameters								
Flow	gpm				0.20	0.32		0.2
Conductivity (Field)	µmhos/cm	290	460	364	580	654		861
pH (Field)	SU	7.9	8.6	8.2	7.31	7.97		8.26
Temperature (Field)	°C				7.5	8.9		10.7
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-02		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	136	290	169				
Bicarbonate as CaCO3	mg/L	136	290	168				
Calcium, dissolved	mg/L	19.9	29.4	24.4				
Carbonate as CaCO3	mg/L		7	0.9				
Cation - Anion Balance	mg/L	1.3	4.3	2.8				
Chloride	mg/L	2	6	3				
Conductivity @25C	µmhos/cm	368	437	403		606		
Hardness as CaCO3	mg/L	64	122	85				
Iron, dissolved	mg/L		0.02	0.01		-0.03	U	
Iron, total	mg/L	0.16	9.15	1.68		0.18		
Magnesium, dissolved	mg/L	4.5	7.8	5.77				
Manganese, total	mg/L		0.192	0.037				
Nitrate (as N), dissolved	mg/L		0.4	0.08				
Nitrate/Nitrite (as N)	mg/L		0.4	0.08				
pH	SU	7.6	8.2	7.9		8.3	H	
Phosphorus, ortho dissolved	mg/L		0.022	0.003				
Potassium, dissolved	mg/L	1	1.2	1.1				
Residue, Filterable (TDS) @180C	mg/L	210	300	252		378		
Residue, Non-Filterable (TSS) @105C	mg/L		96	42		-5	U	
Sodium Adsorption Ratio (SAR)	calc.	2.91	4.98	3.4				
Sodium, dissolved	mg/L	57.2	74.5	66.1				
Sulfate	mg/L	30	80	57				
Sum of Anions	meq/L	3.9	4.5	4.2				
Sum of Cations	meq/L	4	4.9	4.45				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-7
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring G-7		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/13/2019
Field Parameters								
Flow	gpm				8.74	1.49		1.22
Conductivity (Field)	µmhos/cm				466	540		634
pH (Field)	SU				7.32	8.03		8.39
Temperature (Field)	°C				7.2	7.9		8.0
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-15		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Aluminum, dissolved	mg/L	0.05	0.05	0.05				
Bicarbonate as CaCO3	mg/L	177	184	180.5				
Calcium, dissolved	mg/L	41.8	41.8	41.8				
Chloride	mg/L		1	0.5				
Conductivity @25C	µmhos/cm	387	414	400.5		491		
Hardness as CaCO3	mg/L	134	142	138				
Iron, dissolved	mg/L	0.04	0.07	0		-0.03	U	
Iron, total	mg/L	0.35	0.4	0.375		-0.03	U	
Lead, dissolved	mg/L		0.02	0.01				
Magnesium, dissolved	mg/L	6.8	7.2	7				
Manganese, total	mg/L	0.005	0.006	0				
Nitrate/Nitrite (as N)	mg/L	0.08	0.1	0.09				
pH	SU	7.8	8.1	7.95		8.3	H	
Phosphorus, ortho dissolved	mg/L		0.014	0.007				
Residue, Filterable (TDS) @180C	mg/L	230	230	230		316		
Residue, Non-Filterable (TSS) @105C	mg/L	10	30	20		-5.0	U	
Sodium Adsorption Ratio (SAR)	calc.	1.54	1.63	1.6				
Sodium, dissolved	mg/L	42.8	42.8	42.8				
Sulfate	mg/L	40	50	45				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-16
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring G-16		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/13/2019
Field Parameters								
Flow	gpm				9.20	8.32		3.19
Conductivity (Field)	µmhos/cm				551	763		770
pH (Field)	SU				7.70	8.48		8.70
Temperature (Field)	°C				6.8	7.5		8.0
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-17		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Bicarbonate as CaCO3	mg/L	241	441	307				
Calcium, dissolved	mg/L	55.2	55.9	55.6				
Chloride	mg/L	2	12	5				
Conductivity @25C	µmhos/cm	529	1,120	691		770		
Hardness as CaCO3	mg/L	160	453	220				
Iron, dissolved	mg/L		0.08	0.01		-0.03	U	
Iron, total	mg/L		4.63	0.56		0.13		
Magnesium, dissolved	mg/L	15.1	15.8	15.3				
Manganese, total	mg/L		0.07	0.01				
Nitrate/Nitrite (as N)	mg/L	0.07	0.16	0.1				
pH	SU	7.1	8.2	7.7		8.5	H	
Phosphorus, ortho dissolved	mg/L		0.19	0.04				
Residue, Filterable (TDS) @180C	mg/L	274	700	349		436		
Residue, Non-Filterable (TSS) @105C	mg/L		194	21		11.0	B	
Sodium Adsorption Ratio (SAR)	calc.	1.4	2	1.8				
Sodium, dissolved	mg/L	58.1	64.5	61.3				
Sulfate	mg/L	18.2	200	51.6				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-24
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring G-24		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/13/2019
Field Parameters								
Flow	gpm				4.48	6.21		2.39
Conductivity (Field)	µmhos/cm				920	901		907
pH (Field)	SU				7.14	7.82		7.97
Temperature (Field)	°C				8.7	9.2		9.8
Comment		Decreed Spring #8						
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-14		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Aluminum, dissolved	mg/L		0.08	0.04				
Arsenic, total	mg/L	0.001	0.001	0.001				
Bicarbonate as CaCO3	mg/L	267	376	307				
Calcium, dissolved	mg/L	56.4	56.4	56.4				
Chloride	mg/L	1.2	10	4.4				
Conductivity @25C	µmhos/cm	550	564	557		846		
Hardness as CaCO3	mg/L	176	233	203				
Iron, dissolved	mg/L		0.1	0.03		-0.03	U	
Iron, total	mg/L		2.28	0.45		0.03	B	
Magnesium, dissolved	mg/L	15.9	16.5	16.2				
Manganese, dissolved	mg/L		0.006	0.002				
Manganese, total	mg/L		0.048	0.005				
Nitrate/Nitrite (as N)	mg/L	0.05	0.1	0.08				
pH	SU	7.2	8.3	7.9		8.2	H	
Phosphorus, ortho dissolved	mg/L		0.105	0.027				
Residue, Filterable (TDS) @180C	mg/L	214	520	362		504		
Residue, Non-Filterable (TSS) @105C	mg/L		102	21		-5	U	
Sodium Adsorption Ratio (SAR)	calc.	1.8	1.8	1.8				
Sodium, dissolved	mg/L	58.9	58.9	58.9				
Sulfate	mg/L	21.2	70	30.5				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-14
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring G-14		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/13/2019
Field Parameters								
Flow	gpm				1.27	2.58		0.1
Conductivity (Field)	µmhos/cm				1,097	1,137		1,081
pH (Field)	SU				7.82	8.74		9.32
Temperature (Field)	°C				6.4	10.3		26.0
Comment		Decreed Spring #7						
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-03		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Arsenic, total	mg/L	0.001	0.001	0.001				
Bicarbonate as CaCO3	mg/L	325	484	406				
Calcium, dissolved	mg/L	54.9	61.4	58.2				
Chloride	mg/L	2	14	6				
Conductivity @25C	µmhos/cm	553	682	637		1,050		
Hardness as CaCO3	mg/L	215	307	257				
Iron, dissolved	mg/L		0.11	0.02		-0.03	U	
Iron, total	mg/L		3	0.1		0.04	B	
Magnesium, dissolved	mg/L	21.5	29.8	24.6				
Manganese, total	mg/L		0.03	0.003				
Nitrate/Nitrite (as N)	mg/L	0.12	0.21	0.16				
pH	SU	7.1	8.2	7.7		8.5	H	
Phosphorus, ortho dissolved	mg/L		2.08	0.15				
Residue, Filterable (TDS) @180C	mg/L	324	708	499		672		
Residue, Non-Filterable (TSS) @105C	mg/L		107	5		-5.0	U	
Selenium, total	mg/L	0.001	0.001	0.001				
Sodium Adsorption Ratio (SAR)	calc.	2.22	3.11	2.53				
Sodium, dissolved	mg/L	81.3	114	97.7				
Sulfate	mg/L	40	150	88				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-22
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring G-22		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/22/2019	Q[4]	9/13/2019
Field Parameters								
Flow[5]	gpm				11	15		2
Conductivity (Field)	µmhos/cm				1,170	923		1,285
pH (Field)	SU				NM	7.59		7.52
Temperature (Field)	°C				7.4	11.9		12.9
Comment		Decreed Spring #3			pH not measured, meter malfunction			
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-04		
Sample Date						6/22/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Bicarbonate as CaCO3	mg/L	287	359	332				
Calcium, dissolved	mg/L	64.9	64.9	64.9				
Chloride	mg/L	3	18	7				
Conductivity @25C	µmhos/cm	633	640	637		1,200		
Hardness as CaCO3	mg/L	180	270	234				
Iron, dissolved	mg/L		0.05	0.01		-0.03	U	
Iron, total	mg/L		0.2	0.08		1.17		
Lead, dissolved	mg/L	0.02	0.02	0.02				
Magnesium, dissolved	mg/L	19	19.9	19.5				
Manganese, total	mg/L		0.85	0.11				
Nitrate/Nitrite (as N)	mg/L	0.08	0.08	0.08				
pH	SU	7	7.9	7.6		8.2	H	
Phosphorus, ortho dissolved	mg/L		0.044	0.019				
Residue, Filterable (TDS) @180C	mg/L	300	516	388		746		
Residue, Non-Filterable (TSS) @105C	mg/L		24	5		29		
Sodium Adsorption Ratio (SAR)	calc.	1.78	1.92	1.85				
Sodium, dissolved	mg/L	66.1	66.1	66.1				
Sulfate	mg/L	24	80	41				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Visual flow estimate.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 11-2
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 11-2		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/22/2019	Q[4]	9/13/2019
Field Parameters								
Flow[5]	gpm				2.50	6		0.75
Conductivity (Field)	µmhos/cm				1,428	1,933		5,340
pH (Field)	SU				8.74	8.76		9.25
Temperature (Field)	°C				11.5	9.9		18.6
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-12		
Sample Date						6/22/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Conductivity @25C	µmhos/cm					1,890		
Iron, dissolved	mg/L					-0.03	U	
Iron, total	mg/L					0.31		
pH	SU					8.6	H	
Residue, Filterable (TDS) @180C	mg/L					1,310		
Residue, Non-Filterable (TSS) @105C	mg/L					22.0		

[1] Insufficient flows for baseline measurements and sampling.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Visual flow estimate.

Spring 10-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 10-1		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/22/2019	Q[4]	9/10/2019
Field Parameters								
Flow	gpm				17.26	8.85		7.38
Conductivity (Field)	µmhos/cm				1,648	1,771		1,267
pH (Field)	SU				8.31	8.26		8.44
Temperature (Field)	°C				9.2	9.5		10.4
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-10		
Sample Date						6/22/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Conductivity @25C	µmhos/cm					1,700		
Iron, dissolved	mg/L					-0.03	U	
Iron, total	mg/L					-0.03	U	
pH	SU					8.5	H	
Residue, Filterable (TDS) @180C	mg/L					1,110		
Residue, Non-Filterable (TSS) @105C	mg/L					-5	U	

[1] Insufficient flows for baseline measurements and sampling.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Spring E10-2
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring E10-2		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/22/2019	Q[4]	9/10/2019
Field Parameters								
Flow	gpm				3	0.3		dry
Conductivity (Field)	µmhos/cm				1,330	1,716		
pH (Field)	SU				9.11	8.14		
Temperature (Field)	°C				9.7	13.4		
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-08		
Sample Date						6/22/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Conductivity @25C	µmhos/cm					1,720		
Iron, dissolved	mg/L					-0.03	U	
Iron, total	mg/L					0.7		
pH	SU					8.5	H	
Residue, Filterable (TDS) @180C	mg/L					1,150		
Residue, Non-Filterable (TSS) @105C	mg/L					20.0		

[1] Insufficient flows for baseline measurements and sampling.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Spring 15-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 15-1		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/18/2019	Q[4]	9/10/2019
Field Parameters								
Flow	gpm				1.41	0.07		dry
Conductivity (Field)	µmhos/cm	1,060	1,240	1,137	2,350	2,320		
pH (Field)	SU	7.4	8.6	8.2	7.35	8.6		
Temperature (Field)	°C	1.1	12.8	8	19.6	17.9		
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52685-05		
Sample Date						6/18/2019		
Lab Test Date						6/21-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	375	520	480				
Arsenic, total	mg/L		0.001	0.001				
Bicarbonate as CaCO3	mg/L	364	520	477				
Cadmium, dissolved	mg/L		0.004	0.0005				
Calcium, dissolved	mg/L	44.9	67.8	58.3				
Carbonate as CaCO3	mg/L		12	2.2				
Cation - Anion Balance	mg/L	-5.8	3.8	-1				
Chloride	mg/L	4	9	6.3				
Conductivity @25C	µmhos/cm	1,080	1,120	1,100		2,080		
Copper, dissolved	mg/L		0.01	0.01				
Hardness as CaCO3	mg/L	222	307	271				
Iron, dissolved	mg/L		0.01	0.01		-0.03	U	
Iron, total	mg/L	0.01	0.73	0.12		-0.03	U	
Magnesium, dissolved	mg/L	25.8	33.4	30				
Manganese, total	mg/L		0.022	0.001				
Nitrate/Nitrite (as N)	mg/L	0.08	0.18	0.11				
pH	SU	7.9	8.2	8.1		8.5	H	
Phosphorus, ortho dissolved	mg/L		0.009	0.001				
Potassium, dissolved	mg/L	2.8	3.2	3				
Residue, Filterable (TDS) @180C	mg/L	660	730	701		1,450		
Residue, Non-Filterable (TSS) @105C	mg/L		26	9		-5	U	
Selenium, total	mg/L		0.002	0.001				
Sodium Adsorption Ratio (SAR)	calc.	4.61	5.39	4.99				
Sodium, dissolved	mg/L	163	200	185				
Sulfate	mg/L	140	180	151				
Sum of Anions	meq/L		0.5	0.09				
Sum of Cations	meq/L	12.1	14.4	13.3				
Zinc, dissolved	mg/L		0.01	0.01				
Zinc, total	mg/L		0.05	0.02				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring G-1A
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Spring G-1A		**Baseline[1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/22/2019	9/13/2019
Field Parameters							
Flow	gpm				seep	seep	dry
Conductivity (Field)	µmhos/cm				749	717	
pH (Field)	SU				7.99	8.13	
Temperature (Field)	°C				9.4	9.8	
Comment						not enough water for lab sample	
Laboratory Parameters[2]							
Name of Certified Lab[3]							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Bicarbonate as CaCO3	mg/L	288	501	342			
Calcium, dissolved	mg/L	69.4	69.4	69.4			
Chloride	mg/L	4	17	8			
Conductivity @25C	µmhos/cm	570	672	621			
Hardness as CaCO3	mg/L	266	271	269			
Iron, dissolved	mg/L						
Iron, total	mg/L		1.18	0.2			
Magnesium, dissolved	mg/L	23.7	25.9	24.8			
Manganese, dissolved	mg/L	0.005	0.005	0.005			
Manganese, total	mg/L		0.03	0.004			
Nitrate/Nitrite (as N)	mg/L		0.23	0.08			
pH	SU	7.9	8.5	8.17			
Phosphorus, ortho dissolved	mg/L		0.04	0.01			
Residue, Filterable (TDS) @180C	mg/L	312	550	396			
Residue, Non-Filterable (TSS) @105C	mg/L		66	10			
Sodium Adsorption Ratio (SAR)	calc.	1.22	1.61	1.37			
Sodium, dissolved	mg/L	50.4	50.4	50.4			
Sulfate	mg/L	40	207	83			

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

Spring G-20
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Spring G-20		**Baseline[1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/2/2019	6/18/2019	9/10/2019
Field Parameters							
Flow	gpm				dry	dry	dry
Conductivity (Field)	µmhos/cm						
pH (Field)	SU						
Temperature (Field)	^{o}C						
Comment							
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Bicarbonate as CaCO3	mg/L	452	657	539			
Calcium, dissolved	mg/L	81	81	81			
Chloride	mg/L	1.2	10	5.3			
Conductivity @25C	µmhos/cm	970	1,090	1,023			
Hardness as CaCO3	mg/L	193	416	318			
Iron, dissolved	mg/L		0.05	0.01			
Iron, total	mg/L		0.32	0.05			
Magnesium, dissolved	mg/L	33.3	33.3	33.3			
Manganese, dissolved	mg/L	0.002	0.002	0.002			
Manganese, total	mg/L		0.06	0.005			
Nitrate/Nitrite (as N)	mg/L	0.01	0.05	0.03			
pH	SU	7	8.1	7.7			
Phosphorus, ortho dissolved	mg/L		0.15	0.02			
Residue, Filterable (TDS) @180C	mg/L	502	686	598			
Residue, Non-Filterable (TSS) @105C	mg/L		19.6	3.5			
Sodium Adsorption Ratio (SAR)	calc.	2.31	2.73	2.52			
Sodium, dissolved	mg/L	102	102	102			
Sulfate	mg/L	16	117	81			

[1] Baseline pre -2000 data, adapted from WWE (2001).

Spring J-4
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring J-4		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	Q[4]	9/12/2019
Field Parameters								
Flow	gpm				8.77	3.19		dry
Conductivity (Field)	µmhos/cm	340	480	392	573	637		
pH (Field)	SU	7.5	8.2	7.8	7.50	8.02		
Temperature (Field)	°C				10.4	10.4		
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-19		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	109	262	195				
Aluminum, dissolved	mg/L		0.05	0.02				
Arsenic, dissolved	mg/L		0.001	0				
Bicarbonate as CaCO3	mg/L	169	262	195				
Calcium, dissolved	mg/L	34.2	54.4	43				
Cation - Anion Balance	mg/L	1.1	3.2	2.3				
Chloride	mg/L		3	1.9				
Conductivity @25C	µmhos/cm	412	429	423		593		
Copper, dissolved	mg/L		0.01	0				
Hardness as CaCO3	mg/L	125	191	156				
Iron, dissolved	mg/L		0.06	0.02		0.03	B	
Iron, total	mg/L	0.03	6.75	0.82		0.24		
Magnesium, dissolved	mg/L	9.6	13.4	11.4				
Manganese, total	mg/L		0.066	0.009				
Nitrate (as N), dissolved	mg/L	0.02	0.37	0.14				
Nitrate/Nitrite (as N)	mg/L	0.05	0.37	0.13				
Nitrite (as N), dissolved	mg/L		0.03	0.003				
pH	SU	7.1	8.1	7.5		8.4	H	
Phosphorus, ortho dissolved	mg/L		0.025	0.005				
Potassium, dissolved	mg/L	1.3	1.3	1.3				
Residue, Filterable (TDS) @180C	mg/L	230	300	254		384		
Residue, Non-Filterable (TSS) @105C	mg/L		26	6		7.0	B	
Selenium, total	mg/L		0.002	0				
Sodium Adsorption Ratio (SAR)	calc.	1.08	1.8	1.3				
Sodium, dissolved	mg/L	29.6	51.5	36.7				
Sulfate	mg/L	30	60	45				
Sum of Anions	meq/L	4.5	4.7	4.6				
Sum of Cations	meq/L	4.6	4.91	4.8				
Zinc, dissolved	mg/L		0.01	0				

[1] Baseline pre -2000 data, adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 35-3
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 35-3		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.63	26.5	6.3	14.88	4.26		1.40
Conductivity (Field)	µmhos/cm	223	560	428	372	415		528
pH (Field)	SU	6.53	8.74	7.48	7.91	7.87		7.85
Temperature (Field)	°C	5.9	12.1	8.9	4.7	6.0		8.9
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52655-10		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/5		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	102	217	170				
Aluminum, dissolved	mg/L	-0.03	0.09	0.04				
Arsenic, total	mg/L	0.0009	0.0130	0.0039				
Bicarbonate as CaCO3	mg/L	102	212	169				
Boron, dissolved	mg/L	-0.01	-0.01	-0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	18.2	47.2	34.3				
Carbonate as CaCO3	mg/L	-2	4	2				
Cation - Anion Balance	mg/L	-8.6	-2.1	-4.4				
Chloride	mg/L	1	11	3				
Conductivity @25C	µmhos/cm	216	451	351		381		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	59	142	105				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	0.12	0.06		-0.03	U	
Iron, total	mg/L	0.19	42.50	9.14		0.21		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	3.3	5.8	4.8				
Manganese, dissolved	mg/L	-0.005	0.272	0.055				
Manganese, total	mg/L	0.021	1.280	0.325				
Mercury, total	mg/L	-0.0002	0.0003	0.0001				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.17	0.08				
pH	SU	7.8	8.3	8.2		8.1	H	
Phosphate	mg/L	-0.03	0.15	0.07				
Phosphorus, ortho dissolved	mg/L	-0.01	0.05	0.02				
Potassium, dissolved	mg/L	0.7	1.4	0.9				
Residue, Filterable (TDS) @180C	mg/L	160	250	210		240		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	510	133		16.0	BH	
Selenium, total	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	1.27	1.60	1.45				
Sodium, dissolved	mg/L	25.7	42.5	33.4				
Sulfate	mg/L	10	30	20				
Sum of Anions	meq/L	2.5	4.8	3.9				
Sum of Cations	meq/L	2.3	4.6	3.6				
TDS (calculated)	mg/L	131	248	199				
TDS (ratio - measured/calculated)	calc.	0.09	1.22	0.93				
Zinc, dissolved	mg/L	-0.01	0.02	0.01				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

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H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Deer Creek Spring
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Deer Creek Spring		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/1/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.94	4.15	2.88	6.54	1.07		dry
Conductivity (Field)	µmhos/cm	574	889	735	581	1,158		
pH (Field)	SU	6.72	7.77	7.10	8.18	8.06		
Temperature (Field)	°C	7.1	17.4	10.9	5.8	8.3		
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-05		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	294	302	298				
Aluminum, dissolved	mg/L	-0.03	-0.03	-0.03				
Arsenic, total	mg/L	-0.005	-0.005	-0.005				
Bicarbonate as CaCO3	mg/L	294	302	298				
Boron, dissolved	mg/L	-0.01	-0.01	-0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	64.8	68.6	66.8				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	mg/L	-5.3	0.0	-2.1				
Chloride	mg/L	3	4	3				
Conductivity @25C	µmhos/cm	587	660	611		1,080		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	241	255	249				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	-0.02	-0.02		0.08		
Iron, total	mg/L	-0.02	0.20	0.10		0.47		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	19.1	20.4	20.0				
Manganese, dissolved	mg/L	-0.005	-0.005	-0.005				
Manganese, total	mg/L	-0.005	0.005	0.003				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	1.92	2.33	2.16				
pH	SU	7.9	8.2	8.1		8.4	H	
Phosphate	mg/L	-0.03	0.03	0.02				
Phosphorus, ortho dissolved	mg/L	-0.01	0.01	0.02				
Potassium, dissolved	mg/L	1.9	2.1	2.0				
Residue, Filterable (TDS) @180C	mg/L	320	360	343		682		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	14	5		21		
Selenium, total	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	0.87	0.95	0.92				
Sodium, dissolved	mg/L	31.1	34.7	33.0				
Sulfate	mg/L	30	40	33				
Sum of Anions	meq/L	6.6	6.9	6.7				
Sum of Cations	meq/L	6.2	6.6	6.425				
TDS (calculated)	mg/L	329	341	336				
TDS (ratio - measured/calculated)	calc.	0.95	1.06	1.02				
Zinc, dissolved	mg/L	0.02	0.02	0.02				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

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H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring WCC-24
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring WCC-24		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/1/2019	6/20/2019	Q[4]	9/12/2019
Field Parameters								
Flow	gpm	6.12	40.85	23.36	0.75	45.05		33.12
Conductivity (Field)	µmhos/cm	1,778	3,240	2,319	1,307	1,809		1,943
pH (Field)	SU	7.30	8.64	8.05	8.77	8.79		8.7
Temperature (Field)	°C	11.4	19.0	13.1	6.8	12.1		10.0
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-13		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	323	406	368				
Aluminum, dissolved	mg/L	-0.03	0.04	0.02				
Arsenic, total	mg/L	0.00079	0.0086	0.0070				
Bicarbonate as CaCO3	mg/L	321	406	364				
Boron, dissolved	mg/L	0.74	0.86	0.79				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	165	197	180				
Carbonate as CaCO3	mg/L	-2	16	4				
Cation - Anion Balance	mg/L	-2	2	-0.2				
Chloride	mg/L	2	4	3				
Conductivity @25C	µmhos/cm	1,710	2,070	1,925		1,770		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	856	969	905				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	0.07	0.03		-0.03	U	
Iron, total	mg/L	-0.02	0.53	0.20		0.04	B	
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	106	116	111				
Manganese, dissolved	mg/L	-0.005	0.009	0.003				
Manganese, total	mg/L	-0.005	0.053	0.012				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	0.02	0.01				
Nitrate/Nitrite (as N)	mg/L	2.39	2.97	2.62				
pH	SU	8.1	8.4	8.2		8.5	H	
Phosphate	mg/L	0.12	0.34	0.24				
Phosphorus, ortho dissolved	mg/L	0.04	0.11	0.08				
Potassium, dissolved	mg/L	22.9	26.9	25.0				
Residue, Filterable (TDS) @180C	mg/L	1,460	1,630	1,561		1,440		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	48	12		-5.0	U	
Selenium, total	mg/L	0.014	0.019	0.016				
Sodium Adsorption Ratio (SAR)	calc.	1.71	1.85	1.81				
Sodium, dissolved	mg/L	116	131	123				
Sulfate	mg/L	760	820	800				
Sum of Anions	meq/L	22.5	25.3	24.2				
Sum of Cations	meq/L	23.2	25.8	24.2				
TDS (calculated)	mg/L	1,380	1,530	1,465				
TDS (ratio - measured/calculated)	calc.	1.04	1.11	1.07				
Zinc, dissolved	mg/L	-0.01	0.03	0.02				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

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H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring J-2
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring J-2		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/8/2019	6/19/2019	Q[4]	6/20/2019
Field Parameters								
Flow	gpm	0.11	0.26	0.18	0.3	0.2		0.1
Conductivity (Field)	µmhos/cm	975	1,690	1,281	1,404	1,419		1,123
pH (Field)	SU	8.26	9.10	8.59	8.65	8.99		9.02
Temperature (Field)	°C	9.6	19.6	14.4	4.1	8.3		10.7
Comment								muddy water from cows
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52685-09		
Sample Date						6/19/2019		
Lab Test Date						6/25-7/9		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	605	650	637				
Aluminum, dissolved	mg/L	-0.03	0.20	0.12				
Arsenic, total	mg/L	-0.005	0.010	0.003				
Bicarbonate as CaCO3	mg/L	557	614	584				
Boron, dissolved	mg/L	0.45	0.59	0.54				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	4.2	10.9	5.8				
Carbonate as CaCO3	mg/L	36	72	53				
Cation - Anion Balance	mg/L	-8.6	0.7	-4.6				
Chloride	mg/L	4	12	6				
Conductivity @25C	µmhos/cm	1,090	1,190	1,145		1,340		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	21	47	28				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.05	1.80	0.44		0.11		
Iron, total	mg/L	1.36	37.70	8.42		1.02		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	2.4	4.7	3.2				
Manganese, dissolved	mg/L	0.012	0.18	0.05				
Manganese, total	mg/L	0.046	0.872	0.204				
Mercury, total	mg/L	-0.0002	0.0003	0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	1.14	0.24				
pH	SU	8.4	8.8	8.6		8.7	H	
Phosphate	mg/L	0.46	1.36	0.72				
Phosphorus, ortho dissolved	mg/L	0.15	0.44	0.23				
Potassium, dissolved	mg/L	1.4	5.0	2.1				
Residue, Filterable (TDS) @180C	mg/L	650	910	742		870		
Residue, Non-Filterable (TSS) @105C	mg/L	20	754	192		-5.0	U	
Selenium, total	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	16.30	27.60	23.03				
Sodium, dissolved	mg/L	248	295	266				
Sulfate	mg/L	-10	60	27				
Sum of Anions	meq/L	12.7	14.6	13.5				
Sum of Cations	meq/L	11.4	13.5	12.3				
TDS (calculated)	mg/L	664	752	715				
TDS (ratio - measured/calculated)	calc.	0.96	1.21	1.04				
Zinc, dissolved	mg/L	-0.01	0.19	0.04				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring J-7
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring J-7		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/20/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.19	9.09	4.29	1.70	14.17		0.25
Conductivity (Field)	µmhos/cm	242	496	376	488	813		964
pH (Field)	SU	6.55	8.25	7.60	8.21	8.35		8.59
Temperature (Field)	°C	9.7	21.0	15.4	7.9	15.7		15.3
Comment						water muddy from cows		
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52785-16		
Sample Date						6/20/2019		
Lab Test Date						6/26-7/11		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	121	188	142				
Aluminum, dissolved	mg/L	-0.03	0.05	0.03				
Sum of Anions	meq/L	2.7	4.4	3.8				
Arsenic, total	mg/L	-0.005	0.0008	0.002				
Bicarbonate as CaCO3	mg/L	116	188	140				
Boron, dissolved	mg/L	-0.01	0.02					
Cadmium, dissolved	mg/L	-0.005	-0.005					
Calcium, dissolved	mg/L	21.1	33.9	30.3				
Carbonate as CaCO3	mg/L	-2	7	1				
Cation - Anion Balance	mg/L	-7.3	0	-2.60				
Sum of Cations	meq/L	2.6	4.3	3.6				
Chloride	mg/L	2	4	3				
Conductivity @25C	µmhos/cm	250	426	354		805		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	79	125	107				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.02	0.11	0.05		-0.03	U	
Iron, total	mg/L	0.53	1.96	1.02		217		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	6.3	9.9	7.5				
Manganese, dissolved	mg/L	-0.005	-0.005	-0.005				
Manganese, total	mg/L	-0.005	0.037	0.019				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.33	0.16				
pH	SU	7.6	8.4	8.2		8.3	H	
Phosphate	mg/L	-0.03	0.24	0.09				
Phosphorus, ortho dissolved	mg/L	-0.01	0.08	0.03				
Potassium, dissolved	mg/L	1.2	2.2	1.62				
Selenium, total	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	1.19	1.61	1.41				
Sodium, dissolved	mg/L	23.9	41	33.2				
Sulfate	mg/L	10	60	44				
TDS (ratio - measured/calculated)	calc.	0.99	1.38	1.14				
TDS (calculated)	mg/L	138	234	205				
Residue, Filterable (TDS) @180C	mg/L	190	270	230		880		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	24	10		7,220		
Zinc, dissolved	mg/L	-0.01	0.03	0				

[1] Baseline 2006.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

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H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection
Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Deep Creek Trail Spring
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Deep Creek Trail Spring		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	1.24	3.51	1.77	31.04	7.11		1.92
Conductivity (Field)	µmhos/cm	400	479	455	316	437		531
pH (Field)	SU	7.72	8.07	7.90	8.11	8.1		8.39
Temperature (Field)	°C	5.8	11.8	8.74	5.1	6.5		7.6
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52582-08		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/1		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	161	236	211				
Aluminum, dissolved	mg/L	-0.03	0.11	0.04				
Arsenic, total	mg/L	-0.0005	-0.0005	-0.0005				
Bicarbonate as CaCO3	mg/L	156	232	208				
Boron, dissolved	mg/L	0.02	0.02	0.02				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	29.4	40.3	37.4				
Carbonate as CaCO3	mg/L	-2	7	4				
Cation - Anion Balance	mg/L	-1.1	9.5	1.9				
Chloride	mg/L	1	2	2				
Conductivity @25C	µmhos/cm	357	463	440		409		
Copper, dissolved	mg/L	-0.01	0.02	0.01				
Hardness as CaCO3	mg/L	96	123	116				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	0.14	0.05		-0.03	U	
Iron, total	mg/L	0.14	1.63	0.79		0.09		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	5.2	6.0	5.6				
Manganese, dissolved	mg/L	-0.005	-0.005	-0.005				
Manganese, total	mg/L	-0.005	0.024	0.012				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	1.51	0.66				
pH	SU	8.3	8.4	8.4		8.4	H	
Phosphate	mg/L	-0.03	0.15	0.05				
Phosphorus, ortho dissolved	mg/L	-0.01	0.05	0.02				
Potassium, dissolved	mg/L	1.0	1.1	1.0				
Residue, Filterable (TDS) @180C	mg/L	230	270	253		228		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	60	20		6.0	B	
Selenium, total	mg/L	-0.001	-0.001	-0.001				
Sodium Adsorption Ratio (SAR)	calc.	1.85	2.47	2.22				
Sodium, dissolved	mg/L	41.2	62.0	54.6				
Sulfate	mg/L	10	20	14				
Sum of Anions	meq/L	3.7	4.9	5				
Sum of Cations	meq/L	3.7	5.2	4.7				
TDS (calculated)	mg/L	198	262	243				
TDS (ratio - measured/calculated)	calc.	0.98	1.16	1.05				
Zinc, dissolved	mg/L	-0.01	0.02	0				

[1] Baseline 2007.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Deep Creek Spring # 2
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Deep Creek Spring #2		**Baseline[1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean [2]	5/6/2019	6/17/2019	9/11/2019
Field Parameters							
Flow	gpm	0.19	0.29	0.24	dry	dry	dry
Conductivity (Field)	µmhos/cm	396	453	433			
pH (Field)	SU	7.97	8.19	8.09			
Temperature (Field)	°C	7.1	13.4	10.4			
Comment							
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/L	167	219	195			
Aluminum, dissolved	mg/L	-0.03	0.09	0.06			
Arsenic, total	mg/L	-0.0005	0.0012	0.0006			
Bicarbonate as CaCO3	mg/L	159	211	185			
Boron, dissolved	mg/L	0.01	0.02	0.01			
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005			
Calcium, dissolved	mg/L	41.6	47.8	44.2			
Carbonate as CaCO3	mg/L	6	14	9			
Cation - Anion Balance	mg/L	0	4.9	1.8			
Chloride	mg/L	2	3	2			
Conductivity @25C	µmhos/cm	393	440	422			
Copper, dissolved	mg/L	-0.01	0.03	0.01			
Hardness as CaCO3	mg/L	127	147	136			
Hydroxide as CaCO3	mg/L	-2	-2	-2			
Iron, dissolved	mg/L	0.02	0.08	0.05			
Iron, total	mg/L	1.07	9.71	3.70			
Lead, dissolved	mg/L	-0.04	-0.04	-0.04			
Magnesium, dissolved	mg/L	5.7	6.7	6.3			
Manganese, dissolved	mg/L	-0.005	0.008	0.003			
Manganese, total	mg/L	0.018	0.146	0.057			
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002			
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01			
Nitrate/Nitrite (as N)	mg/L	-0.02	0.25	0.08			
pH	SU	8.4	8.5	8.4			
Phosphate	mg/L	-0.03	0.18	0.05			
Phosphorus, ortho dissolved	mg/L	-0.01	0.06	0.02			
Potassium, dissolved	mg/L	0.9	1.4	1.2			
Residue, Filterable (TDS) @180C	mg/L	230	260	247			
Residue, Non-Filterable (TSS) @105C	mg/L	6	302	136			
Selenium, total	mg/L	-0.001	-0.001	-0.001			
Sodium Adsorption Ratio (SAR)	calc.	1.37	1.63	1.49			
Sodium, dissolved	mg/L	35.1	44.8	39.5			
Sulfate	mg/L	20	20	20			
Sum of Anions	meq/L	3.8	4.8	4.3			
Sum of Cations	meq/L	4.1	4.9	4.5			
TDS (calculated)	mg/L	209	257	234			
TDS (ratio - measured/calculated)	calc.	1.01	1.16	1.06			
Zinc, dissolved	mg/L	-0.01	0.03	0.01			

[1] Baseline 2007.

[2] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

96-2-2 Area Spring
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: 96-2-2 Area Spring		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.11	2.5	0.75	0.97	1.38		seep
Conductivity (Field)	µmhos/cm	348	430	399	444	433		510
pH (Field)	SU	7.78	8.18	7.88	8.04	7.82		8.06
Temperature (Field)	°C	6.9	12.3	10.6	4.9	6.9		9.9
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52582-10		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/5		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	129	172	156				
Aluminum, dissolved	mg/L	-0.03	0.21	0.09				
Arsenic, total	mg/L	-0.0005	0.0012	0.0007				
Bicarbonate as CaCO3	mg/L	129	171	154				
Boron, dissolved	mg/L	0.01	0.02	0.02				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	11.8	18.3	16.2				
Carbonate as CaCO3	mg/L	-2	10	4				
Cation - Anion Balance	mg/L	0.0	5.6	2.2				
Chloride	mg/L	2	3	2				
Conductivity @25C	µmhos/cm	332	421	387		401		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	38	59	52				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.05	0.30	0.13		-0.03	U	
Iron, total	mg/L	0.84	9.08	4.55		0.55		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	2.1	3.3	2.9				
Manganese, dissolved	mg/L	-0.005	0.177	0.045				
Manganese, total	mg/L	0.013	0.153	0.075				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	0.01	0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.04	0.03				
pH	SU	8.2	8.5	8.4		8.3	H	
Phosphate	mg/L	0.03	0.18	0.08				
Phosphorus, ortho dissolved	mg/L	0.01	0.06	0.03				
Potassium, dissolved	mg/L	0.7	1.4	1.2				
Residue, Filterable (TDS) @180C	mg/L	190	240	220		240		
Residue, Non-Filterable (TSS) @105C	mg/L	22	510	175		14.0	BH	
Selenium, total	mg/L	-0.001	0.002	0.0008				
Sodium Adsorption Ratio (SAR)	calc.	3.93	4.17	4.09				
Sodium, dissolved	mg/L	58.5	70.8	67.0				
Sulfate	mg/L	30	30	30				
Sum of Anions	meq/L	3.2	4	3.8				
Sum of Cations	meq/L	3.3	4.3	4.0				
TDS (calculated)	mg/L	183	231	216				
TDS (ratio - measured/calculated)	calc.	0.97	1.04	1.02				
Zinc, dissolved	mg/L	-0.01	0.11	0.03				

[1] Baseline 2007.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentrationentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring J-10
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring J-10		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/1/2019	6/20/2019	Q[4]	9/12/2019
Field Parameters								
Flow	gpm	dry	0.22	seep	0.4	0.10		seep
Conductivity (Field)	µmhos/cm	770	982	879	639	896		845
pH (Field)	SU	7.14	7.92	7.42	7.75	7.97		7.5
Temperature (Field)	°C	5.9	19.5	12.8	4.8	16.8		9
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52785-06		
Sample Date						6/26-7/11		
Lab Test Date						6/20/2019		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	299	463	377				
Aluminum, dissolved	mg/L	-0.03	-0.03	-0.03				
Arsenic, total recoverable	mg/L	-0.0005	0.0055	0.0018				
Bicarbonate as CaCO3	mg/L	294	463	375				
Boron, dissolved	mg/L	0.02	0.06	0.05				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	70	118	92.8				
Carbonate as CaCO3	mg/L	-2	15	3				
Cation - Anion Balance	mg/L	-7.4	4.7	-1.3				
Chloride	mg/L	10	19	14				
Conductivity @25C	µmhos/cm	721	927	822		856		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	273	447	360				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	0.68	0.18		0.28		
Iron, total	mg/L	0.44	10.9	3.45		0.92		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	23.5	36.9	31.0				
Manganese, dissolved	mg/L	0.011	1.06	0.287				
Manganese, total	mg/L	0.043	1.85	0.587				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.01	-0.01	-0.01				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.04	0.02				
pH	SU	8.2	8.3	8.2		8.3	H	
Phosphate	mg/L	-0.03	0.06	-0.03				
Phosphorus, ortho dissolved	mg/L	-0.01	0.02	-0.01				
Potassium, dissolved	mg/L	1.7	2.5	2.0				
Residue, Filterable (TDS) @180C	mg/L	450	600	512		546		
Residue, Non-Filterable (TSS) @105C	mg/L	15	157	53		19.0	B	
Selenium, total recoverable	mg/L	0.0002	0.0011	0.0005				
Sodium Adsorption Ratio (SAR)	calc.	0.84	1.05	0.92				
Sodium, dissolved	mg/L	31.9	47.6	39.8				
Sulfate	mg/L	30	71	57				
Sum of Anions	meq/L	8.0	10.4	9.2				
Sum of Cations	meq/L	6.9	11.1	9.0				
TDS (calculated)	mg/L	397	522	466				
TDS (ratio - measured/calculated)	calc.	1.02	1.15	1.10				
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01				

[1] Baseline Monitoring WY 2011.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 2012-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Spring 2012-1		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/17/2019	9/11/2019
Field Parameters							
Flow	gpm	dry	2.5	NA	0.7	damp soil	dry
Conductivity (Field)	µmhos/cm	123	123	123	86.1		
pH (Field)	SU	7.79	7.79	7.79	7.11		
Temperature (Field)	°C	7.3	7.3	7.3	13.4		
Comment							
Laboratory Parameters[2]							
Name of Certified Lab[3]							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/L						
Aluminum, dissolved	mg/L						
Arsenic, total recoverable	mg/L						
Bicarbonate as CaCO3	mg/L						
Boron, dissolved	mg/L						
Cadmium, dissolved	mg/L						
Calcium, dissolved	mg/L						
Carbonate as CaCO3	mg/L						
Cation - Anion Balance	mg/L						
Chloride	mg/L						
Conductivity @25C	µmhos/cm						
Copper, dissolved	mg/L						
Hardness as CaCO3	mg/L						
Hydroxide as CaCO3	mg/L						
Iron, dissolved	mg/L						
Iron, total	mg/L						
Lead, dissolved	mg/L						
Magnesium, dissolved	mg/L						
Manganese, dissolved	mg/L						
Manganese, total	mg/L						
Mercury, total	mg/L						
Molybdenum, dissolved	mg/L						
Nitrate/Nitrite (as N)	mg/L						
pH	SU						
Phosphate	mg/L						
Phosphorus, ortho dissolved	mg/L						
Potassium, dissolved	mg/L						
Residue, Filterable (TDS) @180C	mg/L						
Residue, Non-Filterable (TSS) @105C	mg/L						
Selenium, total recoverable	mg/L						
Sodium Adsorption Ratio (SAR)	calc.						
Sodium, dissolved	mg/L						
Sulfate	mg/L						
Sum of Anions	meq/L						
Sum of Cations	meq/L						
TDS (calculated)	mg/L						
TDS (ratio - measured/calculated)	calc.						
Zinc, dissolved	mg/L						

[1] Baseline Monitoring May Through October 2013. Insufficient flow for lab samples. Field measurments only.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

Spring 2012-2
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 2012-2		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	dry	3.56	0.59	NM	1.16		dry
Conductivity (Field)	µmhos/cm	91	114	103	95.4	103		
pH (Field)	SU	8.00	8.32	8.16	7.21	7.88		
Temperature (Field)	°C	4.8	6.6	5.7	11.7	10.1		
Comment					flow not measured, overrun by upgradient flow			
Laboratory Parameters [2]								
Name of Certified Lab [3]						ACZ		
Lab Reference #						L52582-11		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/5		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	38.0	38.0	38.0				
Aluminum, dissolved	mg/L	0.05	0.05	0.05				
Arsenic, total recoverable	mg/L	-0.0002	-0.0002	-0.0002				
Bicarbonate as CaCO3	mg/L	38.0	38.0	38.0				
Boron, dissolved	mg/L	-0.01	-0.01	-0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	7.5	7.5	7.5				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	mg/L	6.3	6.3	6.3				
Chloride	mg/L	2	2	2				
Conductivity @25C	µmhos/cm	99	99	99		106		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	25	25	25				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.11	0.11	0.11		-0.03	U	
Iron, total	mg/L	1.04	1.04	1.04		0.71		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	1.6	1.6	1.6				
Manganese, dissolved	mg/L	-0.005	-0.005	-0.005				
Manganese, total	mg/L	0.009	0.009	0.009				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02				
Nitrate/Nitrite (as N)	mg/L	0.41	0.41	0.41				
pH	SU	7.9	7.9	7.9		7.9	H	
Phosphate	mg/L	-0.03	-0.03	-0.03				
Phosphorus, ortho dissolved	mg/L	-0.01	-0.01	-0.01				
Potassium, dissolved	mg/L	0.7	0.7	0.7				
Residue, Filterable (TDS) @180C	mg/L	80	80	80		82		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	-5	-5		-5	UH	
Selenium, total recoverable	mg/L	0.0002	0.0002	0.0002				
Sodium Adsorption Ratio (SAR)	calc.	0.82	0.82	0.82				
Sodium, dissolved	mg/L	9.4	9.4	9.4				
Sulfate	mg/L	1	1	1				
Sum of Anions	meq/L	0.837	0.837	0.837				
Sum of Cations	meq/L	0.949	0.949	0.949				
TDS (calculated)	mg/L	45	45	45				
TDS (ratio - measured/calculated)	calc.	1.78	1.78	1.78				
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01				

[1] Baseline Monitoring May Through October 2013. Only one laboratory sample was collected during the baseline period in May 2013. The spring was dry from June through October 2013.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 2012-3
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 2012-3		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.16	2.63	0.88	27.15	4.71		0.48
Conductivity (Field)	µmhos/cm	396	525	471	266	410		481
pH (Field)	SU	7.51	8.63	8.13	7.94	7.92		8.63
Temperature (Field)	°C	2.0	9.1	6.2	7.3	7.1		8.9
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52582-05		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/1		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	169	201	183				
Aluminum, dissolved	mg/L	-0.03	0.05	0.02				
Arsenic, total recoverable	mg/L	-0.0002	0.0013	0.0005				
Bicarbonate as CaCO3	mg/L	163	191	173				
Boron, dissolved	mg/L	-0.01	0.02	0.01				
Cadmium, dissolved	mg/L	-0.005	-0.005	0.003				
Calcium, dissolved	mg/L	29.3	39.7	37.2				
Carbonate as CaCO3	mg/L	6	17	11				
Cation - Anion Balance	mg/L	-4.2	2.3	1.5				
Chloride	mg/L	1	2	2				
Conductivity @25C	µmhos/cm	373	475	436		379		
Copper, dissolved	mg/L	-0.01	-0.01	0.01				
Hardness as CaCO3	mg/L	97	130	122				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.02	0.27	0.07		-0.03	U	
Iron, total	mg/L	0.49	5.24	1.77		0.09		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	5.7	7.5	7.1				
Manganese, dissolved	mg/L	-0.005	0.032	0.010				
Manganese, total	mg/L	0.017	0.124	0.052				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02				
Nitrate/Nitrite (as N)	mg/L	0.04	0.16	0.09				
pH	SU	8.3	8.5	8.4		8.4	H	
Phosphate	mg/L	-0.03	0.16	0.07				
Phosphorus, ortho dissolved	mg/L	-0.01	0.05	0.02				
Potassium, dissolved	mg/L	1.2	1.8	1.5				
Residue, Filterable (TDS) @180C	mg/L	210	280	260		204		
Residue, Non-Filterable (TSS) @105C	mg/L	13	245	72		5.0	B	
Selenium, total recoverable	mg/L	0.0003	0.0005	0.0004				
Sodium Adsorption Ratio (SAR)	calc.	1.82	1.86	1.84				
Sodium, dissolved	mg/L	41.5	48.2	46.2				
Sulfate	mg/L	33	51.5	42				
Sum of Anions	meq/L	4.1	5.0	4.6				
Sum of Cations	meq/L	3.8	4.8	4.5				
TDS (calculated)	mg/L	214	265	246				
TDS (ratio - measured/calculated)	calc.	0.98	1.11	1.05				
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01				

[1] Baseline Monitoring May Through October 2013.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring 2012-4
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Spring 2012-4		**Baseline[1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean[5]	5/6/2019	6/17/2019	Q[4]	9/11/2019
Field Parameters								
Flow	gpm	0.91	2.26	1.41	2.43	3.16		1.75
Conductivity (Field)	µmhos/cm	444	538	507	367	482		520
pH (Field)	SU	7.02	8.24	7.93	8.06	8.14		8.43
Temperature (Field)	°C	4.7	6.2	5.4	5.4	6.5		7.9
Comment								
Laboratory Parameters[2]								
Name of Certified Lab[3]						ACZ		
Lab Reference #						L52582-07		
Sample Date						6/17/2019		
Lab Test Date						6/21-7/1		
Sampled By						PH		
Alkalinity (Total CaCO3)	mg/L	173	209	196				
Aluminum, dissolved	mg/L	-0.03	0.07	0.03				
Arsenic, total recoverable	mg/L	-0.0002	0.0008	0.0003				
Bicarbonate as CaCO3	mg/L	169	204	189				
Boron, dissolved	mg/L	0.01	0.02	0.02				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	34.8	41.1	39.5				
Carbonate as CaCO3	mg/L	-2	13	7				
Cation - Anion Balance	mg/L	-1.1	2.1	1.0				
Chloride	mg/L	1	2	2				
Conductivity @25C	µmhos/cm	422	496	469		445		
Copper, dissolved	mg/L	-0.01	-0.01	-0.01				
Hardness as CaCO3	mg/L	113	134	128				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.02	0.45	0.11		-0.03	U	
Iron, total	mg/L	0.09	2.99	0.92		0.27		
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	6.4	7.5	7.2				
Manganese, dissolved	mg/L	-0.005	0.013	0.004				
Manganese, total	mg/L	-0.005	0.05	0.02				
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002				
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.03	0.02				
pH	SU	8.2	8.5	8.4		8.4	H	
Phosphate	mg/L	-0.03	0.09	0.05				
Phosphorus, ortho dissolved	mg/L	-0.01	0.03	0.02				
Potassium, dissolved	mg/L	0.9	1.6	1.2				
Residue, Filterable (TDS) @180C	mg/L	240	298	274		264		
Residue, Non-Filterable (TSS) @105C	mg/L	-5	112	34		27.0		
Selenium, total recoverable	mg/L	0.0003	0.0004	0.0003				
Sodium Adsorption Ratio (SAR)	calc.	1.93	2.03	2.01				
Sodium, dissolved	mg/L	46.6	53.1	51.6				
Sulfate	mg/L	37	45	40				
Sum of Anions	meq/L	4.4	5.0	4.8				
Sum of Cations	meq/L	4.3	5.06	4.9				
TDS (calculated)	mg/L	234	268	259				
TDS (ratio - measured/calculated)	calc.	1.03	1.12	1.06				
Zinc, dissolved	mg/L	-0.01	0.16	0.02				

[1] Baseline Monitoring May Through October 2013.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Spring ST-S-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019											
Monitoring Location: Spring ST-S-1		**Baseline[1]**			**Water Year 2019**						
Description	Units	Minimum	Maximum	Mean[5]	5/8/2019	Q[4]	6/19/2019	Q[4]	7/30/2019	Q[4]	9/9/2019
Field Parameters											
Flow	gpm	--	--	--	0.42		0.5		seep		seep
Conductivity (Field)	µmhos/cm	357	596	468	439		420		596		764
pH (Field)	SU	6.85	8.73	8.01	6.85		8.05		7.64		8.41
Temperature (Field)	°C	8.5	19.6	14.5	8.5		19.6		15.2		18.6
Comment											
Laboratory Parameters[2]											
Name of Certified Lab[3]					ACZ		ACZ		ACZ		
Lab Reference #					L51688-02		L52655-06		L53580-02		
Sample Date					5/8/2019		6/19/2019		7/30/2019		
Lab Test Date					5/11-5/24		6/20-7/9		7/31-8/20		
Sampled By					PH		PH		PH		
Alkalinity (Total CaCO3)	mg/L	163	266	206	163		189		220		
Aluminum, dissolved	mg/L	-0.05	0.21	0.09	-0.05	U	0.10	B	-0.05	U	
Arsenic, total recoverable	mg/L	0.0004	0.0045	0.0022	0.0004	B	0.0012		0.0035		
Bicarbonate as CaCO3	mg/L	161	266	203	161		183		220		
Boron, dissolved	mg/L	-0.02	0.04	0.03	0.02	B	-0.02	U	0.03	B	
Cadmium, dissolved	mg/L	-0.008	-0.005	-0.005	-0.008	U	-0.008	U	-0.008	U	
Calcium, dissolved	mg/L	2.6	21.9	12.7	16.2		17.5		21.9		
Carbonate as CaCO3	mg/L	-10	7	4	-10	U	-10	U	-2	U	
Cation-Anion Balance	%	-5.8	3.7	-1.3	0.0		-2.3		-2.0		
Chloride	mg/L	1.6	7.2	3.3	3.3		1.8	B	2.8		
Conductivity @25C	umhos/cm	374	526	430	399		391		460		
Copper, dissolved	mg/L	-0.01	0.01	0.01	-0.01	U	-0.01	U	-0.01	U	
Hardness as CaCO3 (dissolved)	mg/L	9	82	47	62		65		82		
Hydroxide as CaCO3	mg/L	-10	-2	-2	-10	U	-10	U	-2	U	
Iron, dissolved	mg/L	-0.03	0.52	0.18	-0.03	U	0.16		0.04	B	
Iron, total	mg/L	0.63	18.10	8.82	0.63		6.23		10.80		
Lead, dissolved	mg/L	-0.03	-0.03	-0.03	-0.03	U	-0.03	U	-0.03	U	
Magnesium, dissolved	mg/L	0.7	6.5	3.8	5.1		5.2		6.5		
Manganese, dissolved	mg/L	-0.01	0.08	0.03	-0.01	U	-0.01	U	0.08		
Manganese, total	mg/L	-0.01	0.35	0.15	-0.01	U	0.09		0.35		
Mercury, total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002	U	-0.0002	U	-0.0002	U	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	U	-0.02	U	-0.02	U	
Nitrate/Nitrite as N	mg/L	-0.02	0.77	0.17	0.77		-0.02	U	-0.02	U	
pH	units	7.3	8.4	8.1	8.3	H	8.4	H	8.1	H	
Phosphate	mg/L	0.06	0.19	0.11	0.09	B	0.12	B	0.06	B	
Phosphorus, ortho dissolved	mg/L	0.02	0.06	0.04	0.03	BH	0.04	B	0.02	B	
Potassium, dissolved	mg/L	0.6	1.7	1.0	0.7	B	0.6	B	1.5		
Residue, Filterable (TDS) @180C	mg/L	260	760	381	260		260		362		
Residue, Non-Filterable (TSS) @105C	mg/L	14.0	312.0	154.6	14.0	B	129.0	H	134.0		
Selenium, total recoverable	mg/L	-0.0001	0.003	0.001	0.003		0.001		0.001		
Sodium Adsorption Ratio in Water	calc.	3.5	13.0	7.0	3.6		3.5		3.7		
Sodium, dissolved	mg/L	64.5	102.0	79.0	64.5		64.6		75.3		
Sulfate	mg/L	-1	38.9	21.1	38.9		30.7		34.9		
Sum of Anions	meq/L	3.9	5.5	4.6	4.1		4.4		5.2		
Sum of Cations	meq/L	4.1	5.0	4.5	4.1		4.2		5.0		
TDS (calculated)	mg/L	213	280	246	227		232		277		
TDS (ratio - measured/calculated)	calc.	1.12	2.71	1.50	1.15		1.12		1.31		
Zinc, dissolved	mg/L	-0.01	0.01	0.01	-0.01	U	-0.01	U	-0.01	U	

[1] Baseline period is July 2018 through July 2019.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.

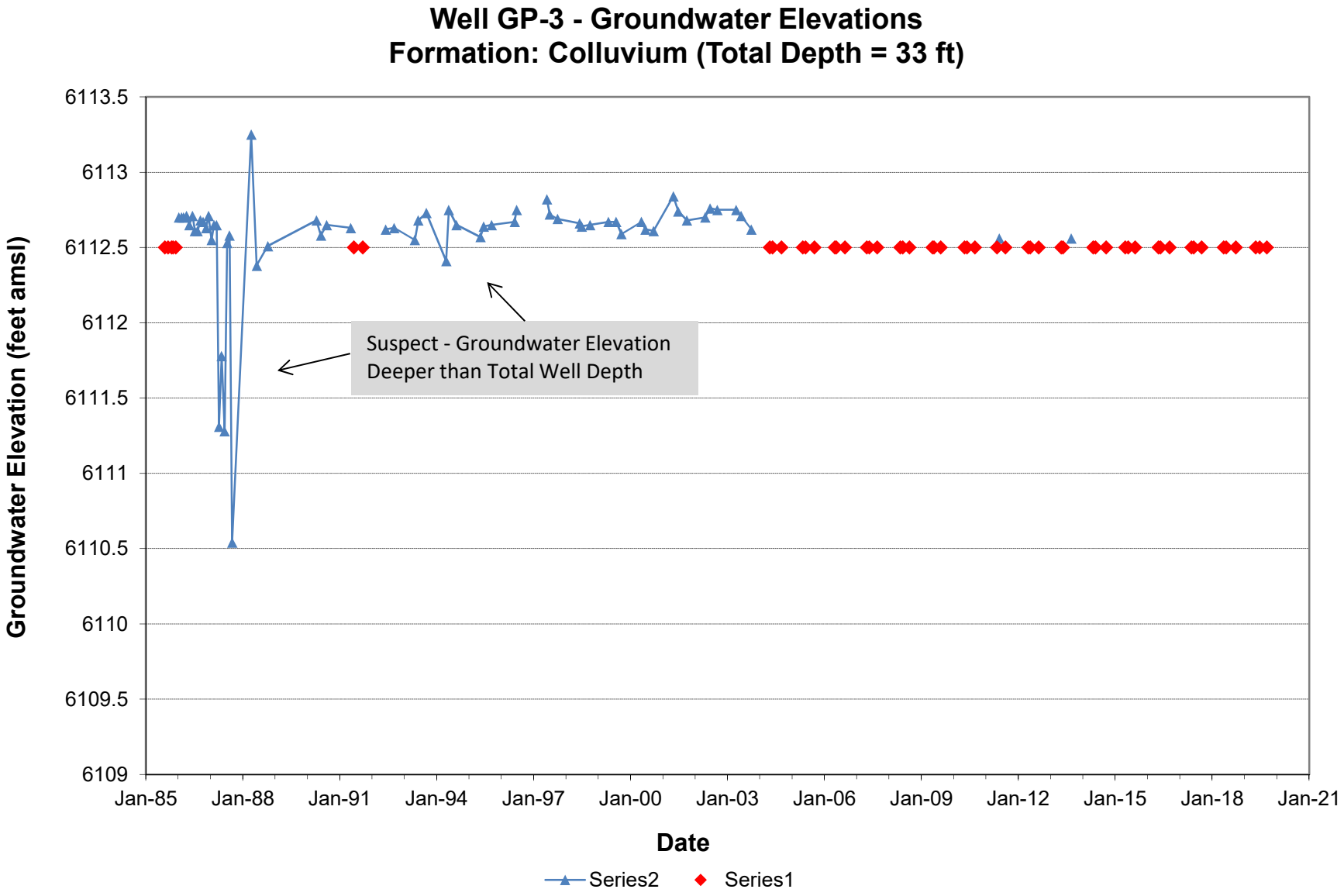
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

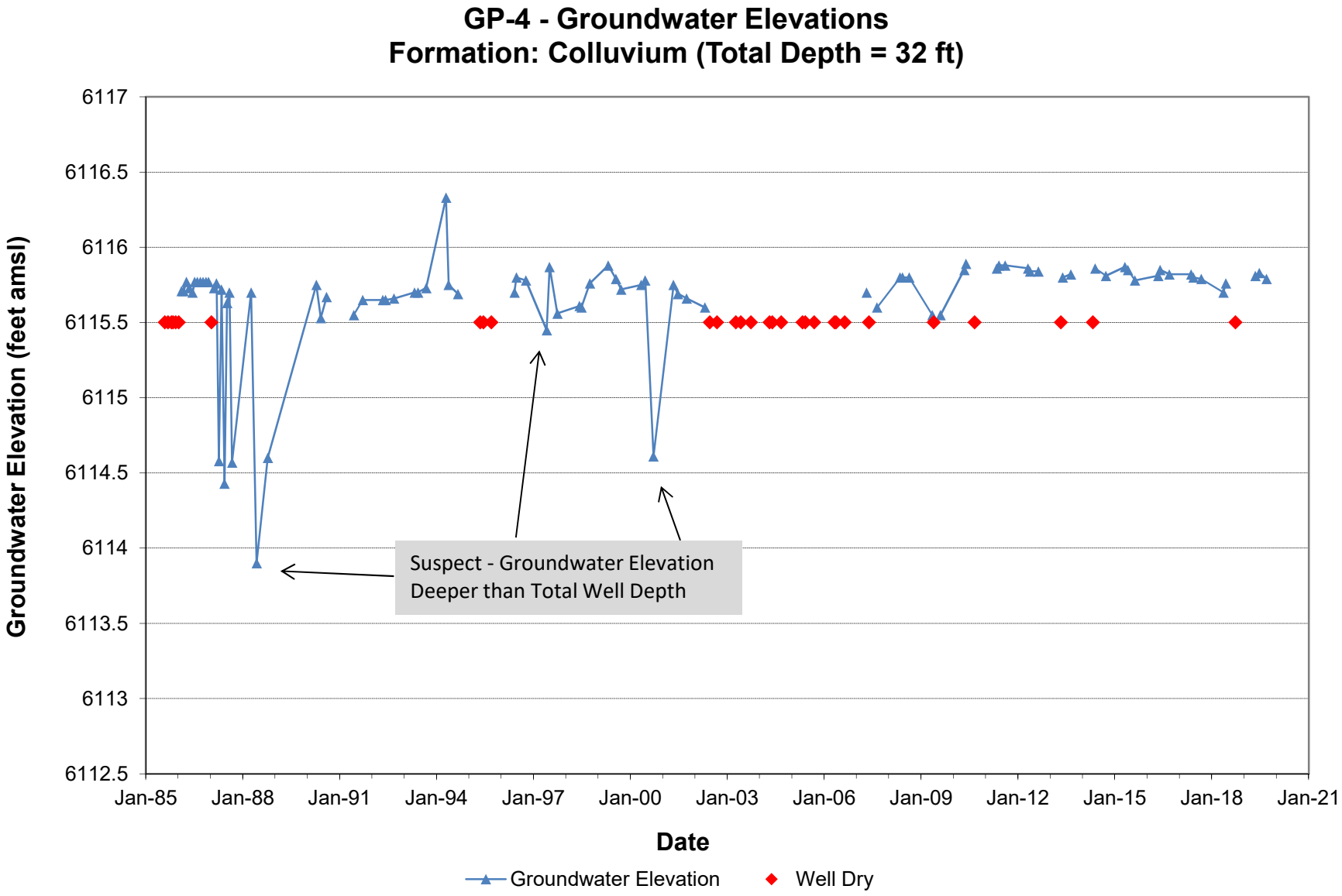
[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

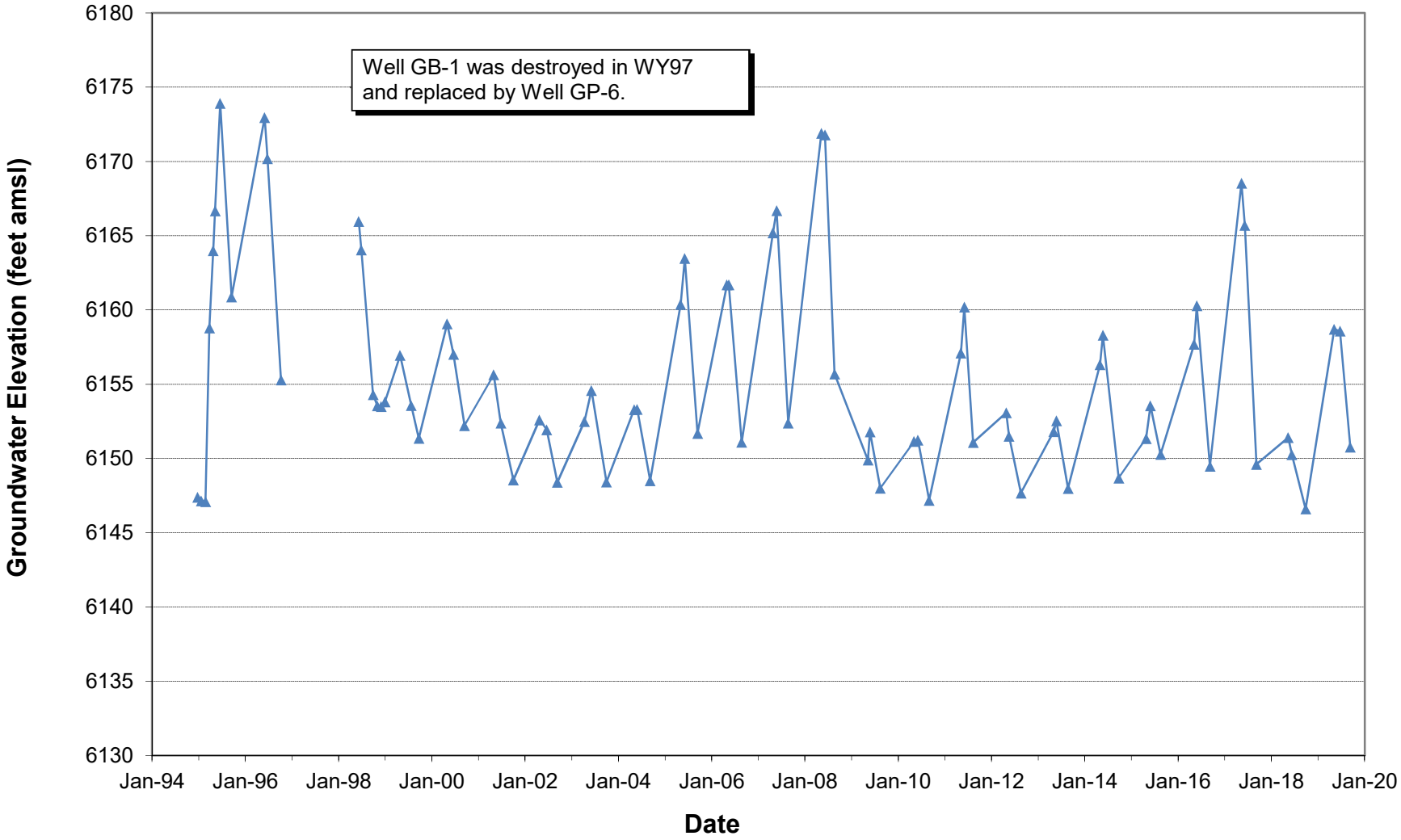
APPENDIX F

WELLS - WATER LEVEL ELEVATION GRAPHS

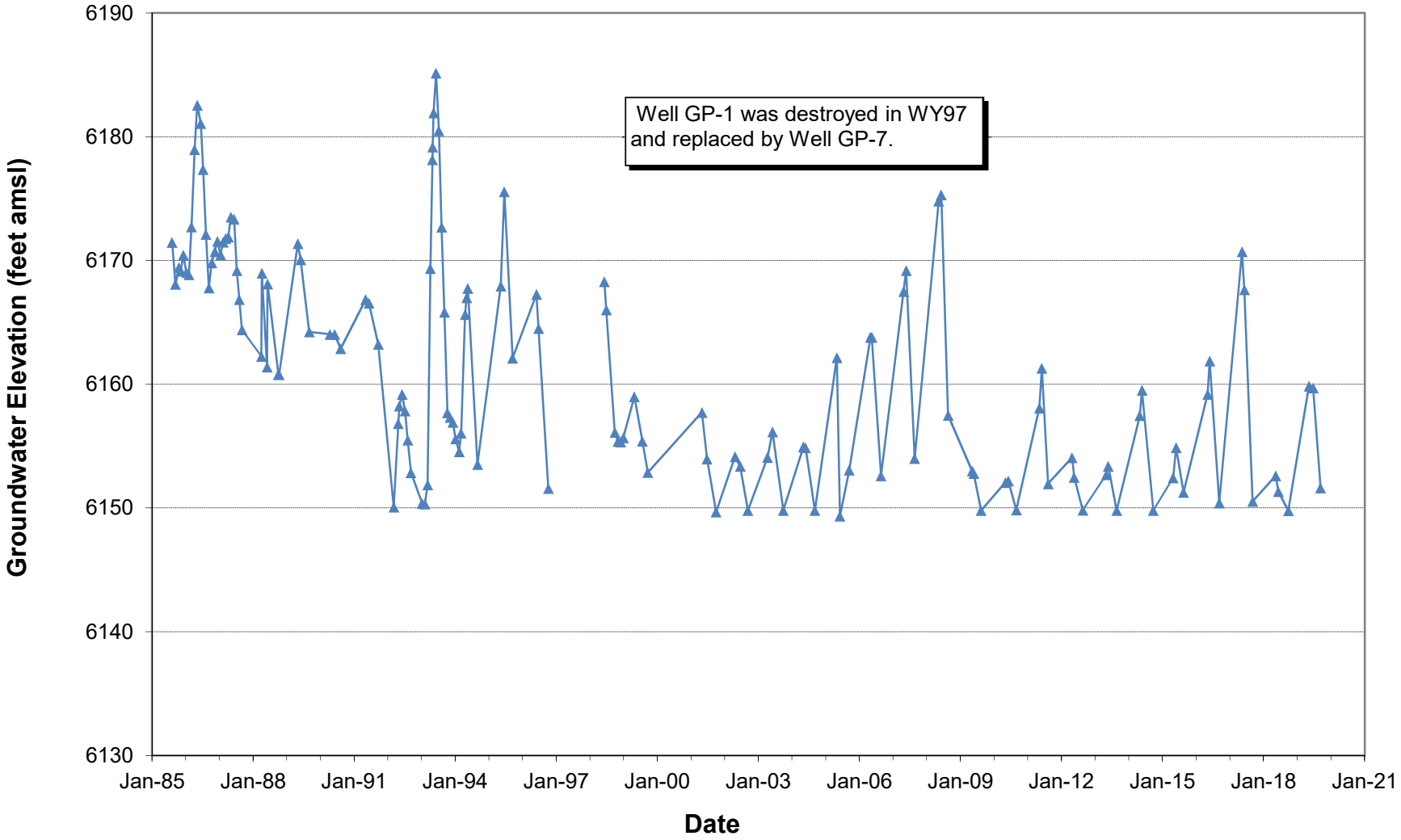

Well GP-3 - Groundwater Elevations
Formation: Colluvium (Total Depth = 33 ft)
Groundwater Elevation (feet amsl)
6113.5
6113
6112.5
6112
6111.5
6111
6110.5
6110
6109.5
6109
Jan-85
Jan-88
Jan-91
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09
Jan-12
Jan-15
Jan-18
Jan-21
Date
Suspect - Groundwater Elevation
Deeper than Total Well Depth
Series2
Series1

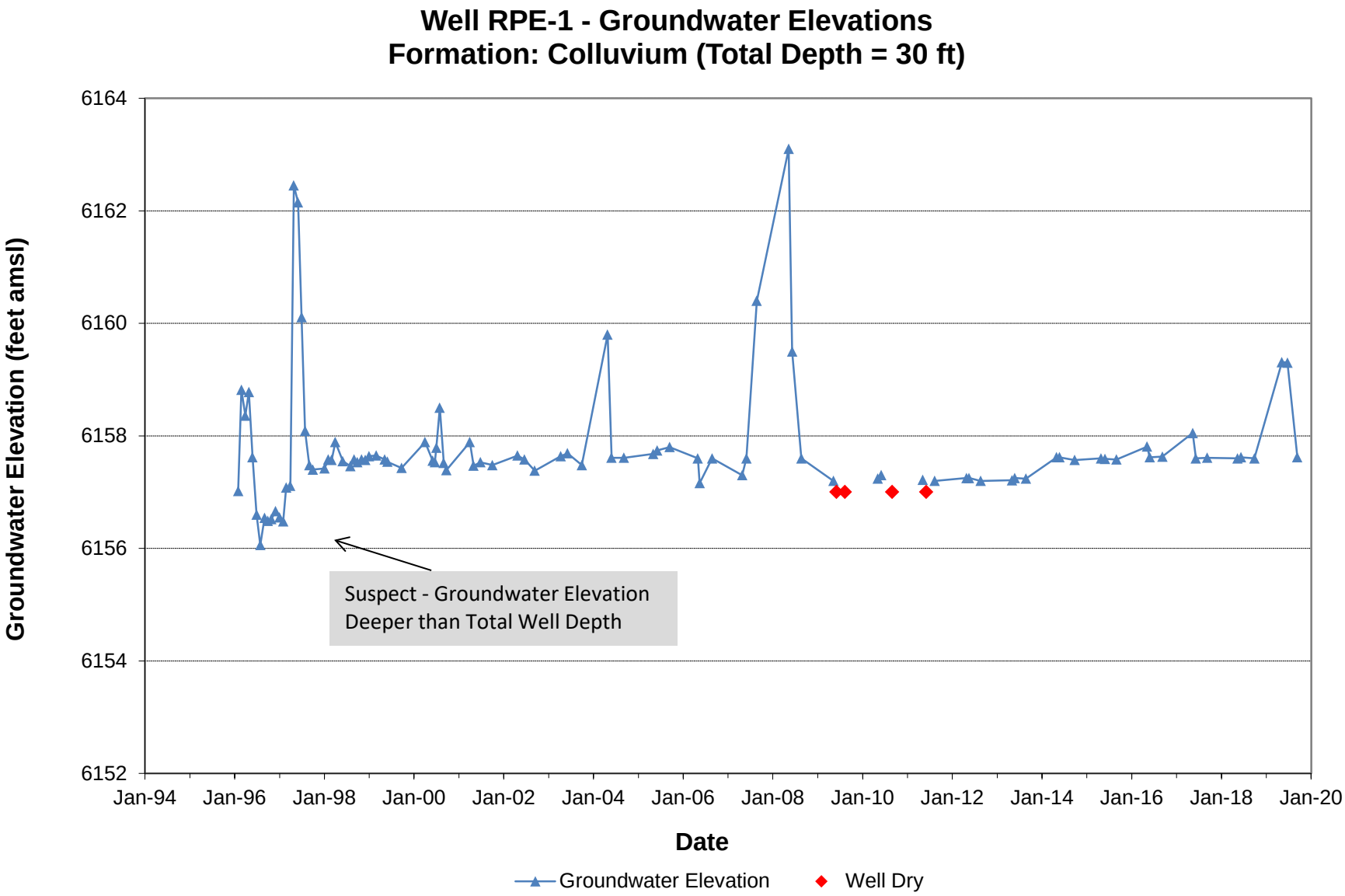

GP-4 - Groundwater Elevations
Formation: Colluvium (Total Depth = 32 ft)
Groundwater Elevation (feet amsl)
6117
6116.5
6116
6115.5
6115
6114.5
6114
6113.5
6113
6112.5
Jan-85
Jan-88
Jan-91
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09
Jan-12
Jan-15
Jan-18
Jan-21
Date
Suspect - Groundwater Elevation
Deeper than Total Well Depth
Groundwater Elevation
Well Dry

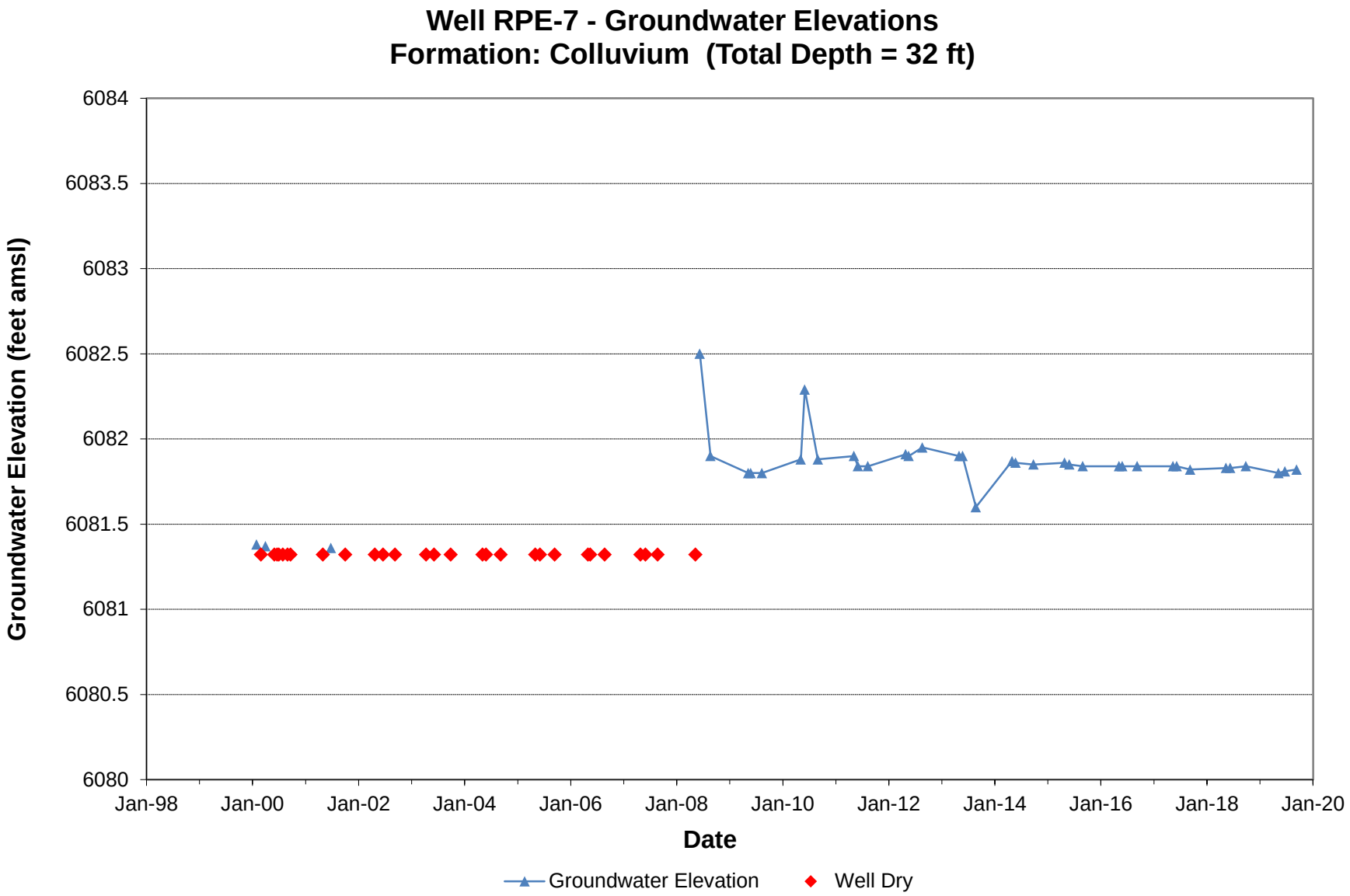
Well GP-6 - Groundwater Elevations
Formation: Sylvester Gulch Alluvium (Total Depth = 83 ft)

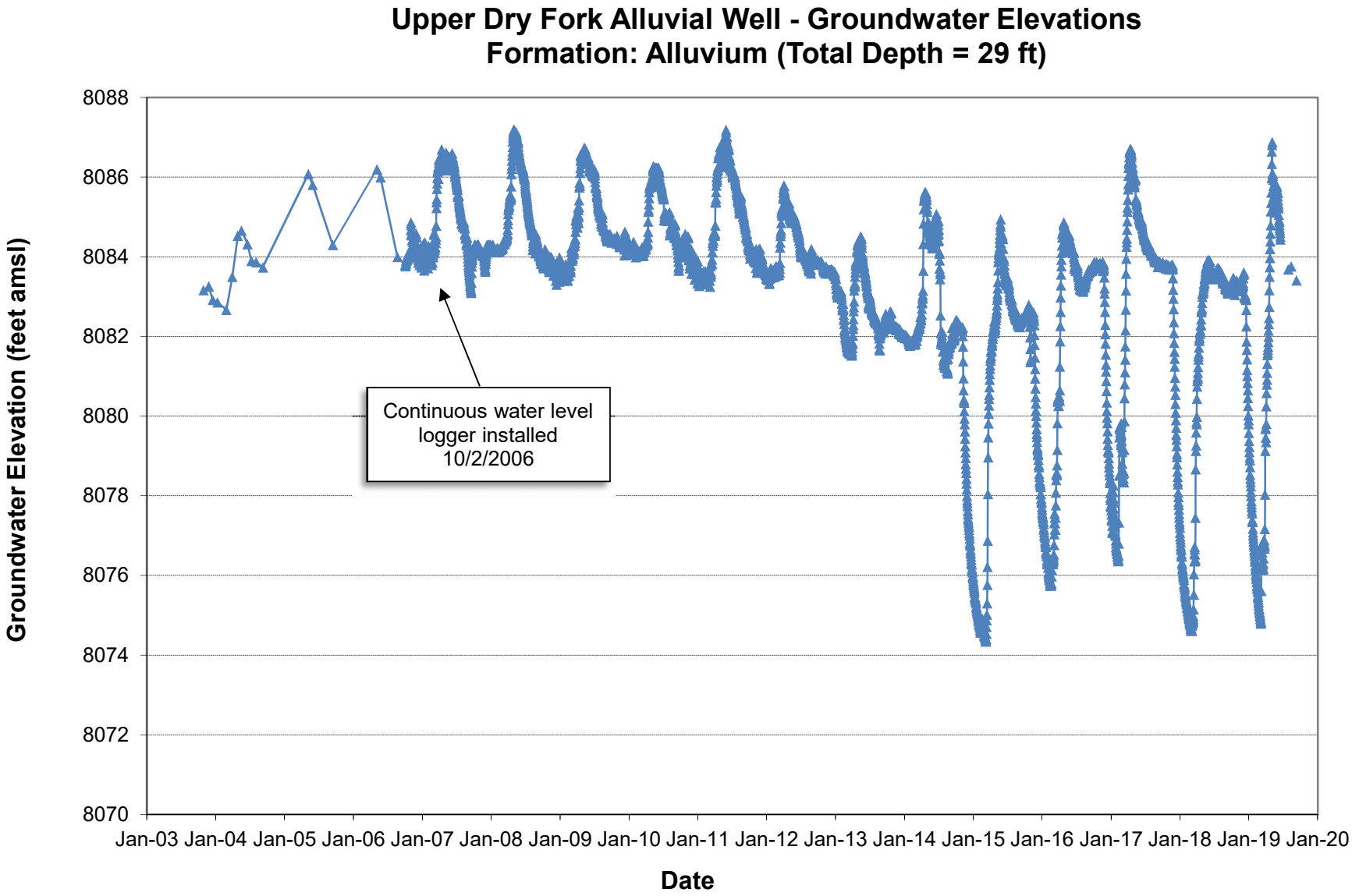


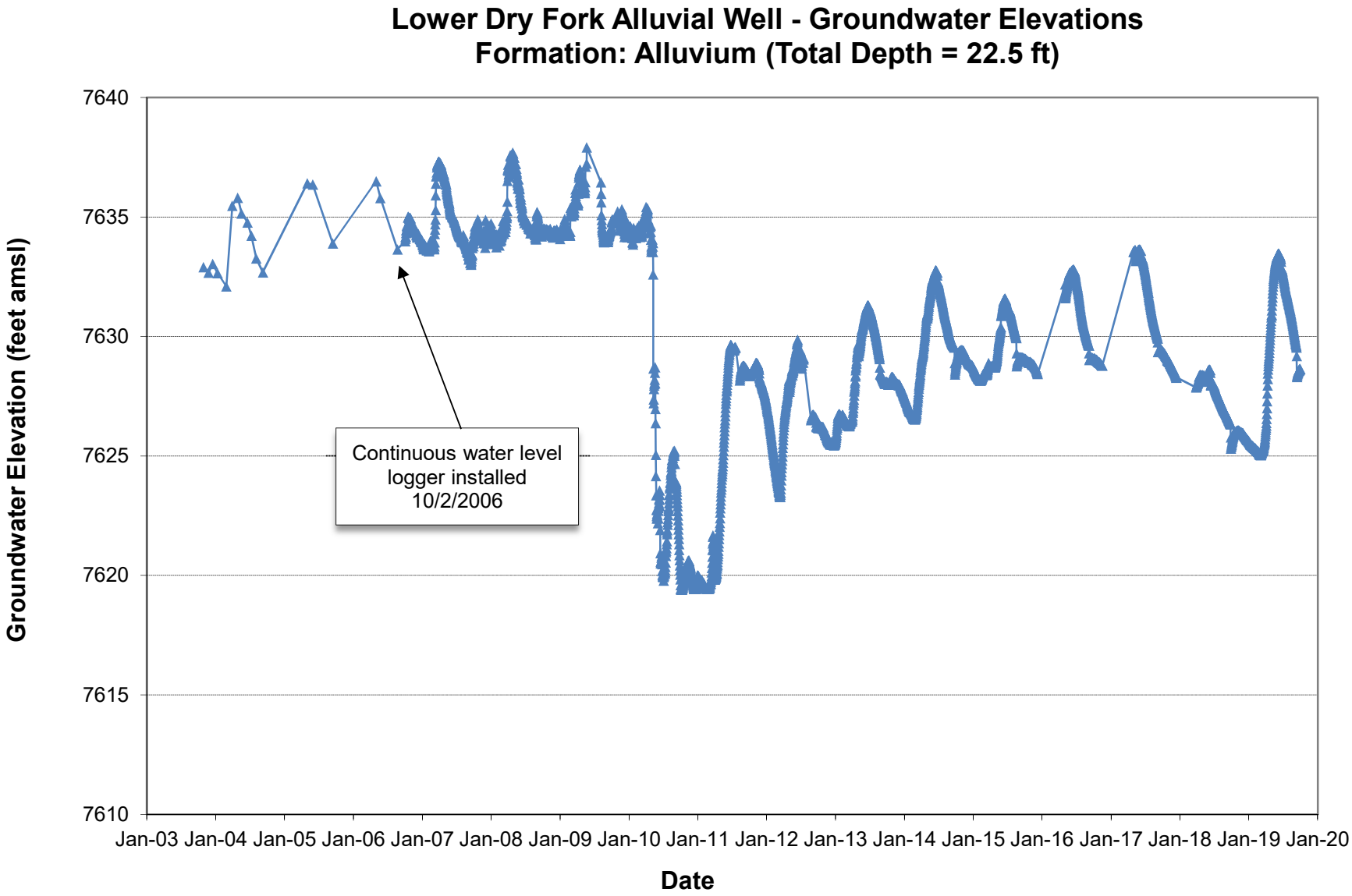
Well GP-7 - Groundwater Elevations
Formation: Sylvester Gulch Alluvium (Total Depth = 55 ft)



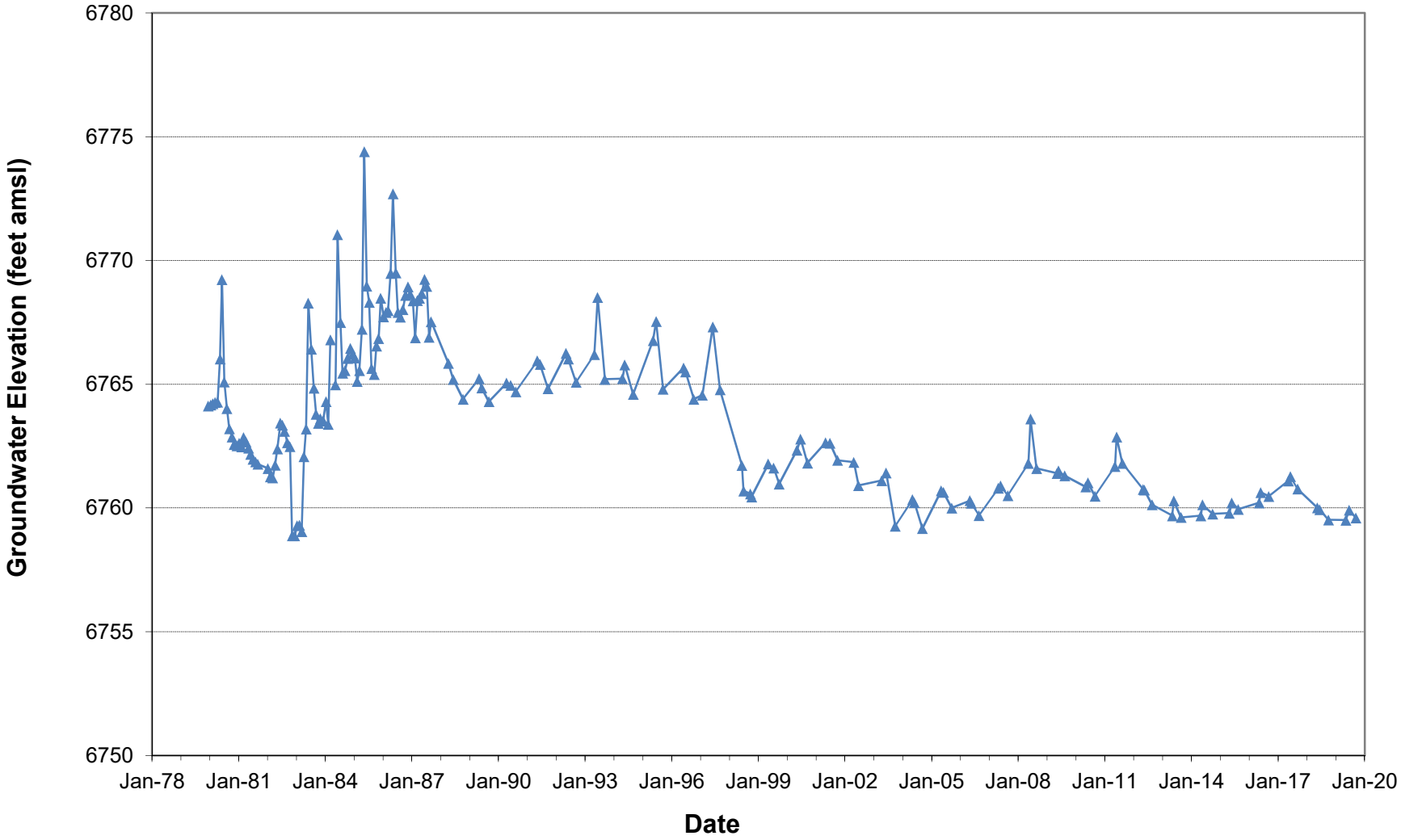

Well RPE-1 - Groundwater Elevations
Formation: Colluvium (Total Depth = 30 ft)
Groundwater Elevation (feet amsl)
6164
6162
6160
6158
6156
6154
6152
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Jan-20
Date
Suspect - Groundwater Elevation
Deeper than Total Well Depth
Groundwater Elevation
Well Dry

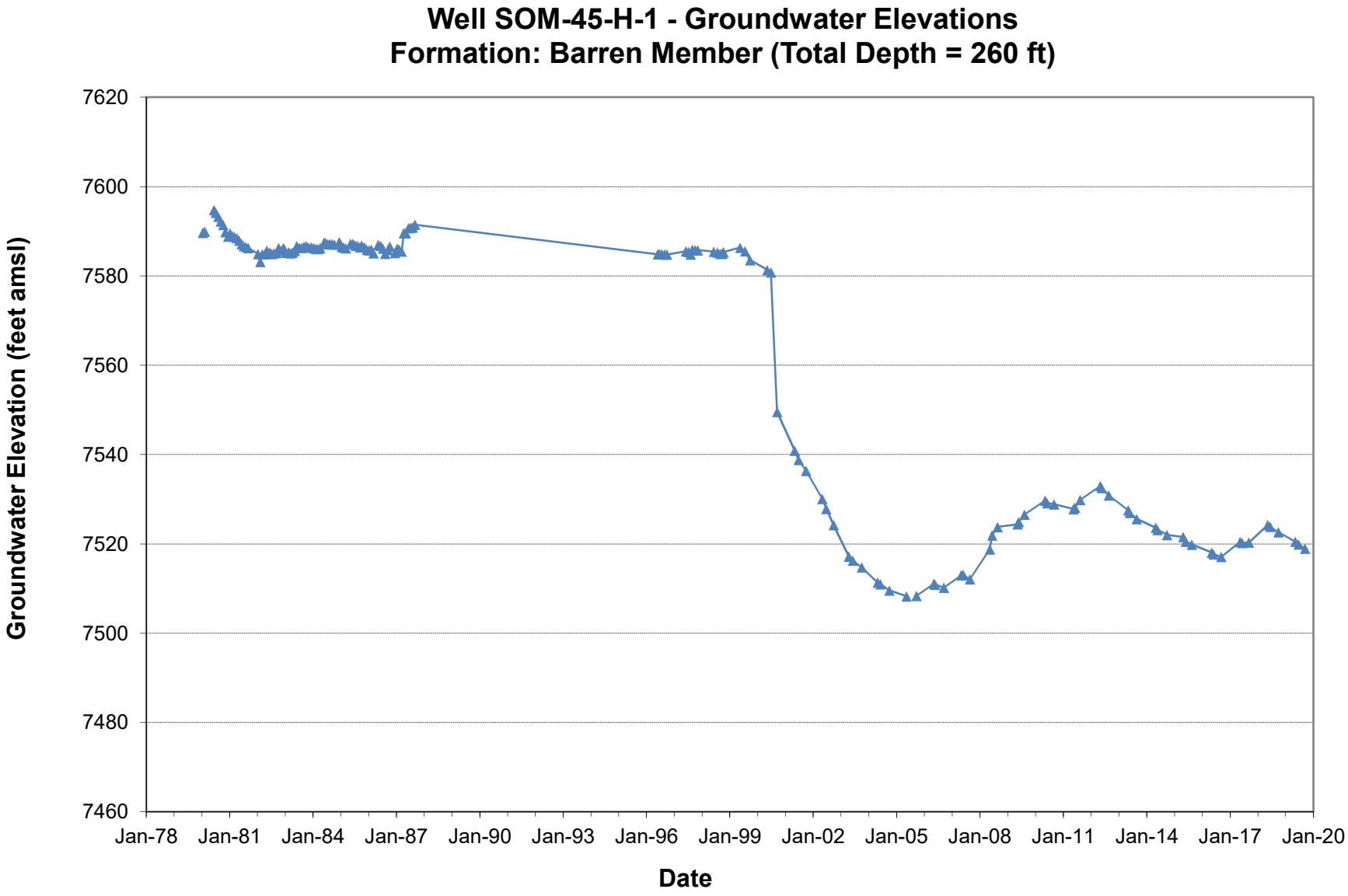

Well RPE-7 - Groundwater Elevations
Formation: Colluvium (Total Depth = 32 ft)
Groundwater Elevation (feet amsl)
6084
6083.5
6083
6082.5
6082
6081.5
6081
6080.5
6080
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Jan-20
Date
Groundwater Elevation
Well Dry

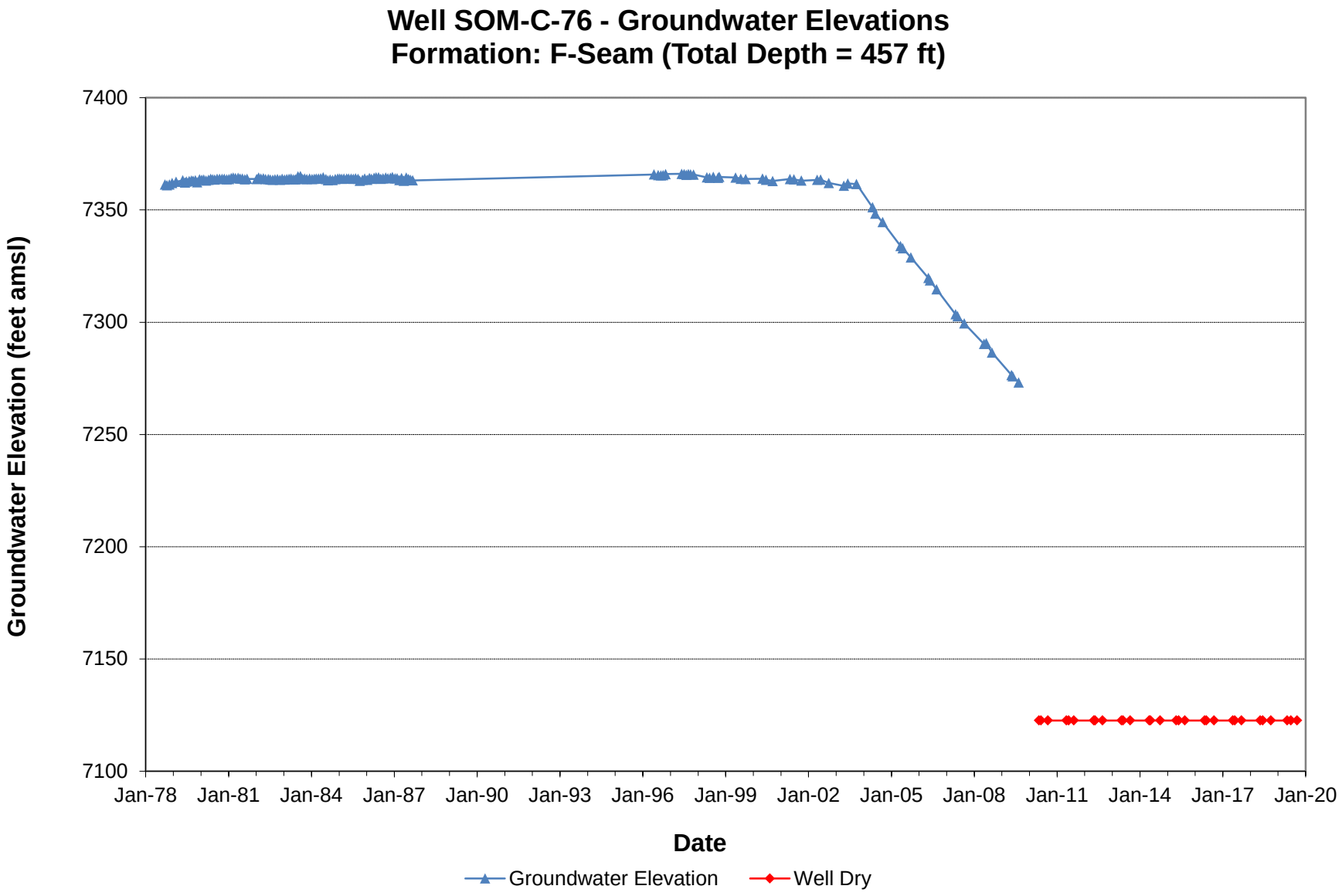

Upper Dry Fork Alluvial Well - Groundwater Elevations
Formation: Alluvium (Total Depth = 29 ft)
Groundwater Elevation (feet amsl)
8088
8086
8084
8082
8080
8078
8076
8074
8072
8070
Continuous water level logger installed 10/2/2006
Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20
Date


Lower Dry Fork Alluvial Well - Groundwater Elevations
Formation: Alluvium (Total Depth = 22.5 ft)
Groundwater Elevation (feet amsl)
7640
7635
7630
7625
7620
7615
7610
Continuous water level logger installed 10/2/2006
Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20
Date

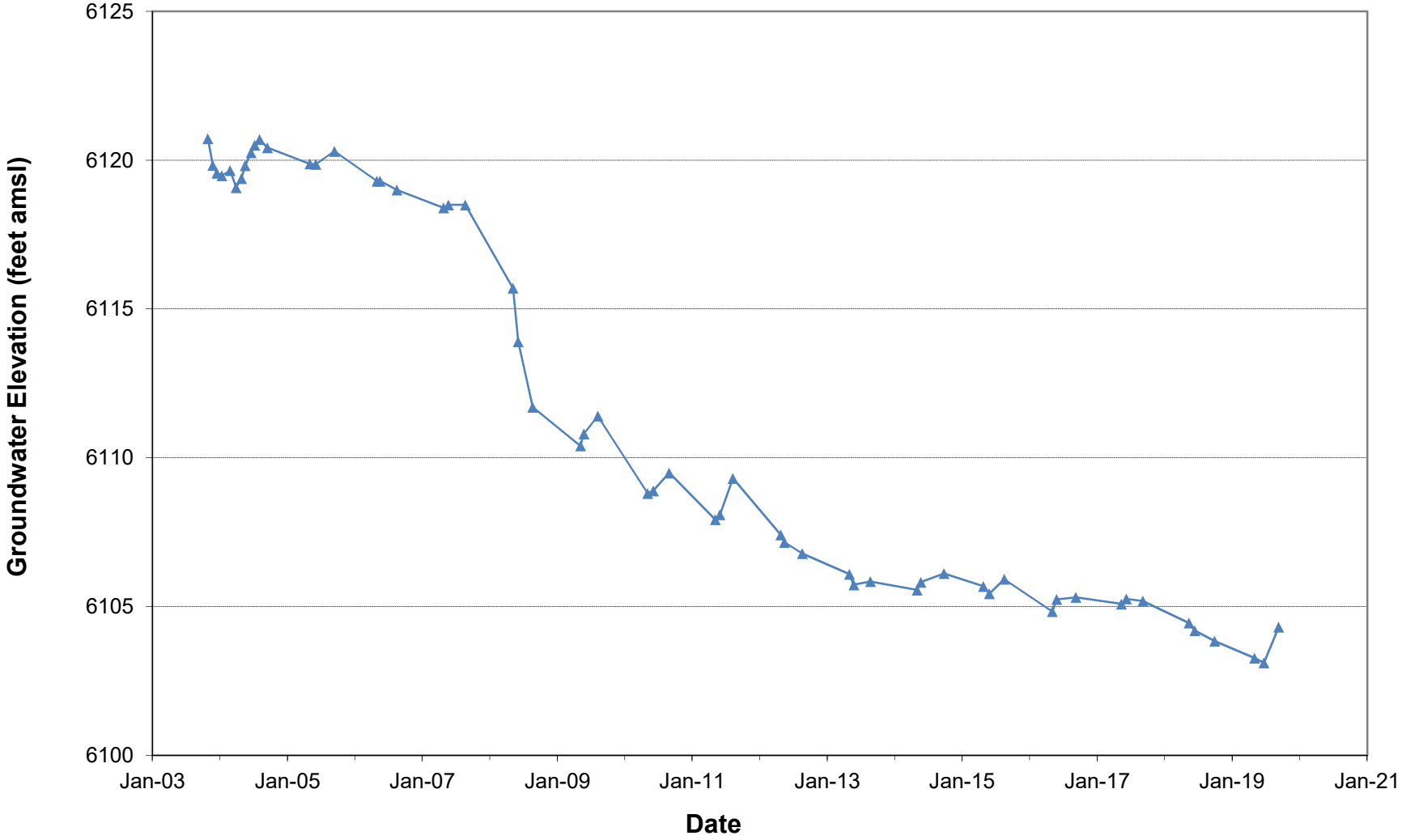
Well SOM-80 - Groundwater Elevations
Formation: Barren Member (Total Depth = 142.5 ft)



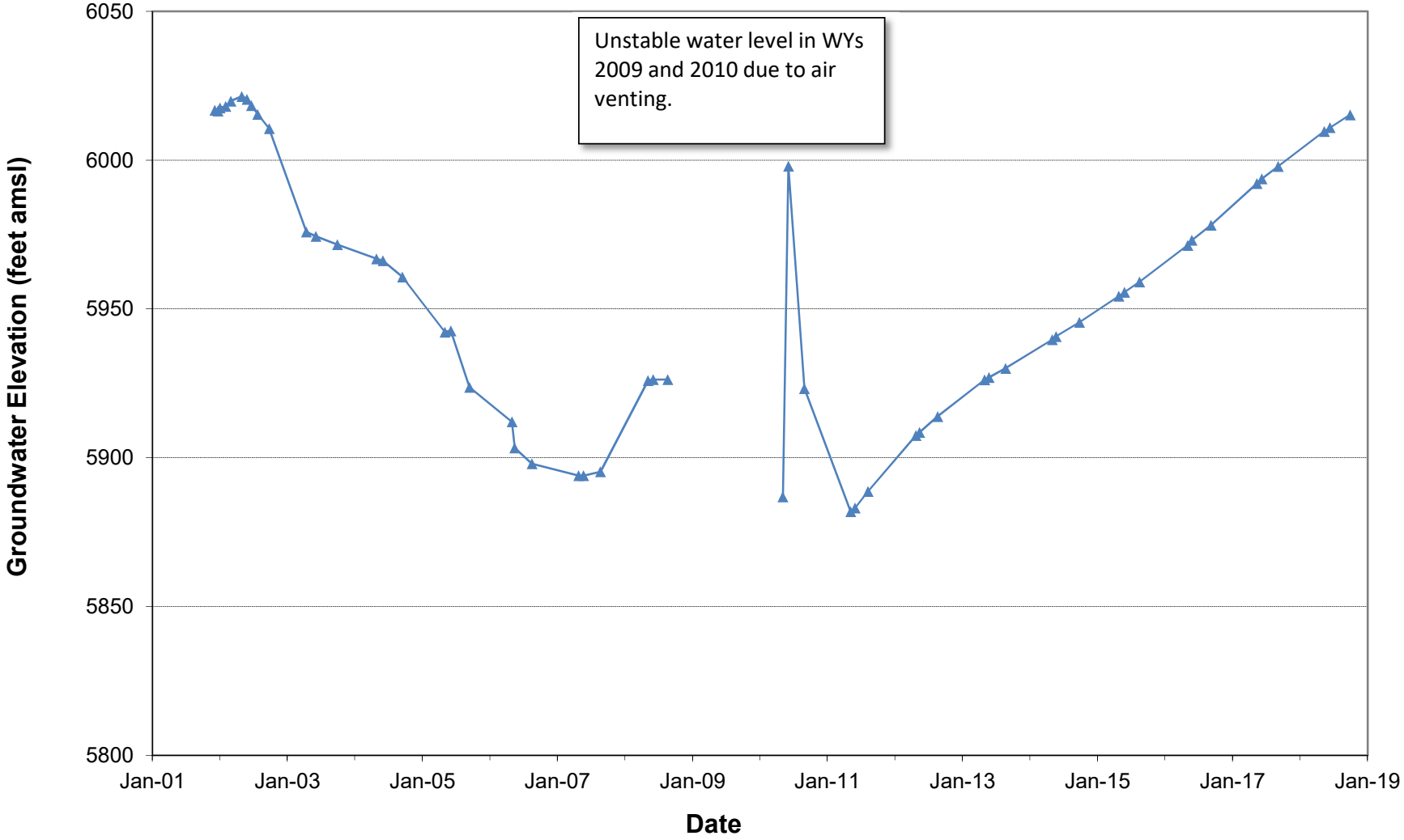

Well SOM-45-H-1 - Groundwater Elevations
Formation: Barren Member (Total Depth = 260 ft)
Groundwater Elevation (feet amsl)
7620
7600
7580
7560
7540
7520
7500
7480
7460
Jan-78
Jan-81
Jan-84
Jan-87
Jan-90
Jan-93
Jan-96
Jan-99
Jan-02
Jan-05
Jan-08
Jan-11
Jan-14
Jan-17
Jan-20
Date


Well SOM-C-76 - Groundwater Elevations
Formation: F-Seam (Total Depth = 457 ft)
Groundwater Elevation (feet amsl)
7400
7350
7300
7250
7200
7150
7100
Jan-78
Jan-81
Jan-84
Jan-87
Jan-90
Jan-93
Jan-96
Jan-99
Jan-02
Jan-05
Jan-08
Jan-11
Jan-14
Jan-17
Jan-20
Date
Groundwater Elevation
Well Dry

Well 03-11-1- Groundwater Elevations
Formation: E-Seam (Total Depth = 250 ft)



Well 01-11-1 - Groundwater Elevations
Formation: B-Seam (Total Depth = 638 ft)



APPENDIX G

WELLS - LABORATORY AND FIELD WATER QUALITY DATA

Well GP-3
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Well GP-3		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/13/2019
Field Parameters							
Water Level Depth	feet				dry	dry	dry
Conductivity (Field)	µmhos/cm						
pH (Field)	SU						
Temperature (Field- F)	^{o}F						
Temperature (Field)	^{o}C						
Comment							
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Conductivity @25C	µmhos/cm						
Iron, dissolved	mg/L						
Iron, total	mg/L						
pH	SU						
Residue, Filterable (TDS) @180C	mg/L						
Residue, Non-Filterable (TSS) @105C	mg/L						

[1] No baseline data.

Well GP-4
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Well GP-4		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/13/2019
Field Parameters							
Water Level Depth	feet				31.69	31.67	31.71
Conductivity (Field)	µmhos/cm						
pH (Field)	SU						
Temperature (Field- F)	^{o}F						
Temperature (Field)	^{o}C						
Comment					not enough water for sample	not enough water for sample	not enough water for sample
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Conductivity @25C	µmhos/cm						
Iron, dissolved	mg/L						
Iron, total	mg/L						
pH	SU						
Residue, Filterable (TDS) @180C	mg/L						
Residue, Non-Filterable (TSS) @105C	mg/L						

[1] No baseline data.

Well GP-6
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location Well GP-6		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/10/2019	Q[4]
Field Parameters								
Water Level Depth	feet				46.10	46.22	54.03	
Conductivity (Field)	µmhos/cm				1,122	1,188	1,192	
pH (Field)	SU				7.47	7.65	7.78	
Temperature (Field)	°C				10.5	10.2	12.4	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54524-07	
Sample Date							9/10/2019	
Lab Test Date							9/13-9/21	
Sampled By							PH	
Conductivity @25C	µmhos/cm						1,120	
Iron, dissolved	mg/L						0.05	B
Iron, total	mg/L						0.31	
pH	SU						8.3	H
Residue, Filterable (TDS) @180C	mg/L						674	
Residue, Non-Filterable (TSS) @105C	mg/L						-5	U

[1] No baseline data.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Well GP-7
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Well GP-7		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/10/2019	Q[4]
Field Parameters								
Water Level Depth	feet				45.84	45.99	54.07	
Conductivity (Field)	µmhos/cm				1,577	1,550	1,707	
pH (Field)	SU				7.17	7.39	7.4	
Temperature (Field)	°C				10.4	10.4	12.4	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							9/10/2019	
Sample Date							L54524-08	
Lab Test Date							9/13-9/21	
Sampled By							PH	
Conductivity @25C	µmhos/cm						1,670	
Iron, dissolved	mg/L						-0.03	U
Iron, total	mg/L						29.7	
pH	SU						8.1	H
Residue, Filterable (TDS) @180C	mg/L						1,060	
Residue, Non-Filterable (TSS) @105C	mg/L						780	

[1] No baseline data.

[2] ACZ Laboratory, Steamboat Springs, CO.

[3] Negative values denote readings below lab detection levels.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Well RPE-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Well RPE-1		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/10/2019
Field Parameters							
Water Level Depth	feet				27.69	27.70	29.38
Conductivity (Field)	µmhos/cm						
pH (Field)	SU						
Temperature (Field)	^{o}C						
Comment					not enough water for sample	not enough water for sample	not enough water for sample
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Conductivity @25C	µmhos/cm						
Iron, dissolved	mg/L						
Iron, total	mg/L						
pH	SU						
Residue, Filterable (TDS) @180C	mg/L						
Residue, Non-Filterable (TSS) @105C	mg/L						

[1] No baseline data.

Well RPE-7
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019							
Monitoring Location: Well RPE-7		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/10/2019
Field Parameters							
Water Level Depth	feet				34.50	34.49	34.48
Conductivity (Field)	µmhos/cm						
pH (Field)	SU						
Temperature (Field)	^{o}C						
Comment					not enough water for sample	not enough water for sample	not enough water for sample
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Conductivity @25C	µmhos/cm						
Iron, dissolved	mg/L						
Iron, total	mg/L						
pH	SU						
Residue, Filterable (TDS) @180C	mg/L						
Residue, Non-Filterable (TSS) @105C	mg/L						

[1] No baseline data.

Upper Dry Fork Alluvial Well
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Upper Dry Fk Alluvial Well		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/6/2019	6/17/2019	9/11/2019	Q[4]
Field Parameters								
Water Level Depth	feet				13.92	15.23	16.59	
Conductivity (Field)	µmhos/cm				911	903	887	
pH (Field)	SU				7.82	8.7	8.15	
Temperature (Field)	°C				10.3	8.7	9.6	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54571-01	
Sample Date							9/11/2019	
Lab Test Date							9/16-9/25	
Sampled By							PH	
Alkalinity (Total CaCO3)	mg/L	227	266	248				
Arsenic, dissolved	mg/L	-0.0005	0.0006	0.0002				
Bicarbonate as CaCO3	mg/L	227	266	248				
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005				
Calcium, dissolved	mg/L	3.2	5.1	3.7				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	%	0.9	3.9	1.9				
Chloride	mg/L	-1	6	4				
Conductivity @25C	µmhos/cm	493	509	503			812	
Hardness as CaCO3	mg/L	10	16	12				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.03	0.49	0.19			0.51	
Iron, total	mg/L	1.3	25.9	13.6			2.23	
Lead, dissolved	mg/L	-0.04	-0.04	-0.04				
Magnesium, dissolved	mg/L	-0.2	0.7	0.4				
Manganese, dissolved	mg/L	0.067	0.101	0.081				
Manganese, total	mg/L	0.109	0.349	0.229				
Mercury, dissolved	mg/L	-0.0002	0.0015	0.0002				
Nitrate/Nitrite (as N)	mg/L	0.04	0.87	0.16				
Nitrogen, ammonia	mg/L	-0.05	0.20	0.10				
pH	SU	8.0	8.1	8.0			8.1	H
Phosphate	mg/L	0.1	0.4	0.2				
Phosphorus, ortho dissolved	mg/L	0.03	0.13	0.06				
Potassium, dissolved	mg/L	0.9	2.7	1.8				
Residue, Filterable (TDS) @180C	mg/L	290	390	326			524	
Residue, Non-Filterable (TSS) @105C	mg/L						15	B
Selenium, dissolved	mg/L	-0.0010	0.0003	0.0003				
Sodium Absorption Ratio (SAR)	calc.	16	17	17				
Sodium, dissolved	mg/L	113	144	126				
Sulfate	mg/L	30	50	35				
Sum of Anions	meq/L	5.6	6.2	5.8				
Sum of Cations	meq/L	5.7	6.7	6.0				
TDS (calculated)	calc.	313	313	313				
TDS (ratio - measured/calculated)	mg/L	1	1	1				
Zinc, dissolved	mg/L	-0.01	0.04	0.02				

[1] Baseline 2004.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Lower Dry Fork Alluvial Well
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019										
Monitoring Location: Lower Dry Fk Alluvial Well		**Baseline [1]**			**Water Year 2019**					
Description	Units	Minimum	Maximum	Mean [5]	5/1/2019	6/20/2019	9/12/2019	Q[4]	9/12/2019 (Duplicate)	Q[4]
Field Parameters										
Water Level Depth	feet	4.19	7.90	6.27	8.95	6.80	10.55		--	
Conductivity (Field)	µmhos/cm	575	693	626	481	560	542		--	
pH (Field)	SU	6.60	7.10	6.87	8.01	8.3	7.99		--	
Temperature (Field)	°C	6.4	16.4	10.3	6.8	11.5	11.6		--	
Comment										
Laboratory Parameters [2]										
Name of Certified Lab [3]							ACZ		ACZ	
Lab Reference #							L54571-03		L54571-02	
Sample Date							9/12/2019		9/12/2019	
Lab Test Date							9/16-9/25		9/16-9/25	
Sampled By							PH		PH	
Alkalinity (Total CaCO3)	mg/L	260	300	272						
Arsenic, dissolved	mg/L	-0.0005	0.0004	0.0003						
Bicarbonate as CaCO3	mg/L	260	300	272						
Cadmium, dissolved	mg/L	-0.005	-0.005	-0.005						
Calcium, dissolved	mg/L	38.5	62.6	53.4						
Carbonate as CaCO3	mg/L	-2	-2	-2						
Cation - Anion Balance	%	0.9	3.3	1.7						
Chloride	mg/L	-1	3	2						
Conductivity @25C	µmhos/cm	459	497	482			498		498	
Hardness as CaCO3	mg/L	186	208	200						
Hydroxide as CaCO3	mg/L	-2	-2	-2						
Iron, dissolved	mg/L	-0.01	0.83	0.15			-0.03	U	-0.03	U
Iron, total	mg/L	0.08	0.51	0.26			0.05	B	0.03	B
Lead, dissolved	mg/L	-0.04	-0.04	-0.04						
Magnesium, dissolved	mg/L	10.2	16.0	13.8						
Manganese, dissolved	mg/L	-0.01	1.96	0.37						
Manganese, total	mg/L	1.13	2.48	1.72						
Mercury, dissolved	mg/L	-0.0002	0.0014	0.0002						
Nitrate/Nitrite (as N)	mg/L	-0.02	0.71	0.13						
Nitrogen, ammonia	mg/L	-0.05	0.09	0.044						
pH	SU	7.8	8.0	7.9			8.2	H	8.2	H
Phosphate	mg/L	-0.030	0.030	0.02						
Phosphorus, ortho dissolved	mg/L	-0.05	0.01	0.01						
Potassium, dissolved	mg/L	2.0	3.1	2.5						
Residue, Filterable (TDS) @180C	mg/L	250	310	297			288		290	
Residue, Non-Filterable (TSS) @105C	mg/L						-5	U	-5	U
Selenium, dissolved	mg/L	-0.0010	0.0001	0.0003						
Sodium Absorption Ratio (SAR)	calc.	1.18	1.45	1.32						
Sodium, dissolved	mg/L	35	46	41						
Sulfate	mg/L	20	20	20						
Sum of Anions	meq/L	5.8	5.8	5.8						
Sum of Cations	meq/L	5.9	6.2	6.0						
Zinc, dissolved	mg/L	-0.01	0.03	0.02						

[1] Baseline 2004.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Well SOM-80
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Well SOM-80		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	9/12/2019	Q[4]
Field Parameters								
Water Level Depth	feet				94.89	94.49	94.8	
Conductivity (Field)	µmhos/cm				1,107	1,149	1,144	
pH (Field)	SU				7.24	7.72	7.88	
Temperature (Field)	°C				10.4	13.0	11.4	
Comment								
Laboratory Parameters [2]					.			
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54571-05	
Sample Date							9/12/2019	
Lab Test Date							9/16-9/25	
Sampled By							PH	
Ammonia	mg/L	0	1.73	0.51				
Arsenic, dissolved	mg/L	0	0	0				
Bicarbonate as CaCO3	mg/L	213	641	443				
Cadmium, dissolved	mg/L	0	0	0				
Calcium, dissolved	mg/L	60.2	60.2	60.2				
Chloride	mg/L	3	17	7				
Conductivity @25C	µmhos/cm	886	897	892			1,070	
Hardness as CaCO3	mg/L	45	754	389				
Iron, dissolved	mg/L	0	0.82	0.15			-0.03	U
Iron, total	mg/L	0	6.8	0.71			0.09	
Lead, dissolved	mg/L	0	0	0				
Magnesium, dissolved	mg/L	17.6	17.6	17.6				
Manganese, dissolved	mg/L	0.005	0.01	0.008				
Manganese, total	mg/L	0	0.557	0.066				
Mercury, dissolved	mg/L	0	0	0				
Nitrate/Nitrite (as N)	mg/L	0.24	0.49	0.33				
pH	SU	6.7	8.1	7.4			8.2	H
Phosphorus, ortho dissolved	mg/L	0	0.3	0.049				
Residue, Filterable (TDS) @180C	mg/L	26.8	1,888	868			682	
Residue, Non-Filterable (TSS) @105C	mg/L						-5	U
Selenium, dissolved	mg/L	0	0	0				
Sodium Absorption Ratio (SAR)	calc.	1.94	5.22	2.91				
Sodium, dissolved	mg/L	129	129	129				
Sulfate	mg/L	70	984	515				
Zinc, dissolved	mg/L	0.02	0.02	0.02				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Well SOM-45-H-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Well SOM-45-H-1		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/20/2019	9/12/2019	Q[4]
Field Parameters								
Water Level Depth	feet				183.29	183.89	184.82	
Conductivity (Field)	µmhos/cm	1,073	1,626	1,285	1,859	1,974	1,980	
pH (Field)	SU	6.4	8.6	7.7	7.79	8.18	8.21	
Temperature (Field)	°C				10.3	10.5	10.4	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54571-04	
Sample Date							9/12/2019	
Lab Test Date							9/16-9/25	
Sampled By							PH	
Alkalinity (Total CaCO3)	mg/L	286	955	635				
Ammonia	mg/L	0.03	2.35	0.69				
Arsenic, dissolved	mg/L	0	0.002	0.001				
Bicarbonate as CaCO3	mg/L	0	1156	455				
Cadmium, dissolved	mg/L	0	0	0				
Calcium, dissolved	mg/L	4	6.9	5.6				
Carbonate as CaCO3	mg/L	0	218	17				
Cation - Anion Balance	%	-5.4	3.8	-0.2				
Chloride	mg/L	2	10	8				
Conductivity @25C	µmhos/cm	1,310	1,390	1,350			1,900	
Hardness as CaCO3	mg/L	15	882	215				
Hydroxide as CaCO3	mg/L	0	0	0				
Iron, dissolved	mg/L	0	0.86	0.25			0.12	
Iron, total	mg/L	0.35	6.15	1.96			3.45	
Lead, dissolved	mg/L	0	0	0				
Magnesium, dissolved	mg/L	1.3	5	2.1				
Manganese, dissolved	mg/L	0.034	0.064	0.048				
Manganese, total	mg/L	0.014	0.39	0.131				
Mercury, dissolved	mg/L	0	0	0				
Nitrate/Nitrite (as N)	mg/L	0	0.04	0.01				
Nitrogen, ammonia	mg/L	0.1	1.04	0.61				
pH	SU	7	8.2	7.6			8.4	H
Phosphate	mg/L	0.39	0.42	0.41				
Phosphorus, ortho dissolved	mg/L	0	0.535	0.074				
Potassium, dissolved	mg/L	2	2.5	2.3				
Residue, Filterable (TDS) @180C	mg/L						1,230	
Residue, Non-Filterable (TSS) @105C	mg/L						132.0	
Selenium, dissolved	mg/L	0	0	0				
Sodium Absorption Ratio (SAR)	calc.	14.9	37.9	32				
Sodium, dissolved	mg/L	308	385	352				
Sulfate	mg/L	20	526	161				
Sum of Anions	meq/L	15	15.5	15.3				
Sum of Cations	meq/L	13.9	16.4	15.3				
Zinc, dissolved	mg/L	0	0.02	0.01				

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.

H - Holding time exceeded; pH is a field test with an immediate hold time.

B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Well SOM-C-76
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water							
Monitoring Location: Well SOM-C-76		**Baseline [1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean [2]	5/1/2019	6/20/2019	9/11/2019
Field Parameters							
Water Level Depth	feet				dry	dry	dry
Conductivity (Field)	µmhos/cm	1,910	2,500	2,970			
pH (Field)	SU	5.2	8.2	9.3			
Temperature (Field)	°C						
Comment							
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/L	1,294	1,503	1,860			
Ammonia	mg/L	0.00	0.64	1.36			
Arsenic, dissolved	mg/L	0.000	0.000	0.001			
Bicarbonate as CaCO3	mg/L	41	1,181	1,894			
Cadmium, dissolved	mg/L	0.000	0.000	0.000			
Calcium, dissolved	mg/L	1.6	2.0	2.3			
Carbonate as CaCO3	mg/L	0	30	186			
Cation - Anion Balance	%	-3.3	-0.45	3.0			
Chloride	mg/L	0	4	17			
Conductivity @25C	µmhos/cm	2,300	2,487	2,650			
Hardness as CaCO3	mg/L	6	15	43			
Hydroxide as CaCO3	mg/L	0	0	0			
Iron, dissolved	mg/L	0.00	0.13	1.00			
Iron, total	mg/L	0.00	5.01	18.00			
Lead, dissolved	mg/L	0.00	0.00	0.00			
Magnesium, dissolved	mg/L	0.6	0.8	1.5			
Manganese, dissolved	mg/L	0.000	0.005	0.016			
Manganese, total	mg/L	0.000	0.017	0.145			
Mercury, dissolved	mg/L	0.0000	0.0000	0.0000			
Nitrate/Nitrite (as N)	mg/L	0.00	0.16	2.16			
Nitrogen, ammonia	mg/L	0.57	0.65	0.73			
pH	SU	7.9	8.4	9.3			
Phosphate	mg/L	0.06	0.06	0.06			
Phosphorus, ortho dissolved	mg/L	0.000	0.068	1.26			
Potassium, dissolved	mg/L	3.6	3.9	4.2			
Residue, Filterable (TDS) @180C	mg/L	1,530	1,642	2,590			
Residue, Non-Filterable (TSS) @105C	mg/L	7	37	226			
Selenium, dissolved	mg/L	0.000	0.000	0.000			
Sodium Absorption Ratio (SAR)	calc.	46.1	102.7	128.6			
Sodium, dissolved	mg/L	658	700	756			
Sulfate	mg/L	0	9	180			
Sum of Anions	meq/L	29.6	30.88	32.71			
Sum of Cations	meq/L	29.30	30.53	31.50			
Zinc, dissolved	mg/L	0.00	0.00	0.01			

[1] Baseline and WY 2000 data adapted from WWE (2001).

[2] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Well 03-11-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Well 03-11-1		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/2/2019	6/22/2019	9/10/2019	Q[4]
Field Parameters								
Water Level Depth	feet				177.73	177.89	176.69	
Conductivity (Field)	µmhos/cm				2,990	2,920	3,490	
pH (Field)	SU				7.81	7.99	7.94	
Temperature (Field)	°C				14.3	14.9	14.4	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54524-06	
Sample Date							9/10/2019	
Lab Test Date							9/13-9/21	
Sampled By							PH	
Alkalinity (Total CaCO3)	mg/L	1620	1950	1802				
Arsenic, dissolved	mg/L	-0.0030	0.0010	-0.0007				
Bicarbonate as CaCO3	mg/L	1,620	1,950	1,802				
Cadmium, dissolved	mg/L	-0.010	-0.005	-0.008				
Calcium, dissolved	mg/L	5.3	12.5	8.1				
Carbonate as CaCO3	mg/L	-2	-2	-2				
Cation - Anion Balance	%	-3.8	-2.5	-3.2				
Chloride	mg/L	66	177	89				
Conductivity @25C	µmhos/cm	2,660	2,730	2,695			3,090	
Hardness as CaCO3	mg/L	35	38	37				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	0.02	0.82	0.31			0.12	
Iron, total	mg/L	0.30	0.49	0.40			0.2	
Magnesium, dissolved	mg/L	1.2	3.0	1.8				
Manganese, dissolved	mg/L	0.03	0.14	0.07				
Manganese, total	mg/L	0.14	0.15	0.15				
Mercury, dissolved	mg/L	-0.0002	0.0006	0.0002				
Nitrate (as N), dissolved	mg/L	0.03	0.21	0.10				
Nitrate/Nitrite (as N)	mg/L	-0.02	0.21	0.07				
Nitrite (as N), dissolved	mg/L	0.06	0.06	0.06				
Nitrogen, ammonia	mg/L	0.73	0.92	0.82				
pH	SU	8.1	8.3	8.2			8.5	H
Phosphate	mg/L	-0.03	0.09	0.01				
Phosphorus, ortho dissolved	mg/L	-0.01	0.03	-0.01				
Potassium, dissolved	mg/L	4.0	4.1	4.1				
Residue, Filterable (TDS) @180C	mg/L	1,850	2,130	2,044			1,990	
Residue, Non-Filterable (TSS) @105C	mg/L						-5	U
Selenium, dissolved	mg/L	-0.0050	0.0030	-0.0010				
Sodium Absorption Ratio (SAR)	calc.	52.6	54.5	53.6				
Sodium, dissolved	mg/L	723	1,780	878				
Sulfate	mg/L	-10	40	1				
Sum of Anions	meq/L	35	36	35				
Sum of Cations	meq/L	33.0	33.4	33.2				
Zinc, dissolved	mg/L	-0.02	0.21	0.05				

[1] Baseline 2004.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

Shaded cells indicate parameters elevated greater than ten percent above the maximum baseline value.

Well 01-11-1
Water Quality and Field Parameters

Mountain Coal West Elk Mine - Water Year 2019								
Monitoring Location: Well 01-11-1		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean [5]	5/2/2019	6/22/2019	9/10/2019	Q[4]
Field Parameters								
Water Level Depth	feet	259.9	295.4	268.4	355.88	353.27	249.67	
Conductivity (Field)	µmhos/cm	5,010	6,820	5,880	3,990	3,860	4,410	
pH (Field)	SU	9.1	9.7	9.4	8.06	7.96	8.12	
Temperature (Field)	°C	9.8	20.2	15.6	17.0	15.8	17.9	
Comment								
Laboratory Parameters [2]								
Name of Certified Lab [3]							ACZ	
Lab Reference #							L54524-05	
Sample Date							9/10/2019	
Lab Test Date							9/13-9/21	
Sampled By							PH	
Alkalinity (Total CaCO3)	mg/L	629	1,880	1,602				
Ammonia	mg/L	0.79	1.56	1.08				
Arsenic, dissolved	mg/L	-0.005	0.003	-0.001				
Bicarbonate as CaCO3	mg/L	522	1300	768				
Boron, dissolved	mg/L	1.11	1.25	1.18				
Cadmium, dissolved	mg/L	-0.0100	-0.0002	-0.0055				
Calcium, dissolved	mg/L	1	6	3				
Carbonate as CaCO3	mg/L	389	1360	1075				
Cation - Anion Balance	%	-10.4	1.7	-4.6				
Chloride	mg/L	527	640	603				
Conductivity @25C	µmhos/cm	4,060	5,740	5,115			4,170	
Hardness as CaCO3	mg/L	3	32	12				
Hydroxide as CaCO3	mg/L	-2	-2	-2				
Iron, dissolved	mg/L	-0.05	0.23	0.09			0.06	B
Iron, total	mg/L	0.16	0.99	0.57			0.31	
Lead, dissolved	mg/L	-0.080	0.081	-0.040				
Magnesium, dissolved	mg/L	-0.4	4.1	0.8				
Manganese, dissolved	mg/L	-0.01	0.05	0.01				
Manganese, total	mg/L	-0.010	0.030	0.003				
Mercury, total	mg/L	-0.00020	0.00040	-0.00003				
Nitrate/Nitrite (as N)	mg/L	-0.02	2.78	0.53				
Nitrogen, ammonia	mg/L	2.21	4.09	3.17				
pH	SU	9.4	10.1	9.8			8.5	H
Phosphate	mg/L	-0.03	0.16	0.09				
Phosphorus, ortho dissolved	mg/L	0.009	0.052	0.034				
Potassium, dissolved	mg/L	159	291	217				
Residue, Filterable (TDS) @180C	mg/L	2,910	3,300	3,180			2,730	
Residue, Non-Filterable (TSS) @105C	mg/L						7.0	B
Selenium, dissolved	mg/L	-0.001	0.002	-0.001				
Sodium Absorption Ratio (SAR)	calc.	72.6	212.0	150.5				
Sodium, dissolved	mg/L	816	1,080	942				
Sulfate	mg/L	40	50	48				
Sum of Anions	meq/L	51.1	56.6	53.7				
Sum of Cations	meq/L	43.4	54.0	47.7				
TDS (calculated)	calc.	2,900	3,430	3,165				
TDS (ratio - measured/calculated)	mg/L	1	1	1				
Zinc, dissolved	mg/L	0.18	8.89	1.78				

[1] Baseline WY 2004.

[2] Negative values denote readings below lab detection levels.

[3] ACZ Laboratory, Steamboat Springs, CO.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

APPENDIX H

MINE WATER – LABORATORY AND FIELD WATER QUALITY DATA

LRP Underdrain
Water Quality and Field Parameters

Mountain Coal West Elk Mine							
Monitoring Location: LRP Underdrain		**Baseline[1]**			**Water Year 2019**		
Description	Units	Minimum	Maximum	Mean	5/7/2019	6/22/2019	9/13/2019
Field Parameters							
Flow	gpm				dry	dry	dry
Electrical Conductivity	mmhos/cm						
pH	SU						
Temperature (^{o}C)	^{o}C						
Comment							
Laboratory Parameters							
Name of Certified Lab							
Lab Reference #							
Sample Date							
Lab Test Date							
Sampled By							
Alkalinity (Total CaCO3)	mg/l						
Aluminum, dissolved	mg/l						
Arsenic, total	mg/l						
Bicarbonate as CaCO3	mg/l						
Boron, dissolved	mg/l						
Calcium, dissolved	mg/l						
Carbonate as CaCO3	mg/l						
Cation - Anion Balance	%						
Chloride	mg/l						
Conductivity @25C	µmhos/cm						
Copper, dissolved	mg/l						
Hardness as CaCO3	mg/l						
Hydroxide as CaCO3	mg/l						
Iron, dissolved	mg/l						
Iron, total	mg/l						
Lead, dissolved	mg/l						
Magnesium, dissolved	mg/l						
Manganese, dissolved	mg/l						
Manganese, total	mg/l						
Mercury, total	mg/l						
Molybdenum, dissolved	mg/l						
Nitrate/Nitrite (as N)	mg/l						
pH	SU						
Phosphate	mg/l						
Phosphorus, ortho dissolved	mg/l						
Potassium, dissolved	mg/l						
Residue, Filterable (TDS) @180C	mg/l						
Selenium, total	mg/l						
Sodium Absorption Ratio (SAR)	calc.						
Sodium, dissolved	mg/l						
Sulfate	mg/l						
Sum of Anions	meq/l						
Sum of Cations	meq/l						
TDS (calculated)	calc.						
TDS (ratio - measured/calculated)	mg/l						
Zinc, dissolved	mg/l						

[1] No baseline data.

RPE Grate
Water Quality and Field Parameters

Mountain Coal West Elk Mine								
Monitoring Location: RPE Underdrain		**Baseline [1]**			**Water Year 2019**			
Description	Units	Minimum	Maximum	Mean	5/8/2019	6/22/2019	9/10/2019	Q[4]
Field Parameters								
Flow [5]	gpm				0.63	1.3	0.5	
Conductivity (Field)	µmhos/cm				5,420	5,560	5,540	
pH (Field)	SU				7.73	7.91	8.44	
Temperature (Field)	°C				9.2	9.5	15.5	
Comment								
Laboratory Parameters [3]								
Name of Certified Lab [2]							ACZ	
Lab Reference #							L54524-01	
Sample Date							9/10/2019	
Lab Test Date							9/14-9/25	
Sampled By							PH	
Alkalinity (Total CaCO3)	mg/L						492	
Aluminum, dissolved	mg/L						-0.05	U
Arsenic, total	mg/L						0.0016	
Bicarbonate as CaCO3	mg/L						492	
Boron, dissolved	mg/L						0.89	
Cadmium, dissolved	mg/L						-0.02	U
Calcium, dissolved	mg/L						122	
Carbonate as CaCO3	mg/L						-2	U
Cation-Anion Balance	%						0	
Chloride	mg/L						895	
Conductivity @25C	umhos/cm						5,160	
Copper, dissolved	mg/L						-0.02	U
Hardness as CaCO3 (dissolved)	mg/L						431	
Hydroxide as CaCO3	mg/L						-2	U
Iron, dissolved	mg/L						-0.06	U
Iron, total	mg/L						-0.06	U
Lead, dissolved	mg/L						-0.03	U
Magnesium, dissolved	mg/L						30.8	
Manganese, dissolved	mg/L						-0.01	U
Manganese, total	mg/L						-0.02	U
Mercury, total	mg/L						-0.0002	U
Molybdenum, dissolved	mg/L						0.04	B
Nitrate/Nitrite as N	mg/L						2.47	
pH	units						8.4	H
Phosphate	mg/L						0.22	
Phosphorus, ortho dissolved	mg/L						0.07	H
Potassium, dissolved	mg/L						17.8	
Residue, Filterable (TDS) @180C	mg/L						3,260	
Selenium, total	mg/L						0.0045	
Sodium Adsorption Ratio in Water	calc.						22	
Sodium, dissolved	mg/L						1,020	
Sulfate	mg/L						913	
Sum of Anions	meq/L						54	
Sum of Cations	meq/L						54	
TDS (calculated)	mg/L						3,300	
TDS (ratio - measured/calculated)	calc.						0.99	
Zinc, dissolved	mg/L						0.14	

[1] No baseline data.

[2] ACZ Laboratory, Steamboat Springs, CO.

[3] Negative values denote readings below lab detection levels.

[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value is an estimated quantity.

[5] Estimated flow.

APPENDIX I

SURFACE WATER - TEMPERATURE DATA

NFG-1
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	11.19	4.55	0.03	-0.38	0.02	0.02	3.83	4.86	8.50	11.60	15.66	12.95
2	11.67	5.56	0.03	-0.07	0.02	0.02	4.48	5.33	7.95	11.72	16.85	13.07
3	14.39	5.61	0.03	-0.02	0.02	0.02	3.95	5.89	7.63	11.46	17.51	13.05
4	12.10	3.06	0.02	-0.01	0.02	0.02	4.83	5.96	7.93	11.32	17.39	13.42
5	11.40	3.57	0.03	0.01	0.02	0.03	4.86	6.63	7.92	11.49	17.55	14.01
6	9.99	2.00	0.03	0.00	0.02	0.02	4.55	6.64	8.05	11.33	17.73	13.86
7	10.77	0.83	0.03	0.00	0.02	0.03	5.09	6.85	7.87	11.50	17.02	13.86
8	9.70	0.14	0.03	0.01	0.02	0.05	4.88	6.16	8.22	11.76	17.58	12.47
9	8.28	0.05	0.03	0.02	0.02	0.05	4.67	6.06	7.58	11.45	17.92	13.10
10	7.87	0.06	0.03	0.02	0.02	0.05	4.03	6.34	7.81	12.04	18.67	12.43
11	6.71	0.06	0.03	0.02	0.02	0.05	3.95	6.60	8.00	12.68	17.17	12.62
12	8.04	0.05	0.03	0.02	0.02	0.04	4.64	7.03	8.42	13.12	17.60	12.94
13	6.93	0.05	0.02	0.02	0.02	0.05	4.09	7.46	8.54	12.95	17.21	12.75
14	6.29	0.05	0.01	0.02	0.02	0.56	4.51	7.53	8.41	13.38	16.50	13.08
15	4.07	0.05	-0.03	0.02	0.02	1.54	5.78	7.12	8.31	13.99	14.45	13.13
16	3.76	0.05	-0.10	0.02	0.02	1.87	5.39	7.21	9.01	14.23	13.34	14.92
17	4.86	0.06	-0.15	0.02	0.03	2.53	6.01	6.33	8.84	14.29	13.47	14.35
18	6.71	0.04	-0.13	0.02	0.02	2.49	5.79	5.76	8.74	13.51	13.19	15.08
19	8.10	0.04	-0.14	0.02	0.02	3.13	5.75	6.13	9.48	14.07	13.20	15.07
20	6.33	0.05	-0.46	0.02	0.02	2.42	5.23	5.96	9.15	14.02	13.33	14.92
21	6.41	0.07	-0.62	0.02	0.02	1.68	5.60	5.68	9.30	14.57	13.31	14.19
22	6.85	0.08	-0.34	0.02	0.02	2.39	5.52	6.44	8.39	15.20	13.19	13.66
23	8.54	0.08	-0.88	0.02	0.02	2.95	5.83	6.35	8.29	15.48	12.87	13.47
24	9.18	0.04	-0.52	0.02	0.03	2.67	5.58	6.92	9.22	15.82	12.47	13.74
25	7.08	0.03	-0.29	0.02	0.02	4.00	6.08	7.49	9.86	15.97	13.20	13.76
26	7.27	0.04	-0.16	0.02	0.02	3.66	5.64	7.47	10.52	16.69	13.32	13.70
27	6.25	0.05	-0.24	0.02	0.02	3.77	6.09	7.56	10.58	17.45	12.83	14.41
28	6.12	0.04	-0.39	0.02	0.02	3.70	5.68	7.11	10.81	16.75	12.46	14.81
29	5.58	0.04	-0.37	0.02	--	2.57	5.32	7.63	10.96	18.43	11.69	14.25
30	5.09	0.03	-0.42	0.02	--	3.61	4.75	8.03	11.37	15.26	12.33	14.14
31	5.06	--	-0.55	0.02	--	2.85	--	8.35	--	15.21	12.61	--

Mean	7.83	0.88	-0.18	0.00	0.02	1.58	5.08	6.67	8.86	13.83	14.96	13.71
Min	3.76	0.03	-0.88	-0.38	0.02	0.02	3.83	4.86	7.58	11.32	11.69	12.43
Max	14.39	5.61	0.03	0.02	0.03	4.00	6.09	8.35	11.37	18.43	18.67	15.08

NFG-2
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	11.05	4.43	-0.07	-0.09	-0.09	-0.09	3.69	4.74	8.38	11.47	15.48	12.72
2	11.53	5.44	-0.08	-0.09	-0.09	-0.09	4.35	5.22	7.83	11.59	16.60	12.84
3	14.30	5.51	-0.08	-0.09	-0.09	-0.09	3.82	5.78	7.51	11.32	17.27	12.83
4	12.00	2.94	-0.09	-0.09	-0.09	-0.09	4.70	5.84	7.80	11.18	17.16	13.23
5	11.31	3.57	-0.09	-0.09	-0.09	-0.08	4.75	6.51	7.79	11.35	17.37	13.80
6	9.87	2.03	-0.09	-0.09	-0.09	-0.09	4.43	6.52	7.93	11.20	17.49	13.65
7	10.69	0.88	-0.09	-0.09	-0.09	-0.08	4.98	6.73	7.74	11.36	16.82	13.66
8	9.59	0.16	-0.08	-0.09	-0.09	-0.09	4.77	6.04	8.10	11.62	17.37	12.29
9	8.17	0.02	-0.08	-0.09	-0.09	-0.06	4.56	5.94	7.46	11.31	17.67	12.89
10	7.77	-0.03	-0.09	-0.09	-0.09	-0.04	3.91	6.22	7.69	11.90	18.41	12.27
11	6.58	-0.05	-0.08	-0.09	-0.09	-0.07	3.83	6.49	7.87	12.55	17.00	12.45
12	8.02	-0.06	-0.09	-0.09	-0.09	-0.07	4.52	6.91	8.29	12.98	17.34	12.74
13	6.93	-0.07	-0.09	-0.09	-0.09	-0.07	3.97	7.35	8.41	12.83	16.97	12.55
14	6.18	-0.08	-0.09	-0.09	-0.09	0.83	4.39	7.42	8.28	13.24	16.28	12.89
15	4.12	-0.06	-0.09	-0.09	-0.09	1.74	5.66	7.01	8.18	13.85	14.22	12.97
16	3.81	-0.04	-0.09	-0.09	-0.09	2.02	5.27	7.09	8.89	14.09	13.13	14.74
17	4.80	-0.03	-0.09	-0.09	-0.09	2.62	5.89	6.20	8.72	14.14	13.25	14.20
18	6.69	0.08	-0.09	-0.09	-0.09	2.61	5.67	5.64	8.61	13.37	12.96	14.90
19	8.13	-0.05	-0.09	-0.09	-0.09	3.14	5.64	6.01	9.36	13.91	12.97	14.90
20	6.35	-0.02	-0.09	-0.09	-0.09	2.38	5.11	5.84	9.02	13.87	13.10	14.75
21	6.37	-0.06	-0.09	-0.09	-0.09	1.59	5.48	5.56	9.16	14.41	13.10	14.03
22	6.78	-0.09	-0.09	-0.09	-0.09	2.28	5.41	6.32	8.27	15.05	12.98	13.51
23	8.41	-0.08	-0.09	-0.09	-0.09	2.83	5.72	6.22	8.16	15.32	12.65	13.31
24	9.10	-0.06	-0.09	-0.09	-0.09	2.55	5.47	6.79	9.07	15.59	12.27	13.59
25	6.96	-0.04	-0.08	-0.09	-0.09	3.91	5.98	7.36	9.71	15.66	12.97	13.62
26	7.25	-0.06	-0.09	-0.09	-0.09	3.56	5.53	7.34	10.38	15.66	13.08	13.55
27	6.24	-0.07	-0.09	-0.09	-0.09	3.65	5.98	7.43	10.43	15.73	12.60	14.26
28	6.11	-0.09	-0.09	-0.09	-0.09	3.58	5.56	6.99	10.66	16.26	12.23	14.67
29	5.51	-0.08	-0.09	-0.09	--	2.44	5.20	7.51	10.83	15.76	11.50	14.11
30	4.96	-0.08	-0.09	-0.09	--	3.49	4.63	7.89	11.23	15.06	12.14	14.00
31	5.01	--	-0.09	-0.09	--	2.72	--	8.22	--	14.99	12.40	--

Mean	7.76	0.80	-0.09	-0.09	-0.09	1.51	4.96	6.55	8.73	13.50	14.73	13.53
Min	3.81	-0.09	-0.09	-0.09	-0.09	-0.09	3.69	4.74	7.46	11.18	11.50	12.27
Max	14.30	5.51	-0.07	-0.09	-0.09	3.91	5.98	8.22	11.23	16.26	18.41	14.90

NFG-3
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	11.21	4.55	-0.01	-0.05	0.01	-0.01	ND	ND	8.56	11.66	15.75	13.10
2	11.64	5.56	-0.04	-0.04	0.01	-0.02	ND	6.38	7.99	11.77	16.90	13.21
3	14.49	5.64	-0.04	-0.04	-0.01	-0.02	ND	5.94	7.67	11.52	17.58	13.19
4	12.16	3.08	-0.04	-0.04	-0.01	-0.01	ND	5.99	7.97	11.36	17.47	13.59
5	11.49	3.67	-0.04	-0.03	0.00	0.01	ND	6.68	7.96	11.54	17.64	14.24
6	9.96	2.14	-0.03	-0.03	-0.01	-0.03	ND	6.68	8.09	11.39	17.76	14.06
7	10.78	0.99	-0.02	-0.03	0.00	0.00	ND	6.91	7.91	11.54	17.10	14.06
8	9.79	0.23	-0.02	-0.03	0.00	-0.03	ND	6.18	8.27	11.82	17.66	12.57
9	8.23	0.09	-0.03	-0.03	0.00	0.02	ND	6.08	7.62	11.50	17.97	13.23
10	7.87	0.04	-0.05	-0.03	0.01	0.08	ND	6.37	7.85	12.09	18.71	12.50
11	6.69	0.02	-0.03	-0.03	0.00	0.02	ND	6.64	8.04	12.74	17.29	12.67
12	8.13	0.02	-0.05	-0.03	0.00	0.09	ND	7.08	8.46	13.17	17.62	12.98
13	7.07	-0.01	-0.04	-0.03	-0.01	0.03	ND	7.52	8.59	13.04	17.22	12.75
14	6.36	0.03	-0.05	-0.04	-0.02	0.30	ND	7.58	8.45	13.43	16.60	13.06
15	4.20	0.02	-0.04	-0.03	-0.01	1.52	ND	7.17	8.35	14.06	14.69	13.08
16	3.89	0.03	-0.04	-0.03	-0.01	2.09	ND	7.27	9.05	14.30	13.53	14.96
17	4.92	0.04	-0.04	-0.03	-0.01	2.74	ND	6.35	8.87	14.38	13.64	14.35
18	6.84	0.13	-0.03	-0.03	-0.01	2.76	ND	5.78	8.87	13.56	13.34	15.08
19	8.30	-0.01	-0.04	-0.01	0.00	3.33	ND	6.13	9.53	14.12	13.34	15.06
20	6.57	-0.02	-0.04	-0.02	0.00	2.53	ND	5.99	9.18	14.10	13.47	14.87
21	6.49	-0.02	-0.04	-0.03	0.00	1.67	ND	5.69	9.34	14.64	13.43	14.11
22	7.00	-0.04	-0.03	-0.02	-0.01	2.37	ND	6.47	8.44	15.28	13.34	13.58
23	8.57	0.00	-0.04	-0.03	-0.01	2.95	ND	6.37	8.30	15.57	12.99	13.35
24	9.29	0.00	-0.03	-0.03	-0.01	2.68	ND	6.93	9.24	15.84	12.57	13.69
25	7.15	-0.01	-0.03	0.01	-0.01	4.12	ND	7.54	9.89	15.93	13.33	13.72
26	7.39	-0.04	-0.03	0.01	-0.01	3.74	ND	7.50	10.57	15.89	13.46	13.65
27	6.39	-0.04	-0.05	0.00	-0.01	0.00	ND	7.59	10.61	16.00	12.95	14.44
28	6.29	-0.04	-0.05	0.00	0.00	ND	ND	7.14	10.85	16.52	12.55	14.87
29	5.65	-0.04	-0.05	-0.01	--	ND	ND	7.71	11.01	16.02	11.74	14.24
30	5.09	-0.03	-0.05	0.00	--	ND	ND	8.06	11.42	15.32	12.44	14.13
31	5.14	--	-0.04	0.01	--	ND	--	8.41	--	15.30	12.73	--

Mean	7.90	0.87	-0.04	-0.02	-0.01	1.22	ND	6.80	8.90	13.72	ND	13.75
Min	3.89	-0.04	-0.05	-0.05	-0.02	-0.03	ND	5.69	7.62	11.36	ND	12.50
Max	14.49	5.64	-0.01	0.01	0.01	4.12	ND	8.41	11.42	16.52	ND	15.08

ND No Data. Dead Data Logger Battery.

MCSG-1
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	9.59	3.24	-0.32	-3.22	-3.94	-0.49	0.14	5.19	11.03	15.19	16.49	13.86
2	10.52	3.61	-0.86	-5.10	-3.23	-0.26	0.31	5.03	10.69	14.79	16.87	13.44
3	11.22	4.01	-0.76	-4.96	-1.18	-0.15	0.36	6.01	10.34	15.38	17.63	13.76
4	10.58	2.85	-1.28	-3.92	-0.38	-0.12	0.57	7.56	10.76	14.81	17.96	16.10
5	9.81	2.31	-1.68	-3.26	-0.65	-0.21	0.59	9.45	11.03	14.57	17.25	15.99
6	8.79	1.14	-0.86	-2.01	-0.75	-0.12	0.58	9.97	11.83	14.67	17.20	16.10
7	8.65	-0.70	-0.56	-1.43	-1.50	-0.08	0.69	11.42	12.41	14.49	16.69	15.32
8	8.39	-1.30	-0.54	-2.18	-3.15	-0.05	0.78	8.03	12.87	14.37	16.82	13.41
9	7.16	-1.58	-0.61	-2.16	-3.31	-0.03	1.42	6.95	12.03	13.95	17.51	12.06
10	6.10	-1.27	-1.33	-2.04	-2.77	-0.03	1.37	7.24	11.57	14.37	17.88	11.65
11	6.23	-0.95	-1.03	-1.42	-2.26	-0.01	0.54	7.65	11.60	15.04	17.01	12.01
12	6.29	-1.89	-1.24	-1.48	-2.92	-0.01	0.70	9.37	12.52	15.45	16.21	9.85
13	5.16	-2.62	-1.49	-2.45	-2.23	0.00	0.73	10.86	13.01	15.94	15.47	9.01
14	5.09	-2.32	-2.00	-3.59	-1.50	0.02	1.00	12.01	13.24	16.62	15.09	9.19
15	2.95	-2.13	-1.67	-2.61	-0.55	0.00	2.85	12.50	12.95	16.95	14.65	10.35
16	2.04	-1.94	-1.56	-1.13	-0.61	0.00	3.81	13.04	13.13	17.23	15.03	12.67
17	2.88	-1.59	-1.47	-1.15	-2.14	0.00	4.41	8.69	13.34	17.53	15.44	11.84
18	3.80	-0.53	-1.06	-0.85	-2.36	0.01	4.78	5.61	12.44	16.36	14.73	11.47
19	4.80	-2.51	-0.83	-2.23	-2.07	0.02	5.60	6.16	12.60	16.45	14.55	11.28
20	4.11	-4.42	-1.38	-2.21	-2.64	0.03	5.89	6.00	12.54	16.30	14.65	11.41
21	4.10	-4.78	-1.48	-1.46	-2.52	0.02	5.75	5.05	12.56	16.54	14.80	8.45
22	4.40	-3.05	-1.04	-2.19	-1.88	0.02	6.63	6.04	11.32	17.14	15.38	7.14
23	5.55	-0.82	-1.71	-4.37	-2.18	0.02	7.45	6.19	9.47	17.68	15.02	7.98
24	6.32	-0.25	-1.07	-2.78	-3.63	0.03	6.86	5.58	9.91	17.76	14.03	7.91
25	5.45	-0.09	-1.07	-3.04	-3.78	0.06	8.11	7.22	10.97	17.69	14.28	8.10
26	5.06	-1.61	-0.69	-3.54	-2.78	0.09	7.87	8.88	11.86	17.70	14.40	9.23
27	4.20	-1.88	-1.40	-3.24	-2.07	0.17	9.16	8.80	12.53	17.02	13.20	9.99
28	3.89	-1.00	-1.92	-3.30	-1.13	0.26	8.60	6.89	13.65	17.01	12.40	11.08
29	3.84	-0.37	-2.38	-4.65	--	0.11	6.93	7.67	14.73	16.26	12.60	11.13
30	4.12	-0.27	-2.80	-5.39	--	0.19	5.54	8.03	15.33	15.89	13.34	9.71
31	3.70	--	-2.17	-4.75	--	0.00	--	9.62	--	16.43	13.60	--

Mean	5.96	-0.76	-1.30	-2.84	-2.15	-0.02	3.67	8.02	12.14	16.05	15.42	11.38
Min	2.04	-4.78	-2.80	-5.39	-3.94	-0.49	0.14	5.03	9.47	13.95	12.40	7.14
Max	11.22	4.01	-0.32	-0.85	-0.38	0.26	9.16	13.04	15.33	17.76	17.96	16.10

Red - Air/Soil Temp. (Stream Likely Dry)

MCSG-2
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	8.85	4.14	0.06	0.20	0.32	0.33	2.19	6.40	9.59	13.94	15.33	13.05
2	10.27	4.84	0.10	0.17	0.36	0.31	2.30	6.38	9.56	13.82	15.37	12.93
3	11.34	4.77	0.15	0.12	0.35	0.33	2.42	6.63	9.66	13.83	15.80	13.09
4	9.99	3.41	0.22	0.11	0.42	0.55	2.39	6.91	9.77	13.38	16.14	13.98
5	9.79	2.50	0.25	0.12	0.46	0.60	2.50	7.57	10.02	13.39	15.83	14.32
6	9.06	1.53	0.27	0.14	0.53	0.59	2.71	7.83	10.42	13.26	15.80	14.48
7	9.20	0.76	0.20	0.21	0.58	0.63	2.98	8.29	10.64	13.35	15.30	14.28
8	8.47	0.27	0.06	0.21	0.59	0.87	3.28	7.70	10.98	13.58	15.79	12.93
9	7.73	0.15	0.28	0.19	0.59	0.84	3.71	7.58	10.32	12.91	16.04	12.58
10	7.12	0.28	0.38	0.30	0.46	0.87	3.66	7.53	10.19	13.09	16.34	11.90
11	7.05	0.50	0.35	0.40	0.54	0.90	3.46	7.35	10.26	13.58	15.79	11.94
12	6.79	0.10	0.38	0.41	0.57	1.05	3.73	7.83	10.91	13.79	15.49	11.10
13	5.50	0.10	0.30	0.35	0.62	0.98	3.77	8.29	11.37	14.04	14.83	10.25
14	5.63	0.10	0.15	0.36	0.58	1.17	3.81	8.63	11.64	14.52	14.28	10.08
15	3.41	0.08	0.15	0.40	0.23	1.19	4.53	9.01	11.46	14.63	13.97	10.29
16	2.77	0.05	0.13	0.31	0.38	1.33	5.01	9.26	11.65	14.87	13.80	11.65
17	3.87	0.03	0.14	0.31	0.46	1.47	5.31	8.74	11.68	15.19	14.09	11.23
18	4.71	0.03	0.18	0.40	0.57	1.60	5.47	7.24	11.40	14.44	13.67	11.25
19	5.13	0.06	0.17	0.43	0.65	1.83	5.74	7.53	11.67	14.50	13.51	11.05
20	3.87	0.01	0.14	0.38	0.71	1.80	5.85	7.51	11.50	14.64	13.57	10.98
21	4.30	-0.07	0.12	0.42	0.75	1.61	6.02	6.67	11.69	14.58	13.55	9.47
22	4.67	-0.18	0.13	0.49	0.80	1.74	6.31	7.61	11.50	14.87	13.72	8.58
23	6.44	-0.07	0.10	0.55	0.68	1.87	6.61	7.24	10.25	14.91	13.61	8.79
24	6.78	-0.04	0.11	0.58	0.64	1.97	6.62	7.46	10.50	15.68	12.95	8.68
25	5.93	-0.04	0.10	0.54	0.62	2.22	7.03	8.05	11.04	15.78	13.32	8.61
26	5.21	-0.05	0.10	0.42	0.57	2.21	7.06	8.34	11.74	15.41	13.41	9.06
27	4.28	-0.04	0.14	0.40	0.48	2.32	7.62	8.55	12.16	15.21	12.78	9.53
28	3.98	-0.03	0.17	0.39	0.40	2.50	7.68	8.15	12.58	15.58	12.31	10.29
29	4.09	0.00	0.15	0.48	--	2.24	7.40	8.61	13.36	14.84	11.83	10.30
30	4.69	0.01	0.20	0.41	--	2.27	6.71	8.57	14.00	15.01	12.29	9.58
31	3.98	--	0.22	0.33	--	2.16	--	9.07	--	14.94	12.63	--

Mean	6.29	0.77	0.18	0.34	0.53	1.37	4.80	7.82	11.12	14.37	14.29	11.21
Min	2.77	-0.18	0.06	0.11	0.23	0.31	2.19	6.38	9.56	12.91	11.83	8.58
Max	11.34	4.84	0.38	0.58	0.80	2.50	7.68	9.26	14.00	15.78	16.34	14.48

MCSG-3
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	9.06	4.35	1.28	0.10	0.39	2.04	2.24	6.21	9.56	12.50	13.50	12.05
2	9.99	5.20	0.32	0.02	0.46	1.94	2.50	6.81	8.83	12.31	13.45	11.84
3	11.22	5.22	0.74	0.04	0.83	1.03	2.42	7.03	8.91	12.19	13.90	12.05
4	9.97	3.45	0.22	0.09	1.25	1.43	2.87	7.08	9.24	11.66	14.13	13.37
5	9.51	3.17	0.10	0.10	1.58	1.36	3.40	8.07	9.54	11.67	13.79	13.57
6	8.41	1.61	0.66	0.21	1.50	1.48	3.69	8.04	9.94	11.82	13.68	13.59
7	8.76	0.63	1.27	0.51	1.08	0.54	4.08	8.92	10.05	11.77	13.27	13.61
8	8.20	0.10	1.32	0.47	0.43	0.91	4.28	7.20	10.50	12.11	13.86	11.90
9	6.99	0.04	1.06	0.51	0.62	0.99	4.54	7.66	9.51	11.21	14.06	11.27
10	6.78	0.13	0.10	0.64	0.85	1.23	3.69	7.24	9.33	11.63	14.35	10.65
11	6.66	0.42	0.35	1.16	1.05	1.49	3.62	7.27	9.52	12.09	13.74	11.35
12	6.54	0.04	0.17	1.16	0.60	1.67	3.94	8.07	10.20	12.44	13.49	10.19
13	5.18	0.01	0.09	0.81	1.28	1.06	3.66	8.63	10.53	12.41	12.75	9.29
14	5.44	0.02	0.02	0.27	1.73	1.42	4.12	8.83	10.75	12.99	12.53	9.22
15	2.51	0.03	0.05	0.55	1.69	1.11	5.36	9.06	10.43	13.08	12.24	9.75
16	2.36	0.06	0.05	1.25	1.49	1.20	5.60	9.28	10.71	13.33	12.16	11.90
17	4.59	0.10	0.10	1.32	0.84	1.35	5.97	7.90	10.29	13.51	12.47	11.03
18	5.47	0.87	0.37	1.47	0.98	1.41	6.25	6.80	9.80	12.30	12.02	10.95
19	6.15	0.07	0.75	0.86	1.34	1.48	6.47	7.18	10.65	12.48	11.91	10.67
20	4.53	-0.02	0.10	0.86	1.14	1.36	6.00	7.05	10.23	12.78	12.09	10.50
21	5.03	-0.01	0.11	1.13	1.48	1.53	6.55	6.52	10.74	12.72	12.20	8.55
22	5.59	0.00	0.64	1.02	1.82	1.70	7.07	7.63	9.34	13.18	12.52	7.57
23	7.56	0.46	0.06	0.40	1.52	1.80	7.08	6.60	8.71	13.21	12.28	8.13
24	7.69	1.20	0.72	0.89	0.65	1.67	6.94	7.86	9.63	13.56	11.52	8.22
25	6.16	0.32	0.74	0.90	0.68	1.73	7.77	8.43	10.12	13.68	12.10	8.41
26	5.71	0.00	1.25	0.58	0.95	1.60	7.49	8.17	10.76	13.27	12.16	8.97
27	4.80	-0.01	0.48	0.65	1.30	1.66	8.64	8.37	11.11	13.20	11.32	9.73
28	4.76	0.20	0.17	0.66	2.03	1.77	7.96	7.64	11.44	13.51	10.80	10.85
29	4.75	1.01	0.08	0.34	--	2.08	7.01	8.23	12.13	12.87	10.56	10.37
30	5.14	1.28	0.06	0.30	--	2.31	6.22	8.69	12.52	12.64	11.54	9.33
31	4.35	--	0.16	0.45	--	2.05	--	9.15	--	13.03	11.68	--

Mean	6.45	1.00	0.44	0.64	1.13	1.50	5.25	7.79	10.17	12.62	12.65	10.63
Min	2.36	-0.02	0.02	0.02	0.39	0.54	2.24	6.21	8.71	11.21	10.56	7.57
Max	11.22	5.22	1.32	1.47	2.03	2.31	8.64	9.28	12.52	13.68	14.35	13.61

MCSG-4
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	9.28	4.04	-0.26	-1.27	-2.62	0.89	2.22	6.41	9.62	12.75	13.83	12.40
2	10.35	4.97	-0.85	-1.78	-2.19	0.77	2.47	6.51	8.89	12.53	13.80	12.18
3	12.37	5.20	-0.65	-2.05	-0.85	0.49	2.43	7.01	8.96	12.42	14.29	12.40
4	10.27	3.17	-0.81	-1.89	-0.29	0.92	2.78	7.07	9.31	11.87	14.52	13.68
5	10.03	2.94	-1.09	-1.67	-0.20	0.90	3.25	8.05	9.62	11.89	14.15	13.99
6	8.98	1.38	-0.57	-1.02	0.03	0.89	3.55	8.03	10.02	12.05	14.04	14.02
7	9.40	0.50	-0.33	-0.57	0.41	0.42	3.90	8.91	10.14	12.00	13.58	13.97
8	8.74	0.26	-0.42	-0.60	0.36	0.68	4.13	7.22	10.59	12.36	14.22	12.10
9	7.39	0.17	-0.60	-0.69	0.44	0.63	4.42	7.68	9.60	11.47	14.45	11.59
10	6.91	0.08	-1.68	-0.64	0.51	0.77	3.64	7.26	9.41	11.88	14.78	10.84
11	6.72	0.10	-1.21	-0.52	0.68	0.94	3.55	7.26	9.62	12.38	14.06	11.50
12	6.84	0.06	-1.60	-0.50	0.52	1.07	3.88	8.07	10.32	12.72	13.83	10.41
13	5.05	-0.16	-1.93	-0.58	0.83	0.77	3.62	8.62	10.67	12.69	13.09	9.47
14	5.26	-0.75	-2.59	-0.94	1.11	0.80	4.03	8.83	10.89	13.30	12.76	9.40
15	2.23	-0.97	-2.25	-1.01	0.63	0.41	5.28	9.09	10.56	13.41	12.53	9.82
16	1.87	-0.99	-2.23	-0.60	0.91	0.56	5.54	9.31	10.85	13.67	12.49	12.22
17	4.11	-1.09	-2.00	-0.27	0.63	0.83	5.89	7.98	10.41	13.89	12.81	11.16
18	5.21	-0.16	-1.33	-0.21	0.80	1.10	6.14	6.86	9.94	12.63	12.36	11.22
19	6.22	-1.28	-1.07	-0.21	1.04	1.31	6.40	7.19	10.80	12.81	12.23	10.86
20	4.51	-1.90	-2.10	-0.36	0.95	0.59	5.96	7.08	10.36	13.12	12.42	10.63
21	4.97	-2.02	-2.13	-0.45	1.15	0.77	6.51	6.52	10.89	13.09	12.52	8.65
22	5.31	-1.75	-1.36	-0.43	1.36	1.01	7.01	7.65	9.59	13.54	12.83	7.66
23	7.37	-0.34	-2.31	-0.61	1.10	1.16	7.06	6.69	8.80	13.58	12.59	8.17
24	7.82	-0.18	-1.18	-0.68	0.58	1.08	6.90	7.81	9.74	14.19	11.78	8.32
25	5.95	-1.34	-1.07	-0.73	0.56	1.31	7.74	8.42	10.23	14.13	12.42	8.52
26	5.75	-3.02	-0.57	-1.60	0.62	1.26	7.45	8.21	10.91	13.64	12.49	9.05
27	4.65	-2.62	-1.17	-1.70	0.77	1.70	8.60	8.41	11.25	13.55	11.64	9.89
28	4.56	-1.05	-1.68	-1.81	1.00	2.06	7.95	7.66	11.60	13.94	11.09	11.03
29	4.51	-0.38	-1.64	-2.48	--	2.08	7.18	8.29	12.31	13.16	10.73	10.48
30	4.77	-0.46	-1.90	-3.08	--	2.29	6.43	8.72	12.77	13.20	11.74	9.45
31	4.25	--	-1.54	-2.93	--	2.05	--	9.17	--	13.34	11.93	--

Mean	6.50	0.08	-1.36	-1.09	0.39	1.05	5.20	7.81	10.29	12.94	12.97	10.84
Min	1.87	-3.02	-2.59	-3.08	-2.62	0.41	2.22	6.41	8.80	11.47	10.73	7.66
Max	12.37	5.20	-0.26	-0.21	1.36	2.29	8.60	9.31	12.77	14.19	14.78	14.02

MCSG-5
Daily Mean Temperature Values
(Degrees Celsius)

Day	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1	13.24	4.14	0.23	-4.48	-3.94	-0.14	1.25	5.66	11.13	15.77	17.11	17.36
2	12.59	5.44	-2.04	-7.02	-3.02	-0.12	2.22	5.93	10.16	15.38	17.64	17.16
3	13.45	5.05	-1.08	-6.08	-0.54	-0.12	2.09	6.59	10.21	15.15	18.49	17.54
4	11.50	3.21	-3.17	-4.27	-0.21	-0.12	2.47	6.74	10.72	13.98	18.45	19.37
5	10.65	2.97	-2.84	-3.06	-0.13	-0.11	3.01	8.13	10.95	14.03	17.49	19.49
6	9.46	1.41	-0.58	-0.74	-0.17	-0.11	3.24	8.50	12.00	14.26	17.68	19.40
7	9.62	0.27	-0.41	-0.12	-0.97	-0.09	3.77	9.75	12.25	14.32	17.04	18.26
8	9.15	-0.62	-0.37	-0.84	-3.35	-0.09	3.87	7.48	12.69	14.76	17.49	15.89
9	7.65	-1.02	-0.80	-1.70	-3.18	-0.09	4.18	7.56	10.99	13.36	18.16	15.20
10	6.90	-0.21	-2.37	-1.86	-2.62	-0.08	3.18	7.40	10.64	14.21	18.37	14.55
11	6.43	0.37	-1.03	-1.01	-2.12	-0.05	1.97	7.17	10.75	15.17	17.26	14.39
12	6.74	-1.08	-1.72	-1.31	-3.01	0.08	2.35	8.36	12.09	15.74	16.94	12.47
13	5.56	-1.98	-2.81	-2.43	-1.62	-0.05	2.22	9.26	12.84	16.08	16.35	12.26
14	5.51	-1.07	-3.32	-4.12	-0.60	-0.05	2.58	9.83	13.46	16.91	16.00	12.98
15	2.51	-0.36	-2.36	-2.46	-0.14	-0.08	4.90	10.45	12.88	17.17	15.48	14.07
16	2.42	0.45	-2.12	-0.42	-1.16	-0.10	5.31	10.92	13.17	17.60	15.91	15.89
17	4.72	1.14	-1.62	-0.11	-3.66	-0.09	5.66	8.79	12.90	17.74	16.68	14.66
18	5.58	1.75	-0.93	-0.11	-3.40	-0.07	5.36	6.11	11.79	16.04	16.29	14.93
19	6.32	-0.73	-0.84	-1.14	-2.56	0.30	6.11	6.71	12.68	16.49	16.54	15.15
20	4.89	-0.97	-2.24	-1.72	-3.38	0.30	6.00	6.84	12.17	16.91	16.96	14.97
21	5.52	-0.99	-1.54	-1.26	-2.15	0.35	6.02	5.93	12.75	17.61	17.18	11.55
22	6.55	-0.59	-0.87	-1.82	-1.13	0.70	6.71	7.40	10.69	17.73	17.84	10.42
23	8.47	1.49	-2.54	-4.21	-2.25	0.88	7.28	6.37	9.22	17.97	16.75	11.88
24	8.34	1.42	-0.65	-2.06	-4.28	0.76	6.77	7.23	10.37	18.02	15.75	11.77
25	6.39	-1.62	-1.06	-2.84	-3.66	0.98	8.22	8.68	11.31	17.90	17.32	12.36
26	6.06	-2.64	-0.29	-3.33	-2.55	0.88	7.27	8.77	12.41	17.82	17.33	13.36
27	5.29	-1.88	-2.63	-2.96	-1.78	1.32	8.99	8.94	12.81	17.55	16.23	13.80
28	5.61	-0.13	-3.50	-3.28	-0.25	1.40	8.55	7.62	13.57	17.69	15.67	14.87
29	5.52	1.42	-3.96	-5.19	--	1.14	7.13	8.92	15.27	16.77	15.32	15.41
30	5.35	1.17	-4.15	-5.90	--	1.21	5.63	9.35	15.53	16.15	16.02	13.68
31	4.19	--	-2.86	-4.92	--	0.79	--	10.18	--	16.37	16.53	--

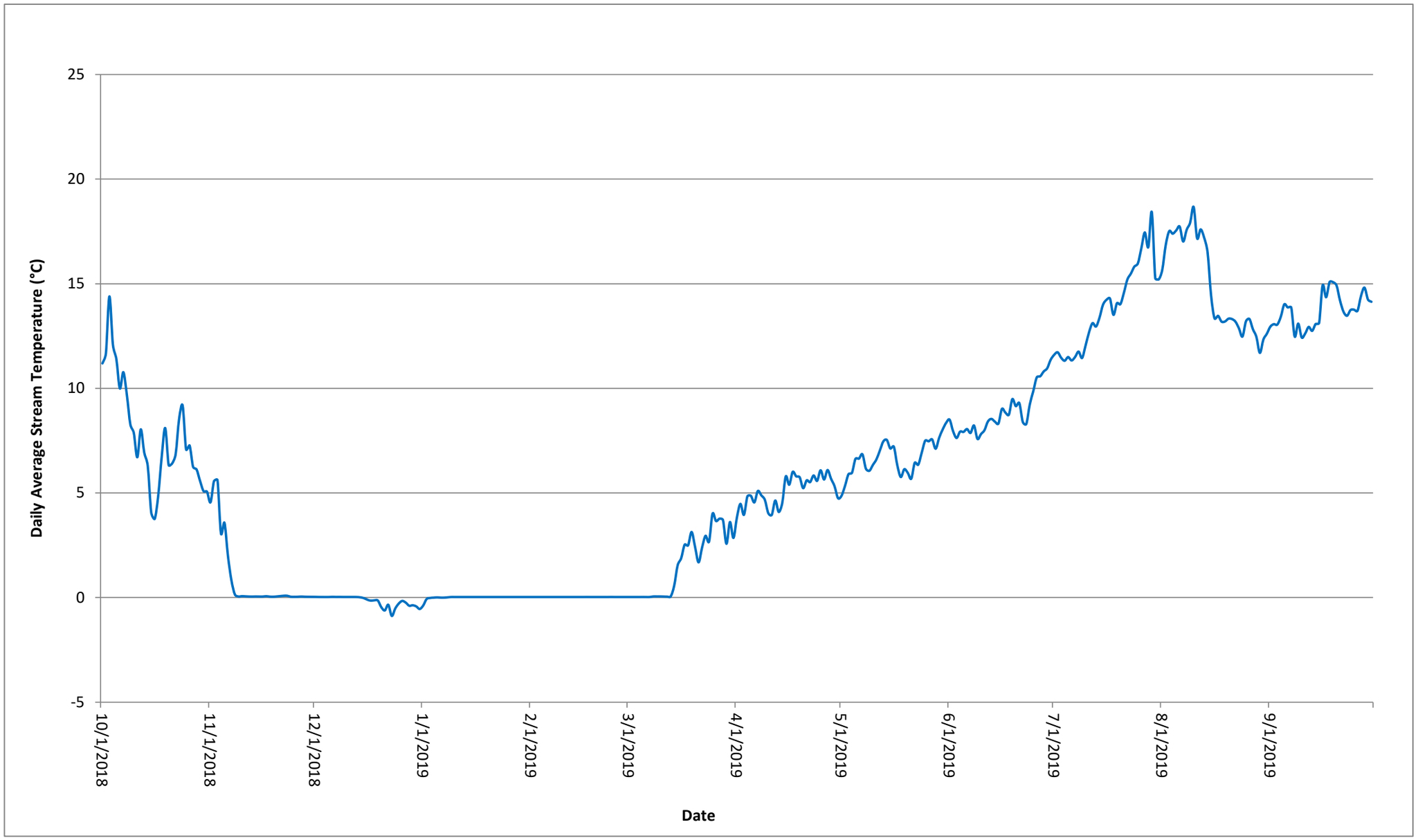
Mean	7.17	0.53	-1.82	-2.67	-2.06	0.31	4.81	7.99	12.01	16.21	16.91	14.84
Min	2.42	-2.64	-4.15	-7.02	-4.28	-0.14	1.25	5.66	9.22	13.36	15.32	10.42
Max	13.45	5.44	0.23	-0.11	-0.13	1.40	8.99	10.92	15.53	18.02	18.49	19.49

Red - Air/Soil Temp. (Stream Likely Dry)

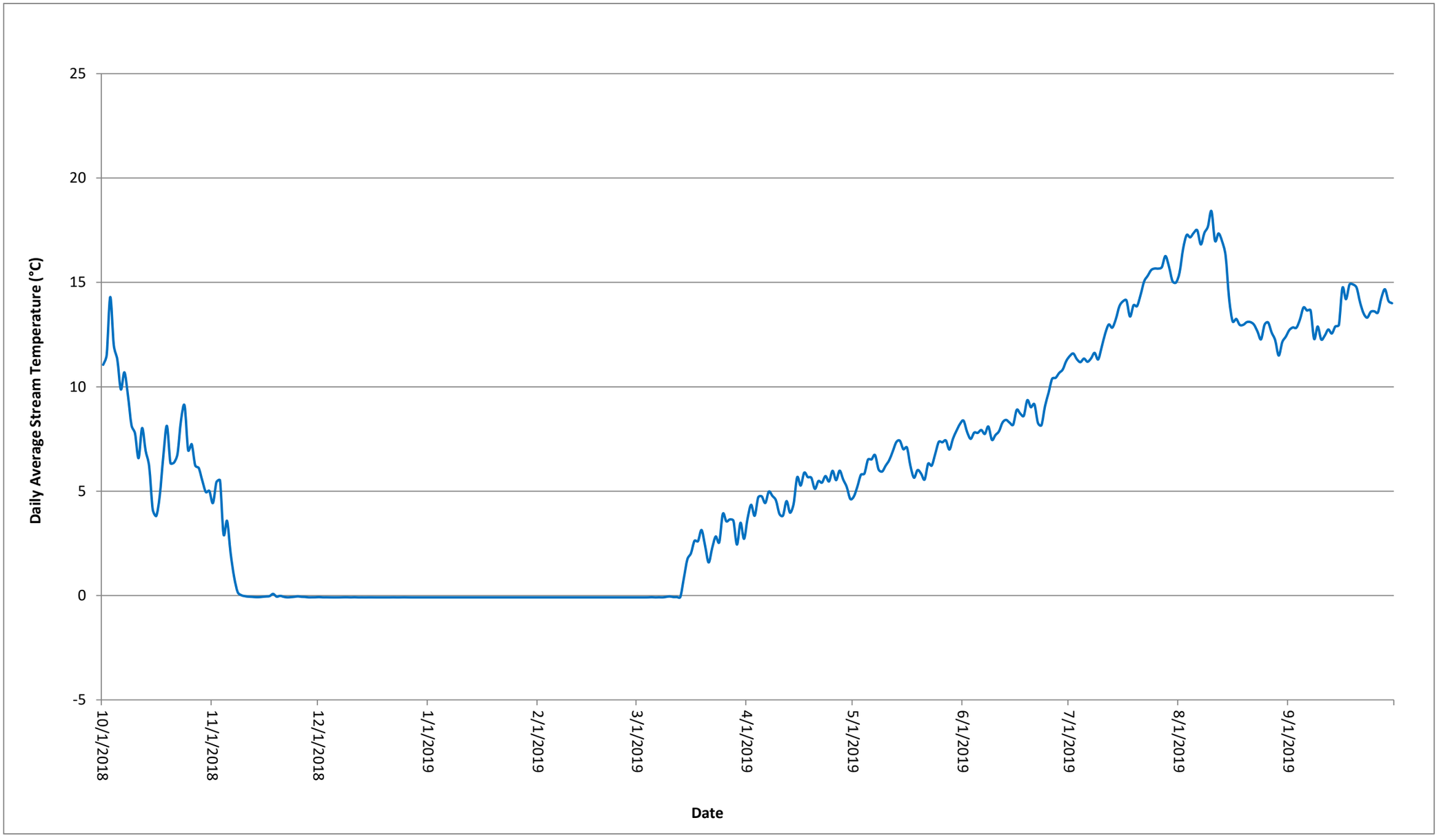
APPENDIX J

SURFACE WATER - TEMPERATURE GRAPHS

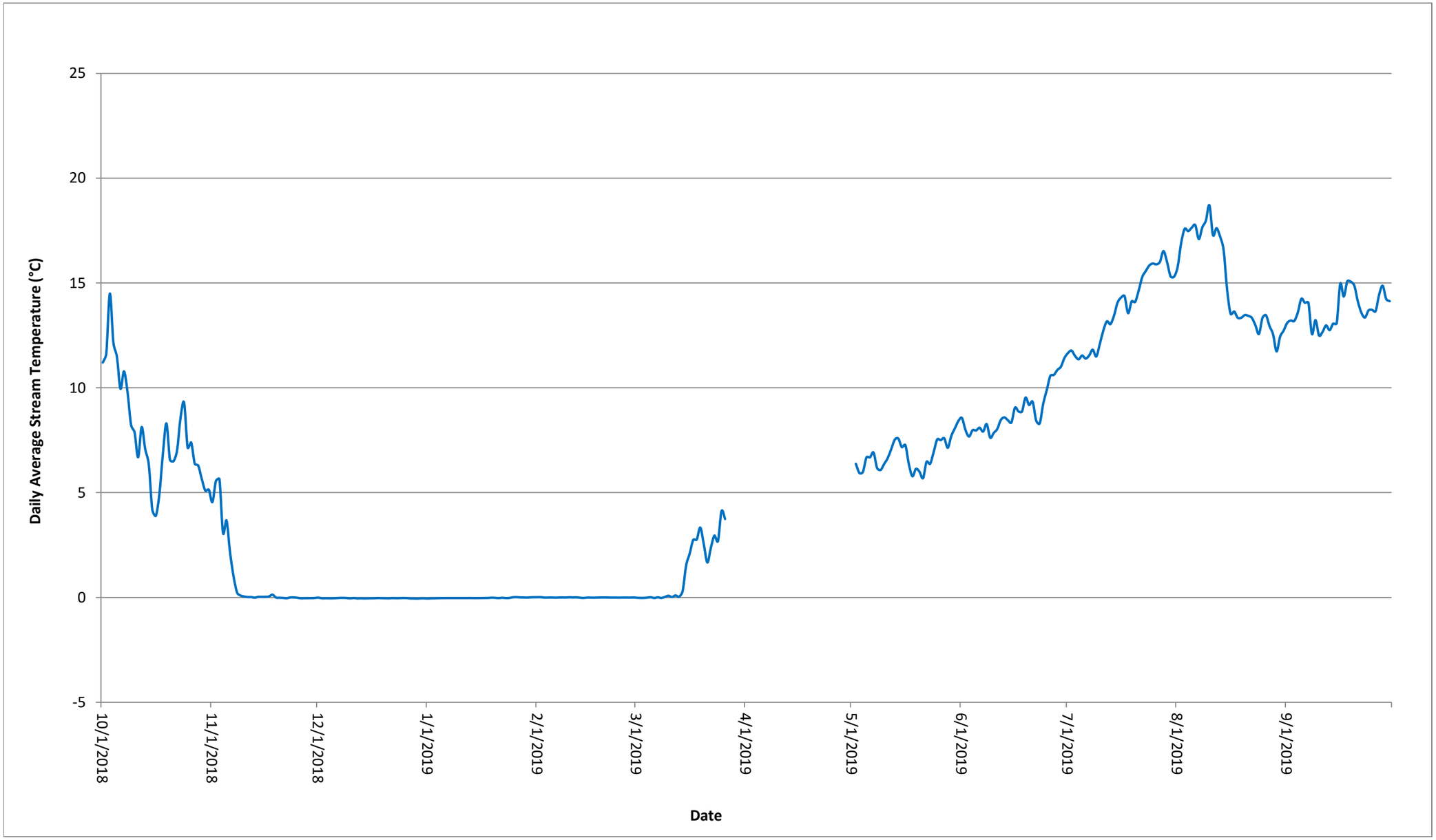
NFG-1
Daily Mean Temperature Graph



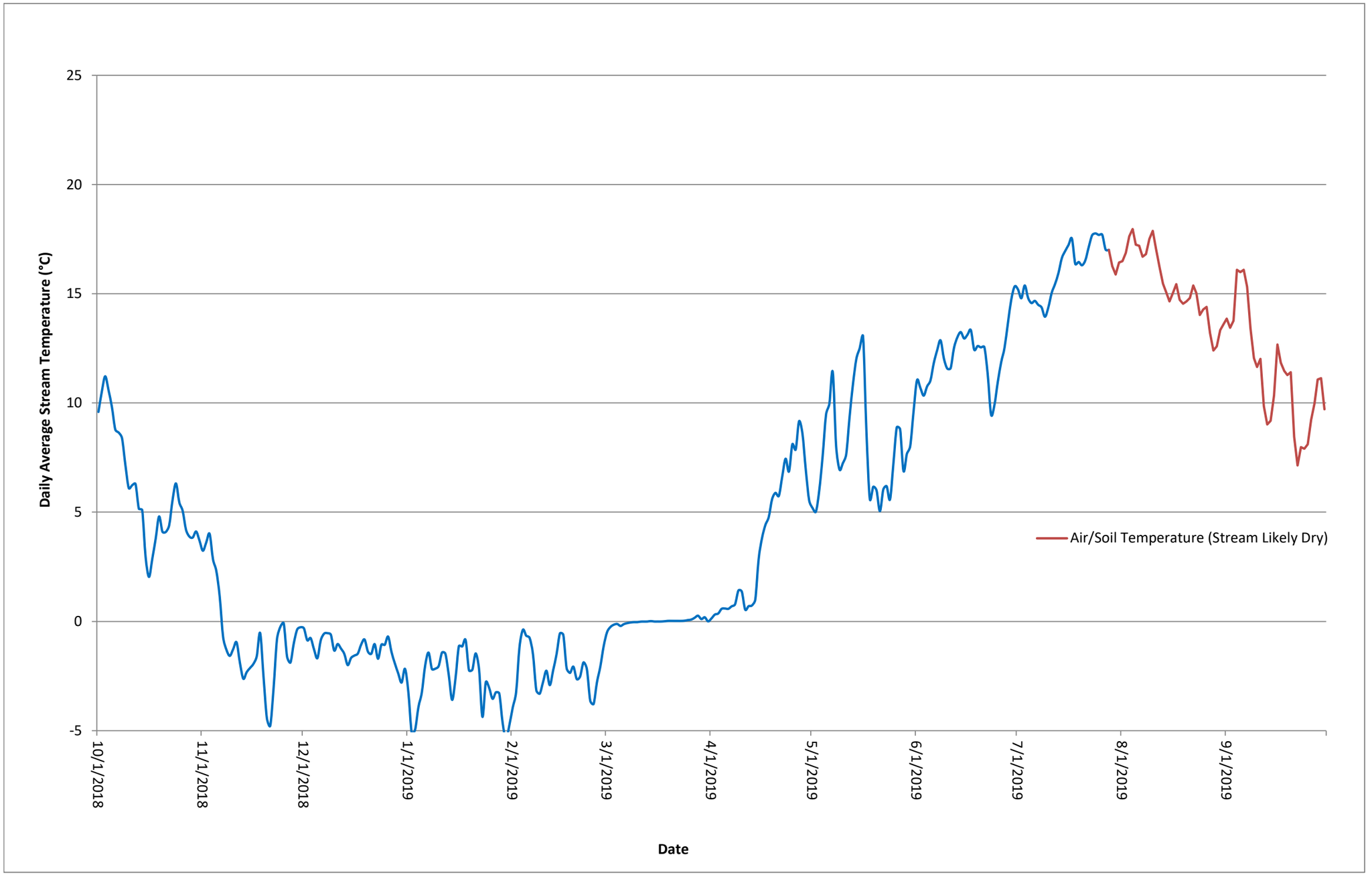
NFG-2
Daily Mean Temperature Graph



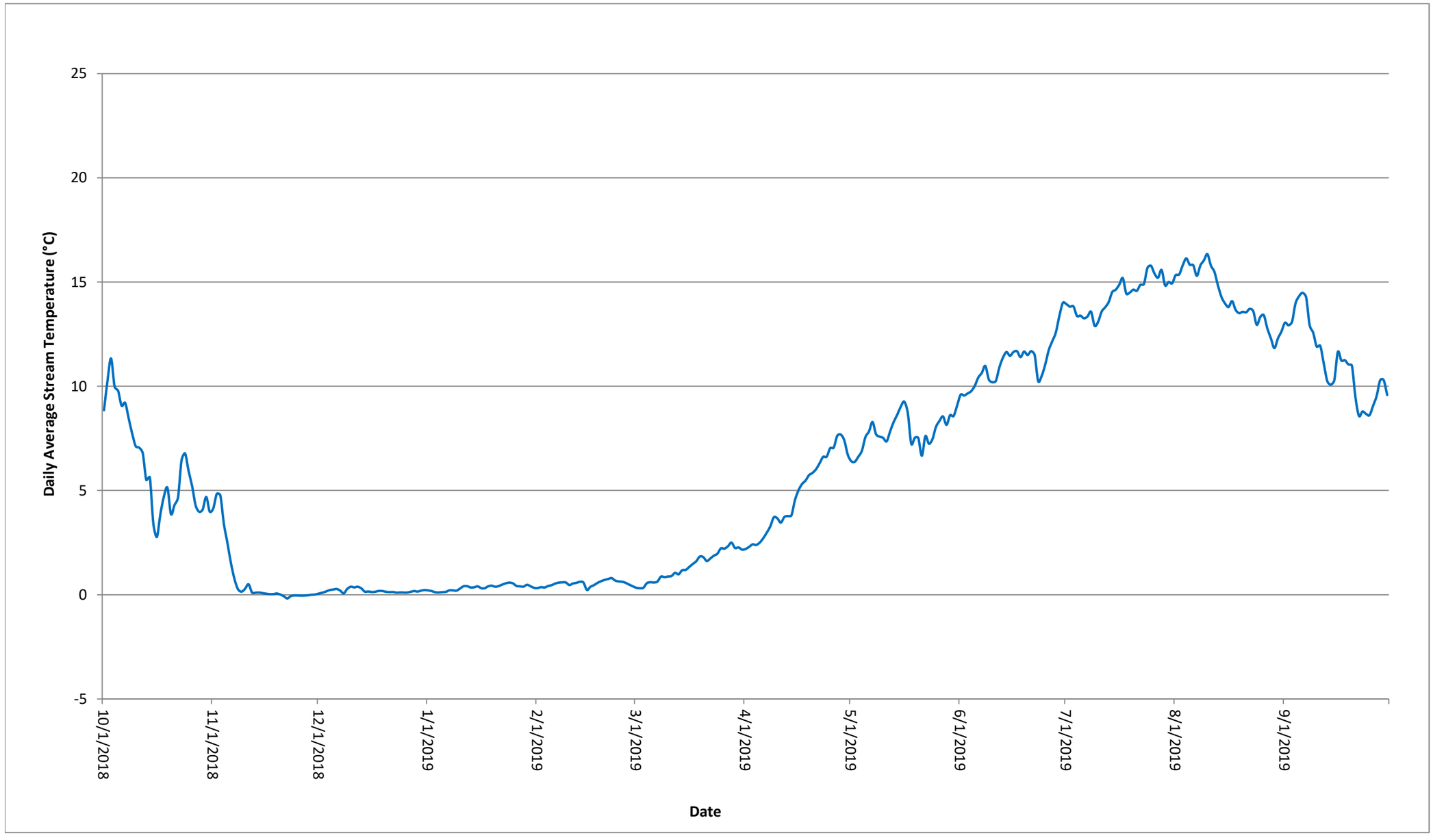
NFG-3
Daily Mean Temperature Graph



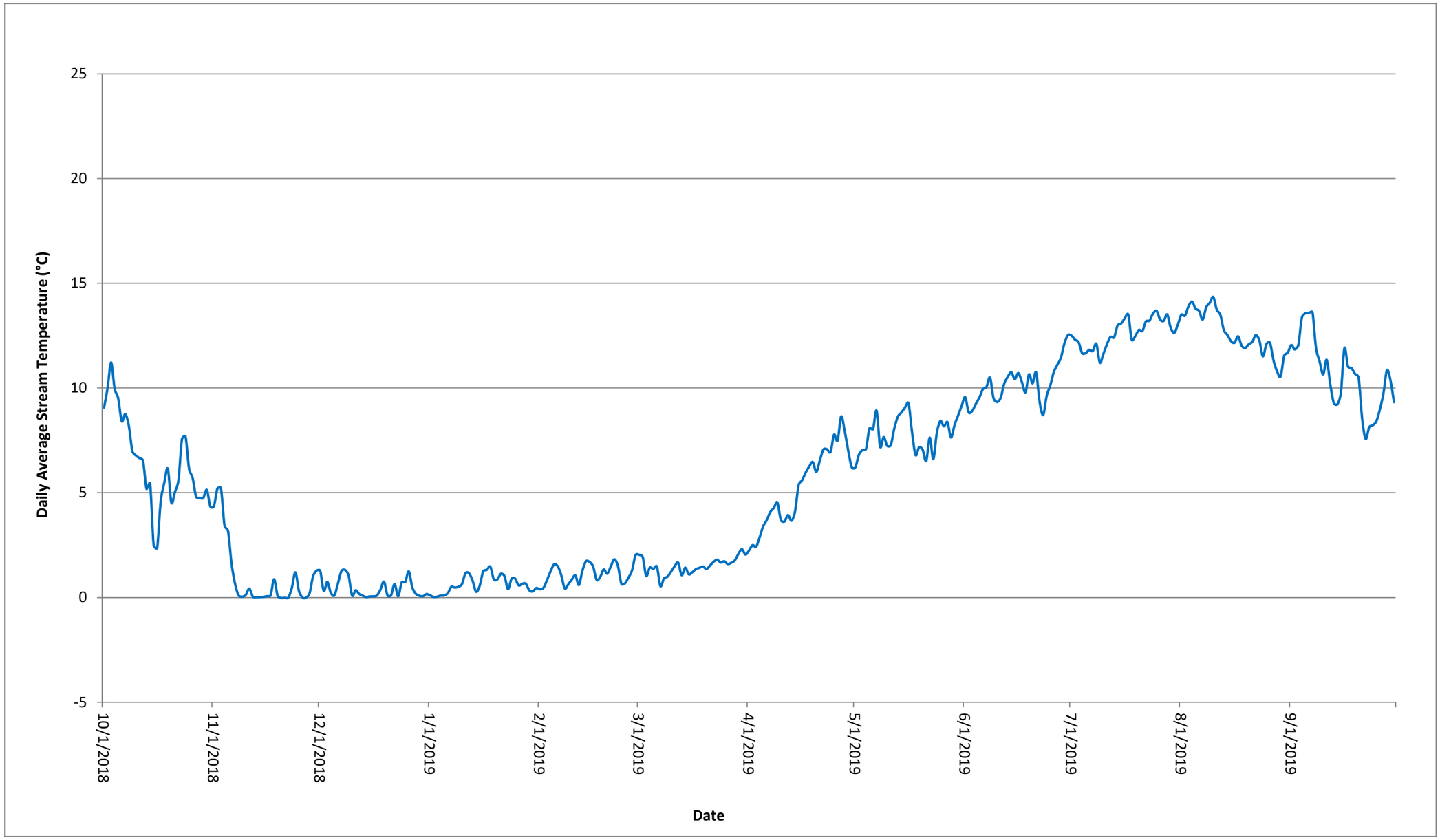
MCSG-1
Daily Mean Temperature Graph



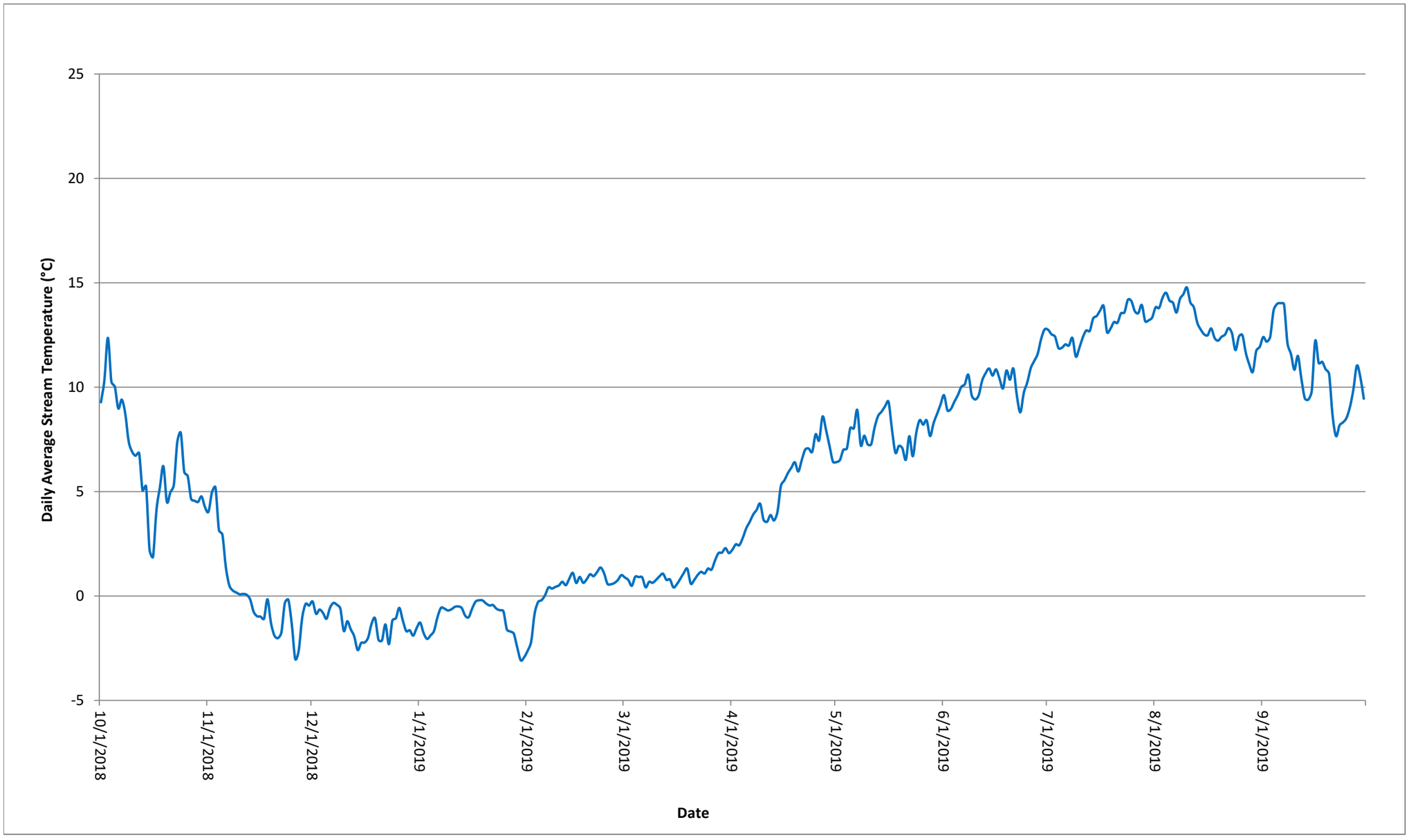
MCSG-2
Daily Mean Temperature Graph



MCSG-3
Daily Mean Temperature Graph



MCSG-4
Daily Mean Temperature Graph



MCSG-5
Daily Mean Temperature Graph