Mountain Coal Company

Mountain Coal Company, LLC
West Elk Mine
5174 Highway 133
Somerset, CO 81434

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June 29, 2018

Mr. Leigh D. Simmons
Colorado Division of Reclamation, Mining and Safety
Office of Mined Land Reclamation
1313 Sherman Street, Room 215
Denver, Colorado 80203

**Re: Mountain Coal Company, LLC, West Elk Mine; Permit No. C-1980-007; Water Year 2017 Annual Hydrology Report**

Dear Mr. Simmons:

Attached is a technical memo for the 2017 Annual Hydrology Report (AHR) prepared by HydroGeology Solutions, Inc. (formerly HydroGeo) for Mountain Coal Company, LLC (MCC) that provides a summary of the water year 2017 (WY2017) water quality and quantity data, assessments of mine-induced hydrology impacts, along with a summary of MCC's current monitoring program. As has been done the past few years, MCC has reduced the bulk of the report by eliminating repeated general discussions that have been included in past AHRs and have also referenced information in those AHRs if that information has not changed during the past year, rather than providing a duplicate copy this year. As there were no new water inflows within the E seam, please reference the mine map in past AHRs. The location of monitored resources can be found on Permit Map 34.

MCC pumped about 228 acre feet of its adjudicated water right from the North Fork of the Gunnison River for mine uses, including domestic water, surface dust control and for the underground mine operations – the largest water use. Most of the water pumped in the mine is absorbed in the mined coal and gob, is evaporated in the mine ventilation air and seeps into the mine floor. Along with domestic water and road dust control uses, water is used on the surface in the coal preparation plant. MCC was again successful during WY2017 with maintaining zero discharges (i.e. no CDPS discharges from the mine site) and continued to recycle water from the ponds for use in the Coal Preparation Plant. As a result, it is estimated that less than 50 acre feet were consumed by the mine operations during WY 2017.

Please don't hesitate to contact me at (970) 929-2238 or by e-mail should you have questions regarding this submittal.

Sincerely,

Kathleen G. Welt

Kathleen G. Welt,
Environmental Engineer III

cc: Dan Gray - USFS
Weston Norris - MCC

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# TECHNICAL MEMO

# WEST ELK MINE

## SUMMARY OF WATER YEAR 2017 SURFACE WATER AND GROUNDWATER QUANTITY AND QUALITY DATA

*Prepared for:*
**Mountain Coal Company, LLC**
**West Elk Mine**
5174 Highway 133
Somerset, CO 81434

*Prepared by:*
HYDROGEOLOGY SOLUTIONS, INC.
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June 2018

# WEST ELK MINE

## SUMMARY OF WATER YEAR 2017 SURFACE WATER AND GROUNDWATER QUANTITY AND QUALITY DATA

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# 1.0 INTRODUCTION

This Mountain Coal Company, LLC (MCC) West Elk Mine 2017 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) 2017 (October 1, 2016 through September 30, 2017). 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 WY 2017. A brief summary of the current monitoring plan (CDRMS, 2016) is presented in the following sections.

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 3$^{rd}$ and May 13$^{th}$; the peak flow period between April 21$^{st}$ and June 26$^{th}$; and the low flow period between July 10$^{th}$ and October 8$^{th}$, 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 consecutive 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 | | | |
| | February | | | |
| Rising Limb<br>April 3 to May 13 | March | | | |
| | April | X | X | X |
| Peak Flow<br>April 21 to June 26 | May | X | X | X |
| | June | X | X | X |
| | July | X | X | X |
| Low Flow<br>July 10 to October 8 | August | X | X | X |
| | 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 20 stream stations comprised of ten monitoring stations with continuous recording devices, 8 monitoring stations where flow is recorded instantaneously, and 2 stations where flow is not measured. A discussion of the surface water stations on the major drainages and the tributaries to these drainages is presented from upstream to downstream areas. 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 September 2007 eight temperature data loggers were installed and deployed 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), and a summary of the temperature monitoring locations is presented in Table 4.

## 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 | Instantaneous, 6 x Year | 6 x Year | Peak Flow Period [2] | Baseline will start ~1 year prior to mining operations |

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 the Temperature Monitoring Site Details

| Site Name | Location | Coordinates (NAD 83, Degrees, Minutes) | Data Collection Interval[1] | Period of Record |
|---|---|---|---|---|
| NFG-1 | North Fork of the Gunnison River | N 38° 55.556' W107° 26.019' | Hourly | Fall 2007 to present |
| NFG-2 | North Fork of the Gunnison River | N 38° 55.730' W107° 27.259' | Hourly | Fall 2007 to present |
| NFG-3 | North Fork of the Gunnison River | N 38° 55.732' W107° 26.257' | Hourly | Fall 2007 to present |
| MCSG-1 | Unnamed tributary to Sylvester Gulch | N 38° 54.630' W107° 26.730' | Hourly | Fall 2007 to present |
| MCSG-2 | Unnamed tributary to Sylvester Gulch | N 38° 54.692' W107° 26.570' | Hourly | Fall 2007 to present |
| MCSG-3 | Sylvester Gulch | N 38° 54.687' W107° 26.567' | Hourly | Fall 2007 to present |
| MCSG-4 | Sylvester Gulch | N 38° 54.706' W107° 26.549' | Hourly | Fall 2007 to present |
| MCSG-5 | Sylvester Gulch | N 38° 55.592' W107° 26.266' | Hourly | Fall 2007 to present |

1. Data were initially collected at 15 minute intervals, then at hourly intervals beginning in WY 2009.

## 2.2 SPRING AND SEEP MONITORING PROGRAM

In WY 2017 a total of 27 springs and seeps were monitored as part of the MCC hydrologic monitoring program.

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 mine panels area | 3 x Year | 3 x Year | Peak Flow Period [1] | 1996 to present |
| 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 |

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 |
|---|---|---|---|---|---|
| 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 |

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 2017, a total of 14 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*** | | | | | |
| RAV-4b | T13S, R90W, Sec. 15, SE,SW | 6687.0 | 600-625 | 630.0 | 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*** | | | | | |
| RAV-4B | Box Canyon mine panels area | 3 x Year | 3 x Year | Low Flow Period (1) | 1995 to present |
| 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).

## 2.4 UNDERDRAIN AND MINE WATER MONITORING

Two underdrains were monitored in WY 2017. 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, 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.

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)** | | | |

**(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.

# 3.0 ASSESSMENT OF MINE-INDUCED HYDROLOGIC IMPACTS IN WY 2017 AND ANTICIPATED IMPACTS IN WY 2018

## 3.1 SURFACE WATER

MCC maintains a network of 20 stream flow gauging 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 are noted in the table below. 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. 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 2017 are presented in Appendix C.

In WY 2017 none of the tested parameters were elevated 10 percent or more above maximum baseline values at the following surface water monitoring locations: Lower Minnesota Creek, Lower Dry Fork, Upper Dry Fork, Lick Creek, and Deep Creek Ditch. The Horse Gulch, Deer Creek, and Box Canyon sites were dry, so there are no water quality data for these sites in WY 2017. There are no baseline data for comparison for Upper Minnesota Creek (WWE, 2001).

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 North Fork (USGS) | 6/7/2017 | Arsenic, total recoverable | mg/L | 0.0015 | 0.001 |
| | 6/7/2017 (Duplicate) | | | 0.0014 | |
| | 9/6/2017 | Magnesium, dissolved | mg/L | 4.5 | 3.4 |
| | 9/6/2017 (Duplicate) | | | 4.5 | |
| | 9/6/2017 | Sodium, dissolved | mg/L | 7.1 | 5.7 |
| | 9/6/2017 (Duplicate) | | | 7.2 | |
| Lower North Fork | 6/7/2017 | Iron, total | mg/L | 5.61 | 3.8 |
| | | Residue, Non-Filterable (TSS) @105C | mg/L | 185 | 107 |
| Upper Sylvester Gulch | 5/12/2017 | Conductivity (Field) | µmhos/cm | 654 | 380 |
| | 6/6/2017 | | | 669 | |
| | 6/6/2017 | Conductivity @25C | µmhos/cm | 631 | 462 |
| | | Iron, dissolved | mg/L | 0.07 | 0.01 |
| | | Iron, total | mg/L | 3.55 | 0.07 |
| | | Residue, Filterable (TDS) @180C | mg/L | 416 | 260 |
| | | Residue, Non-Filterable (TSS) @105C | mg/L | 30.0 | 20 |
| Middle Sylvester Gulch | 6/7/2017 | Chloride | mg/L | 16.3 | 10 |
| | | Sodium Adsorption Ratio (SAR) | calc. | 3.8 | 3.02 |
| Lower Sylvester Gulch | 5/12/2017 | Conductivity (Field) | µmhos/cm | 782 | 700 |
| | 6/6/2017 | | | 811 | |
| | 6/6/2017 | Conductivity @25C | µmhos/cm | 753 | 597 |
| | | Iron, dissolved | mg/L | 0.07 | 0.05 |
| | | Iron, total | mg/L | 0.83 | 0.17 |
| | | Residue, Filterable (TDS) @180C | mg/L | 486 | 430 |
| Middle Dry Fork Flume | 6/8/2017 | Conductivity @25C | µmhos/cm | 123 | 76 |
| | | Iron, dissolved | mg/L | 0.24 | 0.11 |
| East Gulch, East of Horse Gulch | 5/10/2017 | Conductivity (Field) | µmhos/cm | 560 | 480 |
| | 6/8/2017 | | | 545 | |
| | 6/8/2017 | Conductivity @25C | µmhos/cm | 500 | 453 |
| | | Residue, Filterable (TDS) @180C | mg/L | 340 | 290 |
| Upper Deep Creek | 6/7/2017 | Iron, dissolved | mg/L | 0.06 | 0.04 |
| | 9/7/2017 | Conductivity (Field) | µmhos/cm | 460 | 310 |
| Lower Deep Creek | 9/7/2017 | Conductivity (Field) | µmhos/cm | 470 | 380 |
| Poison Gulch | 5/11/2017 | Conductivity (Field) | µmhos/cm | 565 | 479 |
| | 6/7/2017 | | | 546 | |
| | 6/7/2017 | Conductivity @25C | µmhos/cm | 500 | 295 |
| | | Residue, Filterable (TDS) @180C | mg/L | 308 | 170 |
| Minnesota Reservoir Flume | 6/8/2017 | Residue, Non-Filterable (TSS) @105C | mg/L | 77.0 | 60 |
| | 6/8/2017 (Duplicate) | | | 77.0 | |

### 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, and the Minnesota Reservoir Flume 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, and Poison Gulch) 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 2017 (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 27 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 2017 do not indicate significant changes from baseline conditions for most of the monitored springs. However, many of the springs had slightly elevated TDS/TSS, iron, and/or conductivity values that were also noted in WYs 2004 through 2016. 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 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. The discussion below includes monitoring locations where one or more parameters had values 10 percent or higher than comparable maximum baseline values. Spring water quality parameters that are above 10 percent of 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 2017: Springs G-16, 35-3, WCC-24, J-2, Deep Creek Trail Spring, 96-2-2 Area Spring, Spring J-10, and Spring 2012-3. In WY 2017, Springs 27-1, G-1A, G-20, Deer Creek Spring, Deep Creek Spring # 2, and Spring 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).

Several springs had one or more parameters that were 10 percent or higher in WY 2017 than the comparable maximum baseline value (Table 10). It should be noted that only one baseline sample was collected at Spring 2012-2 because it was dry or did not have sufficient flow to collect a laboratory sample in 5 of 6 baseline sampling months.

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 | 5/11/2017 | Conductivity (Field) | µmhos/cm | 722 | 640 |
| | 6/7/2017 | | | 715 | |
| | 9/7/2017 | | | 863 | |
| | 6/7/2017 | Conductivity @25C | µmhos/cm | 652 | 548 |
| Spring 27-1 | 5/11/2017 | Conductivity (Field) | µmhos/cm | 571 | 460 |
| Spring G-7 | 6/6/2017 | Conductivity @25C | µmhos/cm | 464 | 414 |
| | | Residue, Filterable (TDS) @180C | mg/L | 292 | 230 |
| Spring G-24 | 6/6/2017 | Conductivity @25C | µmhos/cm | 747 | 564 |
| Spring G-14 | 6/6/2017 | Conductivity @25C | µmhos/cm | 1,040 | 682 |
| Spring G-22 | 6/6/2017 | Conductivity @25C | µmhos/cm | 1,140 | 640 |
| | | Residue, Filterable (TDS) @180C | mg/L | 750 | 516 |
| Spring 15-1 | 5/12/2017 | Conductivity (Field) | µmhos/cm | 1,967 | 1,240 |
| | 6/6/2017 | | | 2,000 | |
| | 6/6/2017 | Conductivity @25C | µmhos/cm | 1,980 | 1,120 |
| | | Residue, Filterable (TDS) @180C | mg/L | 1,440 | 730 |
| Spring J-4 | 5/10/2017 | Conductivity (Field) | µmhos/cm | 617 | 480 |
| | 6/8/2017 | | | 613 | |
| | 6/8/2017 | Conductivity @25C | µmhos/cm | 561 | 429 |
| | | Residue, Filterable (TDS) @180C | mg/L | 354 | 300 |
| Spring J-7 | 5/11/2017 | Conductivity (Field) | µmhos/cm | 745 | 496 |
| | 6/8/2017 | | | 725 | |
| | 6/8/2017 | Conductivity @25C | µmhos/cm | 697 | 426 |
| | | Residue, Filterable (TDS) @180C | mg/L | 462 | 270 |
| 96-2-2 Area Spring | 9/7/2017 | Conductivity (Field) | µmhos/cm | 533 | 430 |
| Spring 2012-2 | 6/7/2017 | Alkalinity (Total CaCO3) | mg/L | 45.8 | 38.0 |
| | | Arsenic, total recoverable | mg/L | 0.0004 | Not Detected (<0.0002) |
| | | Bicarbonate as CaCO3 | mg/L | 45.8 | 38.0 |
| | | Conductivity @25C | µmhos/cm | 110 | 99 |
| | | Hardness as CaCO3 | mg/L | 28 | 25 |
| | | Iron, total | mg/L | 1.64 | 1.04 |
| | | Magnesium, dissolved | mg/L | 1.8 | 1.6 |
| | | Manganese, total | mg/L | 0.027 | 0.009 |
| | | Sodium, dissolved | mg/L | 10.4 | 9.4 |
| | | TDS (calculated) | mg/L | 50.2 | 45 |
| | | Residue, Filterable (TDS) @180C | mg/L | 106 | 80 |
| | | Residue, Non-Filterable (TSS) @105C | mg/L | 38.0 | Not Detected (<5.0) |
| Spring 2012-4 | 6/7/2017 | Nitrate/Nitrite (as N) | mg/L | 0.04 | 0.03 |

### 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 2017 were within the range of historical averages.

Springs G-1a, G-20, Deep Creek Spring # 2, and Spring 2012-1 have been continuously dry or damp at the time of monitoring for multiple years including WY 2017 and may have been originally impacted by mining. Spring J-7 was dry in multiple years including WY 2010, 2012, and 2013 and WY 2015, but was flowing in WYs 2016 and 2017, and may be recovering after being impacted by mining. Flows at Spring 27-1 have been decreasing steadily since WY 2008, in spite of snowpack and precipitation trends, and this trend has most likely been caused by the deterioration and collapse of the spring discharge pipe. Deer Creek Spring was dry during the 2017 peak flow monitoring round for the first time since routine monitoring began in 2006. This spring is located above Longwall Panel E5 that was mined during the summer of 2015, and may have been impacted by mining, although the continued drought may have been a contributing factor.

## 3.3 GROUNDWATER

In WY 2017, 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. 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 2017 (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 2017: GP-3, GP-4, GP-7, RPE-1, RPE-7, and SOM-C76. Well GP-6 does not have baseline data for comparison (WWE, 2001).

Wells RAV-4b and 01-11-1 did not have any parameters elevated 10 percent or more over baseline maximums in WY 2017. 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 | 9/5/2017 | Conductivity @25C | µmhos/cm | 836 | 509 |
| | | Residue, Filterable (TDS) @180C | mg/L | 528 | 390 |
| Lower Dry Fork Alluvial Well | 5/10/2017 | pH (Field) | SU | 7.82 | 7.10 |
| Well SOM-80 | 9/5/2017 | Conductivity @25C | µmhos/cm | 1,040 | 897 |
| | 9/5/2017 (Duplicate) | | | 1,070 | |
| Well SOM-45-H-1 | 5/12/2017 | Conductivity (Field) | µmhos/cm | 1,937 | 1,626 |
| | 6/8/2017 | | | 1,922 | |
| | 9/5/2017 | | | 1,944 | |
| | 9/5/2017 | Conductivity @25C | µmhos/cm | 1,900 | 1,390 |
| | | Iron, dissolved | mg/L | 2.65 | 0.86 |
| Well 03-11-1 | 9/5/2017 | Conductivity @25C | µmhos/cm | 3,020 | 2,730 |

### 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 the groundwater levels in several wells, but levels may also have been impacted by drought conditions in recent years. The water level drop in the following wells may be mining related, due to the up-gradient diversion of surface water runoff in the area. Wells GP-3, RPE-7, and GP-4 have been dry for multiple years and have remained dry to nearly dry through WY 2017. Wells RPE-1 and RPE-7 did not have enough water to collect a sample in WY 2017.

## 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 No. PR-10, 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. A more detailed description of the hydrologic monitoring plan is presented in Exhibit 71 in the permit documents (CDRMS, 2006; CDRMS 2016).

## 4.1 MINING RELATED HYDROLOGIC IMPACTS

In WY 2017 the West Elk Mine hydrologic monitoring program was conducted in accordance with all permit requirements. The data collected in WY 2017 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 2017, 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.

HydroGeo, Inc. (HydroGeo)

2002 2001 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. August 2002.

2003 2002 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. April 2003.

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2013 2012 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. June 2013.

2014 2013 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. June 2014.

2015 2014 Annual Hydrology Report, Mountain Coal Company, West Elk Mine. June 2015.

2016 West Elk Mine 2015 Surface Water and Groundwater Quantity and Quality Data Summary. June 2016.

2017 West Elk Mine 2016 Surface Water and Groundwater Quantity and Quality Data Summary. June 2017.

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** |
| **APPENDIX B** | **SURFACE WATER - HYDROGRAPHS** |
| **APPENDIX C** | **SURFACE WATER - LABORATORY AND FIELD WATER QUALITY DATA** |
| **APPENDIX D** | **SPRINGS - HYDROGRAPHS** |
| **APPENDIX E** | **SPRINGS - LABORATORY AND FIELD WATER QUALITY DATA** |
| **APPENDIX F** | **WELLS - WATER LEVEL ELEVATION GRAPHS** |
| **APPENDIX G** | **WELLS - LABORATORY AND FIELD WATER QUALITY DATA** |
| **APPENDIX H** | **MINE WATER – LABORATORY AND FIELD WATER QUALITY DATA** |
| **APPENDIX I** | **SURFACE WATER - TEMPERATURE DATA** |
| **APPENDIX J** | **SURFACE WATER - TEMPERATURE GRAPHS** |

# APPENDIX A

## SURFACE WATER - FLOW DATA

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

| Day | Oct-16 | Q[1] | Nov-16 | Q[1] | Dec-16 | Q[1] | Jan-17 | Q[1] | Feb-17 | Q[1] | Mar-17 | Q[1] | Apr-17 | Q[1] | May-17 | Q[1] | Jun-17 | Q[1] | Jul-17 | Q[1] | Aug-17 | Q[1] | Sep-17 | Q[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 96.0 | A | 53.6 | A | 44.0 | A:e | 45.0 | A:e | 93.1 | A:e | 106.0 | A | 841.0 | A | 708.0 | A | 1620.0 | A | 624.0 | A | 211.0 | A | 261.0 | A |
| 2 | 94.4 | A | 61.9 | A | 54.4 | A:e | 45.0 | A:e | 95.4 | A:e | 111.0 | A | 851.0 | A | 719.0 | A | 1780.0 | A | 586.0 | A | 207.0 | A | 256.0 | A |
| 3 | 94.4 | A | 57.5 | A | 54.6 | A:e | 45.5 | A:e | 96.2 | A:e | 118.0 | A | 809.0 | A | 734.0 | A | 1830.0 | A | 542.0 | A | 222.0 | A | 253.0 | A |
| 4 | 96.5 | A | 55.1 | A | 46.4 | A:e | 44.7 | A:e | 99.6 | A:e | 129.0 | A | 683.0 | A | 855.0 | A | 1920.0 | A | 526.0 | A | 214.0 | A | 249.0 | A |
| 5 | 98.3 | A | 56.8 | A | 55.1 | A:e | 47.6 | A:e | 100.0 | A:e | 135.0 | A | 578.0 | A | 1090.0 | A | 2070.0 | A | 510.0 | A | 228.0 | A | 246.0 | A |
| 6 | 107.0 | A | 66.6 | A | 49.5 | A:e | 42.3 | A:e | 100.0 | A:e | 133.0 | A | 563.0 | A | 1320.0 | A | 2370.0 | A | 486.0 | A | 253.0 | A | 244.0 | A |
| 7 | 99.1 | A | 62.2 | A | 48.1 | A:e | 40.0 | A:e | 101.0 | A | 127.0 | A | 637.0 | A | 1620.0 | A | 2600.0 | A | 460.0 | A | 226.0 | A | 242.0 | A |
| 8 | 92.4 | A | 58.7 | A | 40.0 | A:e | 55.1 | A:e | 108.0 | A | 129.0 | A | 735.0 | A | 1730.0 | A | 2550.0 | A | 432.0 | A | 253.0 | A | 239.0 | A |
| 9 | 91.9 | A | 57.5 | A | 53.9 | A:e | 70.9 | A:e | 108.0 | A | 140.0 | A | 789.0 | A | 1750.0 | A | 2490.0 | A | 413.0 | A | 275.0 | A | 236.0 | A |
| 10 | 90.0 | A | 57.1 | A | 52.9 | A:e | 70.2 | A:e | 118.0 | A | 170.0 | A | 773.0 | A | 1720.0 | A | 2350.0 | A | 395.0 | A | 276.0 | A | 235.0 | A |
| 11 | 87.8 | A | 55.4 | A | 54.4 | A:e | 80.4 | A:e | 160.0 | A | 200.0 | A | 782.0 | A | 1770.0 | A | 2270.0 | A | 394.0 | A | 265.0 | A | 233.0 | A |
| 12 | 87.8 | A | 54.6 | A | 52.4 | A:e | 85.7 | A:e | 169.0 | A | 234.0 | A | 852.0 | A | 2240.0 | A | 2090.0 | A | 413.0 | A | 258.0 | A | 235.0 | A |
| 13 | 83.2 | A | 53.6 | A | 51.5 | A:e | 87.8 | A:e | 149.0 | A | 217.0 | A | 1160.0 | A | 2590.0 | A | 1860.0 | A | 378.0 | A | 277.0 | A | 233.0 | A |
| 14 | 80.9 | A | 53.0 | A | 49.0 | A:e | 85.7 | A:e | 155.0 | A | 234.0 | A | 1470.0 | A | 2900.0 | A | 1530.0 | A | 344.0 | A | 295.0 | A | 224.0 | A |
| 15 | 79.7 | A | 52.2 | A | 49.4 | A:e | 84.2 | A:e | 164.0 | A | 308.0 | A | 1600.0 | A | 2600.0 | A | 1500.0 | A | 329.0 | A | 313.0 | A | 237.0 | A |
| 16 | 78.6 | A | 52.9 | A | 63.8 | A:e | 85.4 | A | 166.0 | A | 415.0 | A | 1630.0 | A | 2260.0 | A | 1530.0 | A | 291.0 | A | 308.0 | A | 90.7 | A |
| 17 | 77.9 | A | 55.2 | A | 64.4 | A:e | 81.2 | A | 169.0 | A | 508.0 | A | 1620.0 | A | 1920.0 | A | 1630.0 | A | 279.0 | A | 301.0 | A | 74.4 | A |
| 18 | 77.5 | A | 40.0 | A:e | 47.6 | A:e | 81.3 | A | 176.0 | A | 621.0 | A | 1680.0 | A | 1560.0 | A | 1750.0 | A | 255.0 | A | 284.0 | A | 76.0 | A |
| 19 | 77.5 | A | 51.5 | A:e | 43.1 | A:e | 79.7 | A | 182.0 | A | 777.0 | A | 1950.0 | A | 1390.0 | A | 1670.0 | A | 269.0 | A | 268.0 | A | 71.1 | A |
| 20 | 76.0 | A | 56.6 | A:e | 57.4 | A:e | 90.3 | A | 174.0 | A | 880.0 | A | 1810.0 | A | 1320.0 | A | 1550.0 | A | 265.0 | A | 262.0 | A | 66.9 | A |
| 21 | 75.3 | A | 58.7 | A:e | 56.6 | A:e | 82.5 | A:e | 176.0 | A | 941.0 | A | 1540.0 | A | 1110.0 | A | 1510.0 | A | 239.0 | A | 241.0 | A | 66.3 | A |
| 22 | 75.7 | A | 62.0 | A:e | 59.6 | A:e | 81.0 | A | 190.0 | A | 984.0 | A | 1320.0 | A | 954.0 | A | 1410.0 | A | 232.0 | A | 240.0 | A | 68.9 | A |
| 23 | 75.0 | A | 57.5 | A:e | 63.1 | A:e | 79.4 | A | 190.0 | A | 955.0 | A | 1240.0 | A | 948.0 | A | 1280.0 | A | 228.0 | A | 237.0 | A | 79.8 | A |
| 24 | 76.2 | A | 58.5 | A:e | 63.1 | A:e | 78.9 | A | 173.0 | A | 877.0 | A | 1300.0 | A | 1030.0 | A | 1130.0 | A | 228.0 | A | 235.0 | A | 86.4 | A |
| 25 | 83.3 | A | 37.6 | A:e | 60.0 | A:e | 78.1 | A | 162.0 | A | 748.0 | A | 1310.0 | A | 1260.0 | A | 1010.0 | A | 282.0 | A | 230.0 | A | 76.0 | A |
| 26 | 86.5 | A | 52.5 | A:e | 54.3 | A:e | 74.7 | A | 157.0 | A | 742.0 | A | 1140.0 | A | 1450.0 | A | 936.0 | A | 259.0 | A | 222.0 | A | 73.4 | A |
| 27 | 87.1 | A | 58.0 | A:e | 46.0 | A:e | 65.0 | A:e | 150.0 | A | 721.0 | A | 1010.0 | A | 1580.0 | A | 881.0 | A | 217.0 | A | 218.0 | A | 73.4 | A |
| 28 | 88.0 | A | 58.2 | A:e | 58.6 | A:e | 77.5 | A:e | 129.0 | A | 638.0 | A | 919.0 | A | 1450.0 | A | 825.0 | A | 231.0 | A | 236.0 | A | 77.6 | A |
| 29 | 85.3 | A | 56.6 | A:e | 41.9 | A:e | 80.4 | A:e | -- | -- | 742.0 | A | 833.0 | A | 1420.0 | A | 742.0 | A | 264.0 | A | 250.0 | A | 74.6 | A |
| 30 | 78.5 | A | 46.9 | A:e | 43.5 | A:e | 85.4 | A:e | -- | -- | 771.0 | A | 723.0 | A | 1470.0 | A | 678.0 | A | 356.0 | A | 262.0 | A | 85.1 | A:e |
| 31 | 73.3 | A | -- | -- | 46.3 | A:e | 88.8 | A:e | -- | -- | 843.0 | A | -- | -- | 1570.0 | A | -- | -- | 242.0 | A | 260.0 | A | -- | -- |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 85.5 | -- | 55.3 | -- | 52.4 | -- | 71.6 | -- | 143.2 | -- | 472.7 | -- | 1104.9 | -- | 1517.4 | -- | 1645.4 | -- | 353.8 | -- | 252.5 | -- | 158.8 | -- |
| Min | 73.3 | -- | 37.6 | -- | 40.0 | -- | 40.0 | -- | 93.1 | -- | 106.0 | -- | 563.0 | -- | 708.0 | -- | 678.0 | -- | 217.0 | -- | 207.0 | -- | 66.3 | -- |
| Max | 107.0 | -- | 66.6 | -- | 64.4 | -- | 90.3 | -- | 190.0 | -- | 984.0 | -- | 1950.0 | -- | 2900.0 | -- | 2600.0 | -- | 624.0 | -- | 313.0 | -- | 261.0 | -- |

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

# Lower Minnesota Creek
# Discharge and Gage Height

**Daily Mean Streamflow (cfs)**

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.3 | 2.0 | 2.4 | **3.5** | **4.3** | 5.7 | 9.2 | 35.0 | 96.0 | 23.0 | 16.0 | 11.0 |
| 2 | 4.3 | 2.2 | 2.4 | **3.3** | **4.1** | 6.0 | 8.9 | 34.0 | 98.0 | 27.0 | 15.0 | 4.5 |
| 3 | 4.3 | 2.4 | 2.1 | **3.3** | **4.1** | 5.5 | 9.6 | 34.0 | 96.0 | 26.0 | 16.0 | 4.1 |
| 4 | 4.3 | 2.7 | 3.0 | **3.3** | **4.1** | 5.0 | 8.5 | 37.0 | 102.0 | 26.0 | 16.0 | 3.9 |
| 5 | 4.5 | 2.2 | 2.2 | **3.3** | **4.1** | 4.7 | 7.2 | 43.0 | 113.0 | 24.0 | 15.0 | 3.5 |
| 6 | 4.7 | 2.4 | 3.0 | **8.1** | **4.1** | 4.7 | 7.2 | 57.0 | 133.0 | 23.0 | 16.0 | 3.3 |
| 7 | 5.0 | 2.4 | 2.5 | **4.5** | **4.3** | 4.5 | 8.5 | 78.0 | 174.0 | 22.0 | 18.0 | 3.9 |
| 8 | 5.2 | 2.7 | 3.5 | **4.1** | **4.7** | 4.5 | 11.0 | 89.0 | 184.0 | 19.0 | 19.0 | 3.7 |
| 9 | 5.2 | 2.5 | 2.5 | **4.7** | **5.0** | 4.7 | 12.0 | 96.0 | 201.0 | 18.0 | 19.0 | 3.5 |
| 10 | 5.2 | 2.2 | 2.4 | **ND** | **5.2** | 4.3 | 12.0 | 98.0 | 181.0 | 17.0 | 18.0 | 3.3 |
| 11 | 5.2 | 2.1 | 2.0 | **ND** | **10.0** | 5.0 | 12.0 | 96.0 | 168.0 | 17.0 | 15.0 | 3.1 |
| 12 | 5.2 | 2.1 | 1.9 | **4.7** | **6.9** | 4.5 | 13.0 | 100.0 | 153.0 | 17.0 | 17.0 | 3.0 |
| 13 | 5.2 | 2.2 | **3.5** | **4.5** | **5.5** | 4.5 | 17.0 | 131.0 | 131.0 | 19.0 | 17.0 | 3.0 |
| 14 | 5.2 | 2.1 | **3.5** | **4.5** | **5.5** | 5.0 | 23.0 | 159.0 | 109.0 | 19.0 | 17.0 | 3.0 |
| 15 | 5.0 | 1.9 | **3.3** | **4.3** | **4.5** | 5.5 | 25.0 | 136.0 | 86.0 | 20.0 | 16.0 | 4.1 |
| 16 | 4.7 | 2.1 | **3.9** | **4.3** | **4.7** | 6.0 | 26.0 | 125.0 | 80.0 | 19.0 | 15.0 | 4.1 |
| 17 | 4.7 | 2.0 | **4.5** | **4.3** | 5.0 | 7.5 | 26.0 | 120.0 | 76.0 | 19.0 | 15.0 | 3.7 |
| 18 | 1.9 | 1.9 | **5.2** | **4.3** | 5.0 | 9.2 | 26.0 | 118.0 | 80.0 | 18.0 | 17.0 | 3.3 |
| 19 | 1.9 | 1.9 | **5.2** | **4.5** | 5.2 | 11.0 | 31.0 | 102.0 | 84.0 | 16.0 | 19.0 | 3.3 |
| 20 | 1.9 | 1.9 | **5.2** | **4.7** | 5.2 | 11.0 | 33.0 | 87.0 | 78.0 | 17.0 | 19.0 | 3.0 |
| 21 | 1.9 | 2.0 | **4.3** | **5.0** | 5.0 | 11.0 | 28.0 | 78.0 | 75.0 | 17.0 | 19.0 | 2.8 |
| 22 | 1.9 | 2.1 | **4.1** | **5.2** | 5.0 | 11.0 | 23.0 | 71.0 | 70.0 | 17.0 | 18.0 | 2.7 |
| 23 | 1.9 | 2.2 | **4.1** | **4.3** | 5.0 | 10.0 | 21.0 | 65.0 | 62.0 | 17.0 | 19.0 | 2.7 |
| 24 | 1.9 | 2.1 | **3.9** | **4.1** | 4.7 | 9.6 | 23.0 | 62.0 | 50.0 | 16.0 | 16.0 | 2.8 |
| 25 | 2.0 | 2.1 | **3.9** | **4.3** | 5.0 | 8.9 | 26.0 | 68.0 | 43.0 | 17.0 | 16.0 | 2.8 |
| 26 | 2.0 | 2.1 | **3.9** | **4.3** | 5.2 | 9.2 | 23.0 | 78.0 | 37.0 | 17.0 | 15.0 | 3.0 |
| 27 | 2.0 | 2.0 | **5.5** | **6.0** | 5.0 | 8.1 | 21.0 | 86.0 | 33.0 | 17.0 | 14.0 | 3.0 |
| 28 | 2.0 | 2.0 | **4.1** | **4.5** | 4.7 | 10.0 | 20.0 | 86.0 | 31.0 | 16.0 | 13.0 | 3.1 |
| 29 | 2.0 | 1.9 | **3.9** | **5.0** | -- | 8.1 | 19.0 | 87.0 | 26.0 | 17.0 | 13.0 | 3.1 |
| 30 | 2.0 | 2.1 | **3.9** | **4.7** | -- | 8.5 | 23.0 | 89.0 | 24.0 | 18.0 | 12.0 | 3.1 |
| 31 | 2.0 | -- | **3.7** | **4.5** | -- | 10.0 | -- | 93.0 | -- | 17.0 | 12.0 | -- |
| Mean | 3.5 | 2.2 | 3.5 | 4.5 | 5.0 | 7.2 | 18.4 | 84.8 | 95.8 | 19.1 | 16.2 | 3.6 |
| Min | 1.9 | 1.9 | 1.9 | 3.3 | 4.1 | 4.3 | 7.2 | 34.0 | 24.0 | 16.0 | 12.0 | 2.7 |
| Max | 5.2 | 2.7 | 5.5 | 8.1 | 10.0 | 11.0 | 33.0 | 159.0 | 201.0 | 27.0 | 19.0 | 11.0 |

**Measured Streamflow**

| Date | Streamflow (cfs) |
|---|---|
| 10/18/2016 | 1.9 |
| 11/15/2016 | 1.9 |
| 12/13/2016 | **1.9** |
| 1/27/2017 | **6.3** |
| 2/17/2017 | 4.5 |
| 3/24/2017 | 11.0 |
| 4/28/2017 | 20.0 |
| 5/10/2017 | 96.0 |
| 6/7/2017 | 187.0 |
| 7/18/2017 | 17.0 |
| 8/24/2017 | 16.0 |
| 9/7/2017 | 4.1 |

**0.01** Stream Ice Affected or Frozen.
ND No Data. Datalogger Ice Affected.

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

**Daily Mean Streamflow (CFS)**

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.22 | 1.47 | 2.78 | **1.26** | **0.94** | 4.24 | 11.07 | 38.59 | 51.33 | ND | 18.50 | 22.51 |
| 2 | 4.22 | 1.47 | 2.03 | **1.19** | **0.89** | 4.32 | 11.10 | 38.69 | 51.23 | ND | 18.55 | 12.75 |
| 3 | 4.17 | 1.41 | 2.03 | **1.16** | **0.90** | 3.62 | 11.46 | 38.68 | 51.86 | ND | 18.94 | 12.51 |
| 4 | 4.07 | 1.36 | 2.81 | **1.16** | **1.17** | 2.44 | 10.51 | 39.49 | 53.03 | ND | 18.22 | 12.38 |
| 5 | 4.07 | 1.36 | 2.03 | **1.16** | **1.36** | 2.15 | 9.69 | 41.80 | 55.12 | ND | 18.13 | 12.38 |
| 6 | 4.07 | 1.36 | 2.03 | **1.16** | **1.36** | 2.15 | 9.46 | 44.62 | 55.95 | ND | 20.64 | 12.20 |
| 7 | 4.06 | 1.36 | 2.03 | **1.16** | **1.36** | 3.68 | 10.82 | 48.41 | 55.90 | ND | 22.92 | 9.17 |
| 8 | 3.92 | 1.36 | 2.03 | **1.16** | **1.37** | 2.15 | 12.08 | 51.31 | 49.92 | ND | 24.05 | 7.53 |
| 9 | 3.92 | 1.36 | 2.03 | **ND1** | **1.44** | 2.19 | 12.32 | 52.23 | ND | ND | 24.83 | 7.53 |
| 10 | 3.92 | 1.36 | 2.03 | **ND1** | **1.83** | 2.40 | 11.91 | 52.88 | ND | ND | 24.32 | 7.53 |
| 11 | 3.92 | 1.36 | 2.03 | **ND1** | **ND1** | 2.78 | 12.13 | 51.64 | ND | ND | 26.19 | 7.53 |
| 12 | 3.92 | 1.36 | 2.03 | **1.36** | **ND1** | 2.85 | 13.56 | 52.61 | ND | ND | 28.89 | 7.53 |
| 13 | 3.92 | 1.32 | **1.26** | **1.36** | **ND1** | 2.62 | 17.06 | 55.00 | ND | ND | 28.47 | 7.43 |
| 14 | 3.89 | 1.26 | **1.26** | **1.36** | **1.81** | 3.13 | 20.03 | 54.67 | ND | ND | 28.37 | 7.94 |
| 15 | 3.77 | 1.26 | **1.26** | **1.36** | **1.92** | 4.10 | 22.13 | 56.23 | ND | ND | 27.46 | 8.26 |
| 16 | 3.77 | 1.68 | **1.66** | **1.36** | **1.96** | 4.74 | 22.07 | 55.28 | ND | ND | 27.08 | 7.67 |
| 17 | 3.77 | 1.68 | **1.42** | **1.33** | 2.37 | 5.49 | 22.45 | 54.82 | ND | ND | 27.25 | 7.63 |
| 18 | 1.57 | 2.03 | **1.64** | **1.27** | 2.50 | 6.39 | 23.45 | 53.19 | ND | ND | 31.19 | 7.72 |
| 19 | 1.57 | 2.11 | **4.28** | **1.26** | 2.36 | 7.01 | 26.27 | 51.41 | ND | 22.79 | 29.90 | 7.72 |
| 20 | 1.57 | 2.03 | **6.01** | **1.26** | 2.15 | 7.73 | 26.27 | 49.69 | ND | 22.30 | 29.70 | 7.72 |
| 21 | 1.57 | 2.03 | **2.78** | **1.26** | 2.40 | 8.02 | 24.63 | 48.08 | ND | 22.11 | 29.41 | 7.72 |
| 22 | 1.53 | 2.03 | **0.76** | **1.26** | 2.97 | 8.11 | 21.44 | 46.86 | ND | 21.74 | 29.49 | 7.72 |
| 23 | 1.47 | 2.03 | **1.33** | **1.26** | 2.49 | 7.91 | 20.67 | 46.13 | ND | 21.32 | 29.56 | 7.72 |
| 24 | 1.47 | 2.03 | **1.36** | **1.26** | 3.36 | 11.03 | 22.12 | 46.05 | ND | 20.29 | 29.62 | 7.72 |
| 25 | 1.47 | 2.27 | **1.29** | **1.26** | 3.81 | 10.37 | 23.68 | 47.86 | ND | 21.04 | 29.11 | 7.72 |
| 26 | 1.47 | 2.03 | **1.26** | **1.36** | 3.27 | 10.51 | 22.22 | 49.26 | ND | 20.72 | 28.47 | 7.72 |
| 27 | 1.47 | 2.03 | **1.26** | **ND1** | 2.37 | 10.14 | 21.53 | 50.80 | ND | 19.69 | 27.53 | 7.72 |
| 28 | 1.47 | 2.03 | **1.26** | **0.89** | 2.16 | 11.73 | 29.50 | 50.19 | ND | 19.50 | 26.90 | 7.72 |
| 29 | 1.47 | 2.03 | **1.26** | **0.89** | -- | 10.40 | 28.89 | 50.43 | ND | 20.08 | 26.21 | 7.64 |
| 30 | 1.47 | 2.62 | **1.26** | **0.87** | -- | 10.59 | 31.29 | 50.57 | ND | 19.29 | 25.54 | 7.53 |
| 31 | 1.47 | -- | **1.26** | **0.82** | -- | 11.59 | -- | 51.30 | -- | 18.83 | 24.68 | -- |
| Mean | 2.86 | 1.70 | 1.93 | 1.20 | 2.02 | 6.02 | 18.73 | 48.99 | 53.04 | 20.75 | 25.81 | 9.02 |
| Min | 1.47 | 1.26 | 0.76 | 0.82 | 0.89 | 2.15 | 9.46 | 38.59 | 49.92 | 18.83 | 18.13 | 7.43 |
| Max | 4.22 | 2.62 | 6.01 | 1.36 | 3.81 | 11.73 | 31.29 | 56.23 | 55.95 | 22.79 | 31.19 | 22.51 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 1.57 |
| 11/15/2016 | 1.57 |
| 12/13/2016 | **1.26** |
| 1/27/2017 | **1.47** |
| 2/17/2017 | 2.39 |
| 3/24/2017 | 10.38 |
| 4/28/2017 | 29.70 |
| 5/10/2017 | 55.52 |
| 6/7/2017 | 55.52 |
| 7/18/2017 | 21.33 |
| 8/24/2017 | 30.02 |
| 9/7/2017 | 6.96 |

**0.01** Flume Ice Affected or Frozen.
ND No Data. Logjam in Flume.
ND1 No Data. Stilling Well Frozen.
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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.22 | ND | **ND** | **ND** | ND | 0.95 | 0.90 | 0.51 | 0.21 | 0.00 | 0.00 |
| 2 | 0.00 | 0.16 | ND | **ND** | **ND** | ND | 0.95 | 0.88 | 0.51 | 0.20 | 0.00 | 0.00 |
| 3 | 0.00 | 0.10 | ND | **ND** | **ND** | ND | 0.95 | 0.82 | 0.48 | 0.20 | 0.00 | 0.00 |
| 4 | 0.00 | 0.11 | ND | **ND** | **ND** | ND | 0.92 | 0.78 | 0.47 | 0.20 | 0.00 | 0.00 |
| 5 | 0.00 | 0.21 | ND | **ND** | **ND** | ND | 0.96 | 0.75 | 0.46 | 0.20 | 0.00 | 0.00 |
| 6 | 0.06 | 0.31 | ND | **ND** | **ND** | ND | 0.96 | 0.74 | 0.45 | 0.20 | 0.04 | 0.00 |
| 7 | 0.04 | 0.20 | ND | **ND** | **ND** | ND | 0.96 | 0.73 | 0.38 | 0.20 | 0.00 | 0.00 |
| 8 | 0.04 | 0.14 | ND | **ND** | **ND** | ND | 1.07 | 0.69 | 0.37 | 0.20 | 0.00 | 0.00 |
| 9 | 0.04 | 0.16 | ND | **ND** | **ND** | ND | 0.97 | 0.77 | 0.37 | 0.20 | 0.00 | 0.00 |
| 10 | 0.03 | 0.19 | ND | **ND** | **ND** | ND | 0.97 | 0.74 | 0.35 | 0.27 | 0.01 | 0.00 |
| 11 | 0.03 | 0.17 | ND | **ND** | **ND** | ND | 0.99 | 0.66 | 0.34 | 0.27 | 0.01 | 0.00 |
| 12 | 0.02 | 0.20 | ND | **ND** | **ND** | ND | 1.03 | 0.71 | 0.33 | 0.30 | 0.00 | 0.00 |
| 13 | 0.02 | 0.21 | **ND** | **ND** | **ND** | ND | 0.98 | 0.71 | 0.32 | 0.28 | 0.00 | 0.00 |
| 14 | 0.02 | 0.15 | **ND** | **ND** | **ND** | ND | 0.99 | 0.70 | 0.32 | 0.27 | 0.00 | 0.12 |
| 15 | 0.03 | ND | **ND** | **ND** | **ND** | ND | 0.99 | 0.68 | 0.32 | 0.27 | 0.00 | 0.02 |
| 16 | 0.03 | ND | **ND** | **ND** | **ND** | ND | 1.00 | 0.67 | 0.31 | 0.27 | 0.00 | 0.01 |
| 17 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.00 | 0.85 | 0.31 | 0.27 | 0.00 | 0.00 |
| 18 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.00 | 0.96 | 0.31 | 0.00 | 0.00 | 0.00 |
| 19 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.04 | 0.72 | 0.30 | 0.00 | 0.00 | 0.00 |
| 20 | 0.02 | ND | **ND** | **ND** | ND | ND | 1.01 | 0.68 | 0.29 | 0.00 | 0.00 | 0.00 |
| 21 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.01 | 0.66 | 0.28 | 0.00 | 0.00 | 0.00 |
| 22 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.03 | 0.66 | 0.27 | 0.00 | 0.00 | 0.00 |
| 23 | 0.03 | ND | **ND** | **ND** | ND | ND | 1.02 | 0.62 | 0.27 | 0.00 | 0.00 | 0.01 |
| 24 | 0.05 | ND | **ND** | **ND** | ND | ND | 1.04 | 0.61 | 0.25 | 0.00 | 0.00 | 0.01 |
| 25 | 0.09 | ND | **ND** | **ND** | ND | 0.92 | 1.03 | 0.62 | 0.25 | 0.01 | 0.00 | 0.00 |
| 26 | 0.11 | ND | **ND** | **ND** | ND | 0.87 | 1.06 | 0.60 | 0.25 | 0.00 | 0.00 | 0.00 |
| 27 | 0.12 | ND | **ND** | **ND** | ND | 0.88 | 1.03 | 0.57 | 0.24 | 0.00 | 0.00 | 0.00 |
| 28 | 0.07 | ND | **ND** | **ND** | ND | 0.88 | 1.03 | 0.55 | 0.22 | 0.00 | 0.00 | 0.00 |
| 29 | 0.14 | ND | **ND** | **ND** | -- | 0.92 | 1.03 | 0.54 | 0.22 | 0.00 | 0.00 | 0.00 |
| 30 | 0.22 | ND | **ND** | **ND** | -- | 0.92 | 0.95 | 0.52 | 0.22 | 0.00 | 0.00 | 0.00 |
| 31 | 0.33 | -- | **ND** | **ND** | -- | 0.95 | -- | 0.52 | -- | 0.00 | 0.00 | -- |
| Mean | 0.05 | 0.18 | ND | ND | ND | 0.91 | 1.00 | 0.70 | 0.33 | 0.13 | 0.00 | 0.01 |
| Min | 0.00 | 0.10 | ND | ND | ND | 0.87 | 0.92 | 0.52 | 0.22 | 0.00 | 0.00 | 0.00 |
| Max | 0.33 | 0.31 | ND | ND | ND | 0.95 | 1.07 | 0.96 | 0.51 | 0.30 | 0.04 | 0.12 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.042 |
| 11/15/2016 | 0.042 |
| 12/13/2016 | **0.000** |
| 1/27/2017 | **0.001** |
| 2/17/2017 | 0.640 |
| 3/24/2017 | 0.917 |
| 4/28/2017 | 1.030 |
| 5/12/2017 | 0.706 |
| 6/7/2017 | 0.427 |
| 7/18/2017 | 0.004 |
| 8/24/2017 | 0.004 |
| 9/6/2017 | 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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.24 | | ND | ND | ND | ND | 0.61 | | 5.26 | 6.06 | 10.96 | 1.71 |
| 2 | 1.19 | | ND | ND | ND | ND | 0.57 | | 6.22 | 5.77 | 11.34 | 1.72 |
| 3 | 1.21 | | ND | ND | ND | ND | 0.57 | | 5.88 | 5.65 | 11.18 | 1.62 |
| 4 | 1.19 | | ND | ND | ND | ND | 0.50 | | 5.70 | 5.49 | 10.86 | 1.53 |
| 5 | 1.22 | | ND | ND | ND | ND | | | 5.69 | 5.59 | 10.78 | 1.48 |
| 6 | 1.43 | | ND | ND | ND | ND | | | 5.68 | 5.50 | 10.75 | 1.43 |
| 7 | 1.39 | | ND | ND | ND | ND | | | 5.68 | 5.39 | 10.46 | 1.42 |
| 8 | 1.33 | | ND | ND | ND | ND | | | 5.63 | 5.22 | 10.16 | 1.42 |
| 9 | 1.07 | | ND | ND | ND | ND | | | 5.61 | 5.06 | 9.75 | 1.37 |
| 10 | 0.57 | | ND | ND | ND | ND | | | 5.62 | 4.95 | 9.18 | 1.35 |
| 11 | 0.58 | | ND | ND | ND | ND | | | 5.60 | 4.79 | 2.32 | 1.37 |
| 12 | 0.62 | | ND | ND | ND | ND | | | 5.57 | 5.71 | 2.09 | 1.16 |
| 13 | 0.63 | | ND | ND | ND | ND | | 2.94 | 5.42 | 6.61 | 2.02 | 1.09 |
| 14 | 0.66 | | ND | ND | ND | ND | | 6.43 | 5.34 | 7.70 | 2.18 | 1.36 |
| 15 | 0.71 | ND | ND | ND | ND | ND | | 6.45 | 5.32 | 9.97 | 1.94 | 1.64 |
| 16 | 0.76 | ND | ND | ND | ND | ND | | 6.10 | 5.17 | 9.77 | 1.82 | 1.21 |
| 17 | 0.80 | ND | ND | ND | ND | ND | | 5.92 | 5.11 | 9.72 | 1.66 | 1.17 |
| 18 | 0.29 | ND | ND | ND | ND | ND | | 6.27 | 4.99 | 9.64 | 1.70 | 1.18 |
| 19 | | ND | ND | ND | ND | ND | | 5.45 | 4.89 | 9.43 | 1.68 | 1.15 |
| 20 | | ND | ND | ND | ND | ND | | 4.92 | 4.80 | 9.56 | 1.66 | 1.05 |
| 21 | | ND | ND | ND | ND | ND | | 4.51 | 4.82 | 10.26 | 1.67 | 1.04 |
| 22 | | ND | ND | ND | ND | ND | | 4.57 | 4.75 | 10.16 | 1.68 | 1.05 |
| 23 | | ND | ND | ND | ND | ND | | 4.49 | 4.65 | 10.21 | 1.69 | 1.30 |
| 24 | | ND | ND | ND | ND | ND | | 4.65 | 4.67 | 10.31 | 1.90 | 1.22 |
| 25 | | ND | ND | ND | ND | 0.67 | | 5.08 | 4.38 | 11.11 | 1.83 | 1.09 |
| 26 | | ND | ND | ND | ND | 0.66 | | 5.17 | 4.18 | 11.19 | 1.82 | 1.10 |
| 27 | | ND | ND | ND | ND | 0.63 | | 5.18 | 5.83 | 11.09 | 1.82 | 1.10 |
| 28 | | ND | ND | ND | ND | 0.77 | | 5.18 | 6.50 | 11.04 | 1.82 | 1.15 |
| 29 | | ND | ND | ND | -- | 0.69 | | 5.49 | 6.51 | 11.01 | 1.79 | 1.05 |
| 30 | | ND | ND | ND | -- | 0.67 | | 5.57 | 6.31 | 11.09 | 1.76 | 1.07 |
| 31 | | -- | ND | ND | -- | 0.66 | -- | 5.34 | -- | 11.13 | 1.76 | -- |
| Mean | 0.94 | ND | ND | ND | ND | 0.68 | 0.56 | 5.25 | 5.39 | 8.26 | 4.65 | 1.29 |
| Min | 0.29 | ND | ND | ND | ND | 0.63 | 0.50 | 2.94 | 4.18 | 4.79 | 1.66 | 1.04 |
| Max | 1.43 | ND | ND | ND | ND | 0.77 | 0.61 | 6.45 | 6.51 | 11.19 | 11.34 | 1.72 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.32 |
| 11/15/2016 | 0.52 |
| 12/13/2016 | **0.09** |
| 1/27/2017 | **0.00** |
| 2/17/2017 | 0.16 |
| 3/24/2017 | 0.47 |
| 4/28/2017 | 0.16 |
| 5/10/2017 | 0.16 |
| 6/8/2017 | 5.36 |
| 7/18/2017 | 9.84 |
| 8/24/2017 | 2.40 |
| 9/7/2017 | 1.37 |

**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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.24 | 0.78 | ND | ND | ND | ND | ND | 2.12 | 5.47 | 5.76 | 2.59 | 1.47 |
| 2 | 1.19 | 0.86 | ND | ND | ND | ND | ND | 2.36 | 5.76 | 5.62 | 2.61 | 1.49 |
| 3 | 1.21 | 0.81 | ND | ND | ND | ND | ND | 2.40 | 5.70 | 5.48 | 3.28 | 1.41 |
| 4 | 1.19 | 0.81 | ND | ND | ND | ND | ND | 3.39 | 5.94 | 5.42 | 2.76 | 1.38 |
| 5 | 1.22 | 0.85 | ND | ND | ND | ND | ND | 5.03 | 5.91 | 5.54 | 2.69 | 1.35 |
| 6 | 1.43 | 0.85 | ND | ND | ND | ND | ND | 5.74 | 5.87 | 5.33 | 4.45 | 1.33 |
| 7 | 1.39 | 0.81 | ND | ND | ND | ND | ND | 6.31 | 5.87 | 5.20 | 3.04 | 1.32 |
| 8 | 1.33 | 0.80 | ND | ND | ND | ND | ND | 5.99 | 5.63 | 5.06 | 2.76 | 1.31 |
| 9 | 1.07 | 0.78 | ND | ND | ND | ND | ND | 5.91 | 5.58 | 4.98 | 2.58 | 1.30 |
| 10 | 0.57 | 0.76 | ND | ND | ND | ND | ND | 7.61 | 5.57 | 4.91 | 2.55 | 1.29 |
| 11 | 0.58 | 0.77 | ND | ND | ND | ND | ND | 6.87 | 5.52 | 4.84 | 2.53 | 1.27 |
| 12 | 0.62 | 0.77 | ND | ND | ND | ND | ND | 6.89 | 5.46 | 4.92 | 2.55 | 1.24 |
| 13 | 0.63 | 0.77 | ND | ND | ND | ND | ND | 6.99 | 5.41 | 5.04 | 2.53 | 1.22 |
| 14 | 0.66 | 0.77 | ND | ND | ND | ND | ND | 6.94 | 5.35 | 4.86 | 2.55 | 1.38 |
| 15 | 0.71 | ND | ND | ND | ND | ND | ND | 6.55 | 5.30 | 4.63 | 2.37 | 1.45 |
| 16 | 0.76 | ND | ND | ND | ND | ND | ND | 6.19 | 5.18 | 4.76 | 2.32 | 1.24 |
| 17 | 0.80 | ND | ND | ND | ND | ND | ND | 6.12 | 5.13 | 4.68 | 2.25 | 1.22 |
| 18 | 0.88 | ND | ND | ND | ND | ND | ND | 5.95 | 5.03 | 3.75 | 2.26 | 1.30 |
| 19 | 0.88 | ND | ND | ND | ND | ND | ND | 5.43 | 4.92 | 3.52 | 2.19 | 1.73 |
| 20 | 0.87 | ND | ND | ND | ND | ND | ND | 5.20 | 4.86 | 3.83 | 2.12 | 1.96 |
| 21 | 0.87 | ND | ND | ND | ND | ND | ND | 5.08 | 4.83 | 3.86 | 2.10 | 1.77 |
| 22 | 0.88 | ND | ND | ND | ND | ND | ND | 5.18 | 4.81 | 3.43 | 2.13 | 1.60 |
| 23 | 0.87 | ND | ND | ND | ND | ND | ND | 5.09 | 4.72 | 3.26 | 2.12 | 1.40 |
| 24 | 0.86 | ND | ND | ND | ND | ND | ND | 5.28 | 4.69 | 3.19 | 1.55 | 1.23 |
| 25 | 0.94 | ND | ND | ND | ND | ND | ND | 5.49 | 5.16 | 3.38 | 1.56 | 1.21 |
| 26 | 0.87 | ND | ND | ND | ND | ND | ND | 5.64 | 6.60 | 3.77 | 1.51 | 1.15 |
| 27 | 0.82 | ND | ND | ND | ND | ND | ND | 5.67 | 6.51 | 3.19 | 1.56 | 1.13 |
| 28 | 0.82 | ND | ND | ND | ND | ND | ND | 5.71 | 6.38 | 3.08 | 1.52 | 1.18 |
| 29 | 0.82 | ND | ND | ND | -- | ND | 2.44 | 5.70 | 6.14 | 3.27 | 1.52 | 1.13 |
| 30 | 0.80 | ND | ND | ND | -- | ND | 2.31 | 5.67 | 5.97 | 2.91 | 1.49 | 1.18 |
| 31 | 0.78 | -- | ND | ND | -- | ND | -- | 5.59 | -- | 2.70 | 1.47 | -- |
| Mean | 0.92 | 0.80 | ND | ND | ND | ND | 2.38 | 5.49 | 5.51 | 4.33 | 2.31 | 1.35 |
| Min | 0.57 | 0.76 | ND | ND | ND | ND | 2.31 | 2.12 | 4.69 | 2.70 | 1.47 | 1.13 |
| Max | 1.43 | 0.86 | ND | ND | ND | ND | 2.44 | 7.61 | 6.60 | 5.76 | 4.45 | 1.96 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.32 |
| 11/15/2016 | 0.88 |
| 4/28/2017 | 2.40 |
| 5/10/2017 | 7.62 |
| 6/8/2017 | 5.74 |
| 7/18/2017 | 3.72 |
| 8/24/2017 | 1.78 |
| 9/7/2017 | 1.37 |

**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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.60 | 1.32 | ND | ND | ND | ND | ND | ND | 5.63 | 6.83 | 3.01 | 2.16 |
| 2 | 1.58 | 1.46 | ND | ND | ND | ND | ND | ND | 5.93 | 6.77 | 3.24 | 2.22 |
| 3 | 1.60 | 1.35 | ND | ND | ND | ND | ND | ND | 5.87 | 6.47 | 3.86 | 2.07 |
| 4 | 1.69 | 1.31 | ND | ND | ND | ND | ND | ND | 6.25 | 6.33 | 3.09 | 2.03 |
| 5 | 1.71 | 1.45 | ND | ND | ND | ND | ND | ND | 6.19 | 6.43 | 3.12 | 2.03 |
| 6 | 1.76 | 1.41 | ND | ND | ND | ND | ND | ND | 6.22 | 6.22 | 5.65 | 1.98 |
| 7 | 1.72 | 1.31 | ND | ND | ND | ND | ND | ND | 6.29 | 6.01 | 3.29 | 2.10 |
| 8 | 1.72 | 1.29 | ND | ND | ND | ND | ND | ND | 6.43 | 5.92 | 3.02 | 2.05 |
| 9 | 1.68 | 1.29 | ND | ND | ND | ND | ND | ND | 6.44 | 5.75 | 2.74 | 2.03 |
| 10 | 1.68 | 1.29 | ND | ND | ND | ND | ND | ND | 6.46 | 5.64 | 2.68 | 2.04 |
| 11 | 1.65 | 1.25 | ND | ND | ND | ND | ND | ND | 6.46 | 5.48 | 2.64 | 2.00 |
| 12 | 1.65 | 1.26 | ND | ND | ND | ND | ND | 8.33 | 6.38 | 5.62 | 2.64 | 2.00 |
| 13 | 1.61 | 1.25 | ND | ND | ND | ND | ND | 8.39 | 6.35 | 6.63 | 2.62 | 1.95 |
| 14 | 1.60 | 1.35 | ND | ND | ND | ND | ND | 7.94 | 6.23 | 6.12 | 2.71 | 2.10 |
| 15 | 1.60 | ND | ND | ND | ND | ND | ND | 7.24 | 6.21 | 5.80 | 2.52 | 2.16 |
| 16 | 1.55 | ND | ND | ND | ND | ND | ND | 6.64 | 6.05 | 6.20 | 2.44 | 1.92 |
| 17 | 1.54 | ND | ND | ND | ND | ND | ND | 6.23 | 5.98 | 6.02 | 2.39 | 1.91 |
| 18 | 1.60 | ND | ND | ND | ND | ND | ND | 5.92 | 5.83 | 5.27 | 2.36 | 1.86 |
| 19 | 1.60 | ND | ND | ND | ND | ND | ND | 5.25 | 5.67 | 4.99 | 2.24 | 1.79 |
| 20 | 1.53 | ND | ND | ND | ND | ND | ND | 4.96 | 5.55 | 5.95 | 2.14 | 1.69 |
| 21 | 1.56 | ND | ND | ND | ND | ND | ND | 4.73 | 5.58 | 5.54 | 2.16 | 1.68 |
| 22 | 1.55 | ND | ND | ND | ND | ND | ND | 4.31 | 5.61 | 4.78 | 2.15 | 1.68 |
| 23 | 1.53 | ND | ND | ND | ND | ND | ND | 4.73 | 5.41 | 4.54 | 2.10 | 1.85 |
| 24 | 1.48 | ND | ND | ND | ND | ND | ND | 5.16 | 5.17 | 4.37 | 2.28 | 1.73 |
| 25 | 1.59 | ND | ND | ND | ND | ND | ND | 5.41 | 6.19 | 5.11 | 2.26 | 1.69 |
| 26 | 1.48 | ND | ND | ND | ND | ND | ND | 5.65 | 8.22 | 5.19 | 2.29 | 1.69 |
| 27 | 1.36 | ND | ND | ND | ND | ND | ND | 5.77 | 8.05 | 3.98 | 2.30 | 1.70 |
| 28 | 1.33 | ND | ND | ND | ND | ND | ND | 5.79 | 7.69 | 3.83 | 2.25 | 1.73 |
| 29 | 1.35 | ND | ND | ND | -- | ND | ND | 5.76 | 7.34 | 4.07 | 2.24 | 1.66 |
| 30 | 1.32 | ND | ND | ND | -- | ND | ND | 5.83 | 7.05 | 3.47 | 2.19 | 1.76 |
| 31 | 1.29 | -- | ND | ND | -- | ND | -- | 5.79 | -- | 3.13 | 2.16 | -- |
| Mean | 1.57 | 1.33 | ND | ND | ND | ND | ND | 5.99 | 6.29 | 5.43 | 2.67 | 1.91 |
| Min | 1.29 | 1.25 | ND | ND | ND | ND | ND | 4.31 | 5.17 | 3.13 | 2.10 | 1.66 |
| Max | 1.76 | 1.46 | ND | ND | ND | ND | ND | 8.39 | 8.22 | 6.83 | 5.65 | 2.22 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 1.69 |
| 11/15/2016 | 1.37 |
| 5/11/2017 | 6.12 |
| 6/7/2017 | 6.65 |
| 7/18/2017 | 5.11 |
| 8/24/2017 | 2.40 |
| 9/7/2017 | 2.12 |

**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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.54 | 0.03 | 0.00 | 0.00 |
| 2 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.46 | 0.03 | 0.00 | 0.00 |
| 3 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.39 | 0.03 | 0.00 | 0.00 |
| 4 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.34 | 0.02 | 0.00 | 0.00 |
| 5 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.56 | 0.02 | 0.00 | 0.00 |
| 6 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.53 | 0.02 | 0.00 | 0.00 |
| 7 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.69 | 0.02 | 0.00 | 0.00 |
| 8 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.58 | 0.02 | 0.00 | 0.00 |
| 9 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.55 | 0.02 | 0.00 | 0.00 |
| 10 | 0.00 | ND | ND | ND | ND | ND | ND | ND | 0.32 | 0.02 | 0.00 | 0.00 |
| 11 | 0.00 | ND | ND | ND | ND | ND | ND | 1.15 | 0.23 | 0.01 | 0.00 | 0.00 |
| 12 | 0.00 | ND | ND | ND | ND | ND | ND | 1.28 | 0.17 | 0.01 | 0.00 | 0.00 |
| 13 | 0.00 | ND | ND | ND | ND | ND | ND | 1.23 | 0.16 | 0.01 | 0.00 | 0.00 |
| 14 | 0.00 | ND | ND | ND | ND | ND | ND | 1.06 | 0.14 | 0.01 | 0.00 | 0.00 |
| 15 | 0.00 | ND | ND | ND | ND | ND | ND | 0.96 | 0.14 | 0.01 | 0.00 | 0.00 |
| 16 | 0.00 | ND | ND | ND | ND | ND | ND | 0.87 | 0.14 | 0.01 | 0.00 | 0.00 |
| 17 | 0.00 | ND | ND | ND | ND | ND | ND | 0.77 | 0.12 | 0.00 | 0.00 | 0.00 |
| 18 | ND | ND | ND | ND | ND | ND | ND | 0.65 | 0.11 | 0.01 | 0.00 | 0.00 |
| 19 | ND | ND | ND | ND | ND | ND | ND | 0.57 | 0.11 | 0.01 | 0.00 | 0.00 |
| 20 | ND | ND | ND | ND | ND | ND | ND | 0.53 | 0.12 | 0.01 | 0.00 | 0.00 |
| 21 | ND | ND | ND | ND | ND | ND | ND | 0.54 | 0.13 | 0.01 | 0.00 | 0.00 |
| 22 | ND | ND | ND | ND | ND | ND | ND | 0.54 | 0.11 | 0.00 | 0.00 | 0.00 |
| 23 | ND | ND | ND | ND | ND | ND | ND | 0.62 | 0.09 | 0.00 | 0.00 | 0.00 |
| 24 | ND | ND | ND | ND | ND | ND | ND | 0.77 | 0.08 | 0.00 | 0.00 | 0.00 |
| 25 | ND | ND | ND | ND | ND | ND | ND | 0.82 | 0.07 | 0.00 | 0.00 | 0.00 |
| 26 | ND | ND | ND | ND | ND | ND | ND | 0.80 | 0.09 | 0.00 | 0.00 | 0.00 |
| 27 | ND | ND | ND | ND | ND | ND | ND | 0.71 | 0.08 | 0.00 | 0.00 | 0.00 |
| 28 | ND | ND | ND | ND | ND | ND | ND | 0.65 | 0.05 | 0.00 | 0.00 | 0.00 |
| 29 | ND | ND | ND | ND | -- | ND | ND | 0.62 | 0.04 | 0.00 | 0.00 | 0.00 |
| 30 | ND | ND | ND | ND | -- | ND | ND | 0.59 | 0.04 | 0.00 | 0.00 | 0.00 |
| 31 | ND | -- | ND | ND | -- | ND | -- | 0.59 | -- | 0.00 | 0.00 | -- |
| Mean | 0.00 | ND | ND | ND | ND | ND | ND | 0.79 | 0.24 | 0.01 | 0.00 | 0.00 |
| Min | 0.00 | ND | ND | ND | ND | ND | ND | 0.53 | 0.04 | 0.00 | 0.00 | 0.00 |
| Max | 0.00 | ND | ND | ND | ND | ND | ND | 1.28 | 0.69 | 0.03 | 0.00 | 0.00 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.00 |
| 11/15/2016 | 0.01 |
| 5/11/2017 | 1.94 |
| 6/8/2017 | 0.63 |
| 7/18/2017 | 0.01 |
| 8/24/2017 | 0.00 |
| 9/7/2017 | 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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.22 | ND | ND | ND | ND | ND | ND | ND | 0.80 | 0.96 | 0.59 | 0.38 |
| 2 | 0.21 | ND | ND | ND | ND | ND | ND | ND | 0.87 | 0.91 | 0.62 | 0.36 |
| 3 | 0.20 | ND | ND | ND | ND | ND | ND | ND | 0.88 | 0.91 | 0.68 | 0.31 |
| 4 | 0.20 | ND | ND | ND | ND | ND | ND | ND | 0.98 | 0.92 | 0.60 | 0.30 |
| 5 | 0.20 | ND | ND | ND | ND | ND | ND | ND | 1.04 | 0.86 | 0.60 | 0.30 |
| 6 | 0.20 | ND | ND | ND | ND | ND | ND | ND | 0.97 | 0.80 | 1.13 | 0.29 |
| 7 | 0.21 | ND | ND | ND | ND | ND | ND | ND | 1.06 | 0.86 | 0.80 | 0.29 |
| 8 | 0.21 | ND | ND | ND | ND | ND | ND | ND | 1.02 | 0.89 | 0.73 | 0.29 |
| 9 | 0.21 | ND | ND | ND | ND | ND | ND | ND | 1.03 | 0.85 | 0.72 | 0.28 |
| 10 | 0.21 | ND | ND | ND | ND | ND | ND | ND | 0.96 | 0.83 | 0.69 | 0.28 |
| 11 | 0.22 | ND | ND | ND | ND | ND | ND | ND | 0.93 | 0.75 | 0.67 | 0.27 |
| 12 | 0.22 | ND | ND | ND | ND | ND | ND | 1.49 | 0.89 | 0.75 | 0.68 | 0.26 |
| 13 | 0.21 | ND | ND | ND | ND | ND | ND | 1.23 | 0.86 | 0.75 | 0.63 | 0.25 |
| 14 | 0.21 | ND | ND | ND | ND | ND | ND | 1.03 | 0.86 | 0.75 | 0.63 | 0.28 |
| 15 | 0.21 | ND | ND | ND | ND | ND | ND | 0.95 | 0.87 | 0.75 | 0.65 | 0.26 |
| 16 | 0.20 | ND | ND | ND | ND | ND | ND | 0.91 | 0.85 | 0.76 | 0.62 | 0.24 |
| 17 | 0.20 | ND | ND | ND | ND | ND | ND | 0.93 | 0.83 | 0.73 | 0.59 | 0.24 |
| 18 | ND | ND | ND | ND | ND | ND | ND | 1.01 | 0.81 | 0.86 | 0.60 | 0.24 |
| 19 | ND | ND | ND | ND | ND | ND | ND | 0.92 | 0.80 | 0.83 | 0.57 | 0.22 |
| 20 | ND | ND | ND | ND | ND | ND | ND | 0.85 | 0.82 | 0.89 | 0.56 | 0.21 |
| 21 | ND | ND | ND | ND | ND | ND | ND | 0.84 | 0.76 | 0.86 | 0.55 | 0.21 |
| 22 | ND | ND | ND | ND | ND | ND | ND | 0.82 | 0.80 | 0.78 | 0.57 | 0.21 |
| 23 | ND | ND | ND | ND | ND | ND | ND | 0.80 | 0.77 | 0.73 | 0.59 | 0.22 |
| 24 | ND | ND | ND | ND | ND | ND | ND | 0.90 | 0.81 | 0.69 | 0.42 | 0.20 |
| 25 | ND | ND | ND | ND | ND | ND | ND | 0.90 | 0.91 | 0.77 | 0.40 | 0.20 |
| 26 | ND | ND | ND | ND | ND | ND | ND | 0.94 | 1.02 | 0.82 | 0.39 | 0.20 |
| 27 | ND | ND | ND | ND | ND | ND | ND | 0.87 | 0.99 | 0.72 | 0.37 | 0.20 |
| 28 | ND | ND | ND | ND | ND | ND | ND | 0.85 | 0.96 | 0.69 | 0.37 | 0.20 |
| 29 | ND | ND | ND | ND | -- | ND | ND | 0.88 | 1.00 | 0.75 | 0.37 | 0.20 |
| 30 | ND | ND | ND | ND | -- | ND | ND | 0.85 | 0.94 | 0.65 | 0.35 | 0.21 |
| 31 | ND | -- | ND | ND | -- | ND | -- | 0.84 | -- | 0.59 | 0.39 | -- |
| Mean | 0.21 | ND | ND | ND | ND | ND | ND | 0.94 | 0.90 | 0.80 | 0.58 | 0.25 |
| Min | 0.20 | ND | ND | ND | ND | ND | ND | 0.80 | 0.76 | 0.59 | 0.35 | 0.20 |
| Max | 0.22 | ND | ND | ND | ND | ND | ND | 1.49 | 1.06 | 0.96 | 1.13 | 0.38 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.20 |
| 11/15/2016 | 0.20 |
| 5/11/2017 | 1.55 |
| 6/7/2017 | 1.17 |
| 7/18/2017 | 0.91 |
| 8/24/2017 | 0.46 |
| 9/7/2017 | 0.29 |

**0.01** Flume Ice Affected or Frozen.
ND No Data. Data Logger Removed for Winter.
ND1 No Data. Data Logger Malfunction.

# Minnesota Reservoir Flume
# Streamflow
# (cubic feet per second)

**Daily Mean Streamflow (CFS)**

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.87 | 0.59 | ND | ND | ND | ND | 3.64 | 1.53 | 4.78 | 5.93 | 1.71 | 1.19 |
| 2 | 0.82 | 0.76 | ND | ND | ND | ND | 3.66 | 1.86 | 5.21 | 5.57 | 1.71 | 1.26 |
| 3 | 0.82 | 0.63 | ND | ND | ND | ND | 3.71 | 1.73 | 5.05 | 5.35 | 2.88 | 1.16 |
| 4 | 0.82 | 0.60 | ND | ND | ND | ND | 3.06 | 3.29 | 5.41 | 5.07 | 1.99 | 1.08 |
| 5 | 0.82 | 0.69 | ND | ND | ND | ND | 2.40 | 6.44 | 5.29 | 5.31 | 1.84 | 1.05 |
| 6 | 1.00 | 0.80 | ND | ND | ND | ND | 2.56 | 8.15 | 5.31 | 4.89 | 5.07 | 1.03 |
| 7 | 0.96 | 0.65 | ND | ND | ND | ND | 2.94 | 9.42 | 5.33 | 4.69 | 2.45 | 1.04 |
| 8 | 0.94 | 0.58 | ND | ND | ND | ND | 3.28 | 9.22 | 5.55 | 4.46 | 2.03 | 1.03 |
| 9 | 0.92 | 0.59 | ND | ND | ND | ND | 3.16 | 9.36 | 5.56 | 4.30 | 1.74 | 0.96 |
| 10 | 0.86 | 0.56 | ND | ND | ND | ND | 2.79 | 8.53 | 5.44 | 4.08 | 1.69 | 0.99 |
| 11 | 0.87 | 0.56 | ND | ND | ND | ND | 2.68 | 7.24 | 5.44 | 4.05 | 1.60 | 1.00 |
| 12 | 0.87 | 0.56 | ND | ND | ND | ND | 2.75 | 7.30 | 5.29 | 4.16 | 1.63 | 0.99 |
| 13 | 0.82 | 0.56 | ND | ND | ND | ND | 2.98 | 7.42 | 5.19 | 4.19 | 1.59 | 0.99 |
| 14 | 0.85 | 0.53 | ND | ND | ND | ND | 2.99 | 7.47 | 5.10 | 4.10 | 1.70 | 1.27 |
| 15 | 0.82 | ND | ND | ND | ND | ND | 2.95 | 6.78 | 5.01 | 3.57 | 1.44 | 1.51 |
| 16 | 0.76 | ND | ND | ND | ND | ND | 2.79 | 6.17 | 4.82 | 3.72 | 1.33 | 1.03 |
| 17 | 0.73 | ND | ND | ND | ND | ND | 2.66 | 6.11 | 4.69 | 3.74 | 1.22 | 1.02 |
| 18 | 0.75 | ND | ND | ND | ND | ND | 2.48 | 6.00 | 4.54 | 3.69 | 1.23 | 1.02 |
| 19 | 0.76 | ND | ND | ND | ND | ND | 2.44 | 4.92 | 4.34 | 3.25 | 1.16 | 1.02 |
| 20 | 0.70 | ND | ND | ND | ND | ND | 2.08 | 4.47 | 4.16 | 3.64 | 0.97 | 0.88 |
| 21 | 0.73 | ND | ND | ND | ND | ND | 2.34 | 4.12 | 4.10 | 3.93 | 1.01 | 0.91 |
| 22 | 0.78 | ND | ND | ND | ND | ND | 1.80 | 4.33 | 3.98 | 3.13 | 1.04 | 0.92 |
| 23 | 0.73 | ND | ND | ND | ND | ND | 1.51 | 4.07 | 3.88 | 2.72 | 1.05 | 1.19 |
| 24 | 0.68 | ND | ND | ND | ND | ND | 4.05 | 4.33 | 3.80 | 2.60 | 1.42 | 1.09 |
| 25 | 0.83 | ND | ND | ND | ND | 1.91 | 4.25 | 4.67 | 4.29 | 2.99 | 1.37 | 0.97 |
| 26 | 0.78 | ND | ND | ND | ND | 2.21 | 3.13 | 4.97 | 7.26 | 3.80 | 1.27 | 0.95 |
| 27 | 0.68 | ND | ND | ND | ND | 2.29 | 3.05 | 5.04 | 7.21 | 2.61 | 1.32 | 0.93 |
| 28 | 0.63 | ND | ND | ND | ND | 2.88 | 2.48 | 5.11 | 7.01 | 2.40 | 1.29 | 1.00 |
| 29 | 0.64 | ND | ND | ND | -- | 2.83 | 2.22 | 5.15 | 6.58 | 2.81 | 1.25 | 0.92 |
| 30 | 0.61 | ND | ND | ND | -- | 3.30 | 1.84 | 5.06 | 6.20 | 2.14 | 1.25 | 0.98 |
| 31 | 0.58 | -- | ND | ND | -- | 3.84 | -- | 4.96 | -- | 1.84 | 1.18 | -- |
| Mean | 0.79 | 0.62 | ND | ND | ND | 2.75 | 2.82 | 5.65 | 5.19 | 3.83 | 1.63 | 1.05 |
| Min | 0.58 | 0.53 | ND | ND | ND | 1.91 | 1.51 | 1.53 | 3.80 | 1.84 | 0.97 | 0.88 |
| Max | 1.00 | 0.80 | ND | ND | ND | 3.84 | 4.25 | 9.42 | 7.26 | 5.93 | 5.07 | 1.51 |

**Measured Streamflow**

| Date | Streamflow (CFS) |
|---|---|
| 10/18/2016 | 0.81 |
| 11/15/2016 | 0.63 |
| 12/13/2016 | **0.07** |
| 3/24/2017 | 1.86 |
| 4/28/2017 | 2.68 |
| 5/10/2017 | 7.76 |
| 6/8/2017 | 5.74 |
| 7/18/2017 | 3.61 |
| 8/24/2017 | 1.61 |
| 9/7/2017 | 1.30 |

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

## 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 |

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 |

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 |

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 | |

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 | |

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 |

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 |

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

## Poison Gulch
## Measured Flow

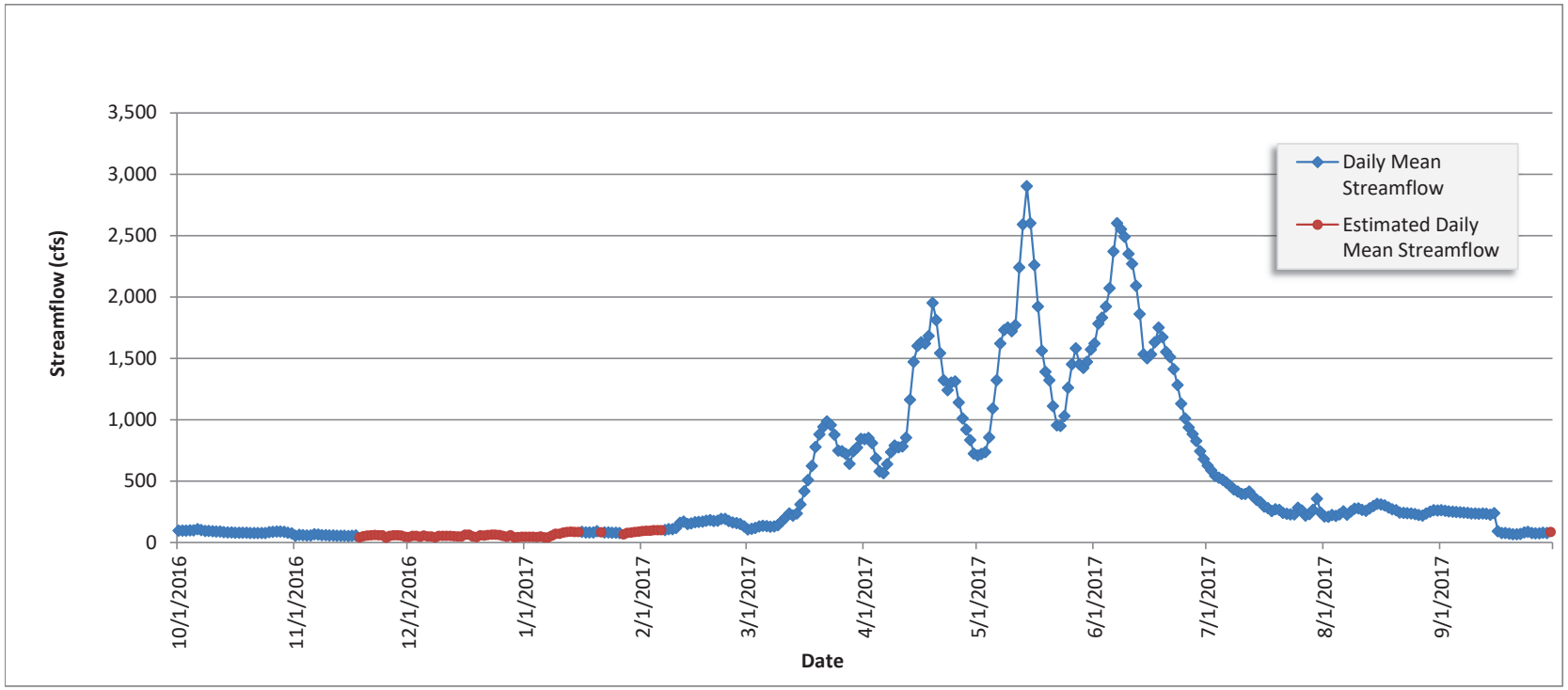
| Date | GPM | CFS | Comments |
|---|---|---|---|
| 5/9/2005 | 97 | 0.22 | |
| 6/6/2005 | 12.5 | 0.03 | |
| 7/5/2005 | 0.00 | 0.00 | Wet |
| 8/4/2005 | 0.00 | 0.00 | Dry |
| 9/6/2005 | 0.00 | 0.00 | Dry |
| 10/2/2005 | 0.00 | 0.00 | Dry |
| 5/1/2006 | 31.33 | 0.07 | |
| 5/22/2006 | 4.01 | 0.01 | |
| 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 |

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

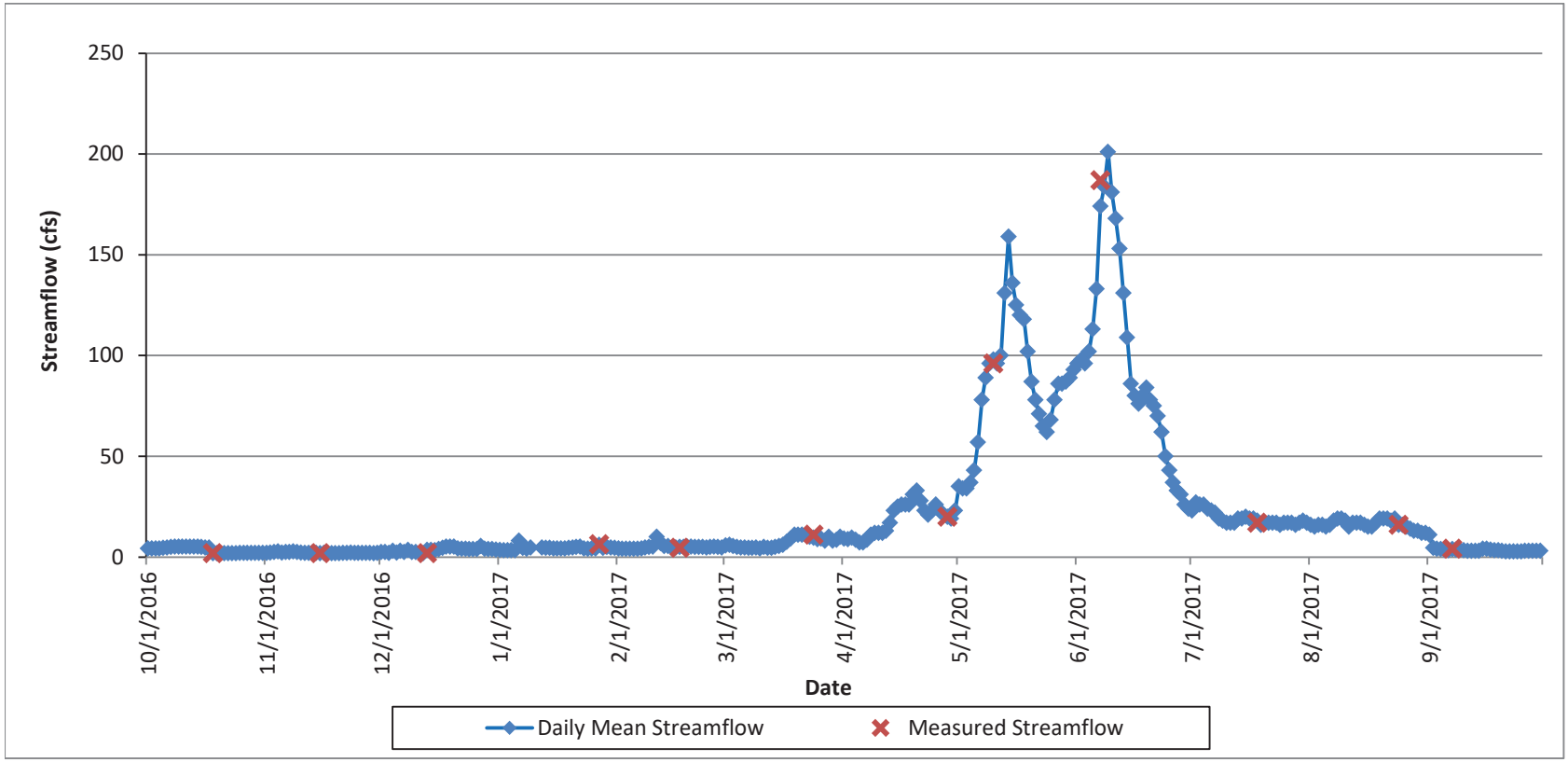
# APPENDIX B

## SURFACE WATER - HYDROGRAPHS

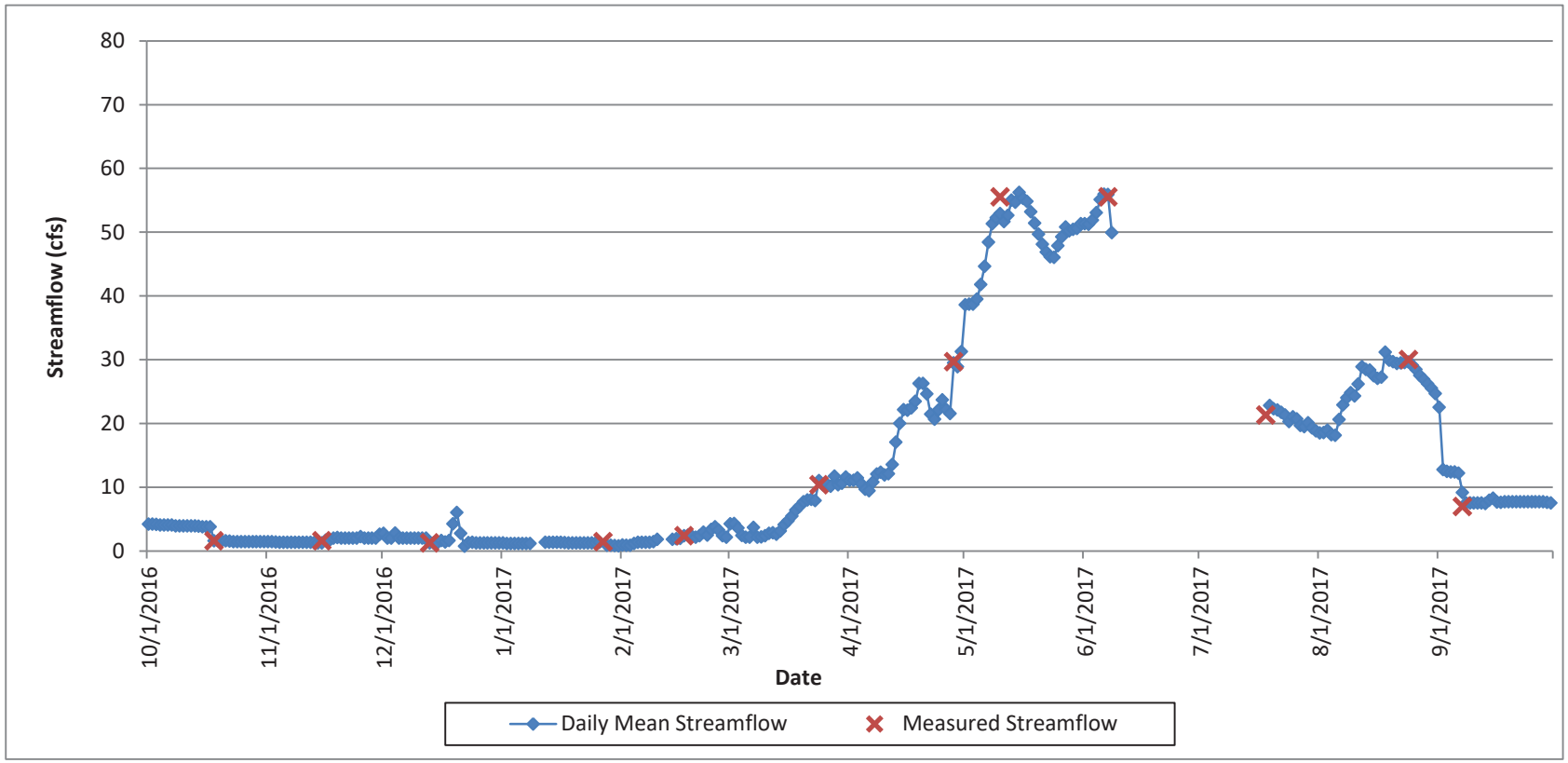
## Upper North Fork (USGS) Hydrograph
## WY 2017



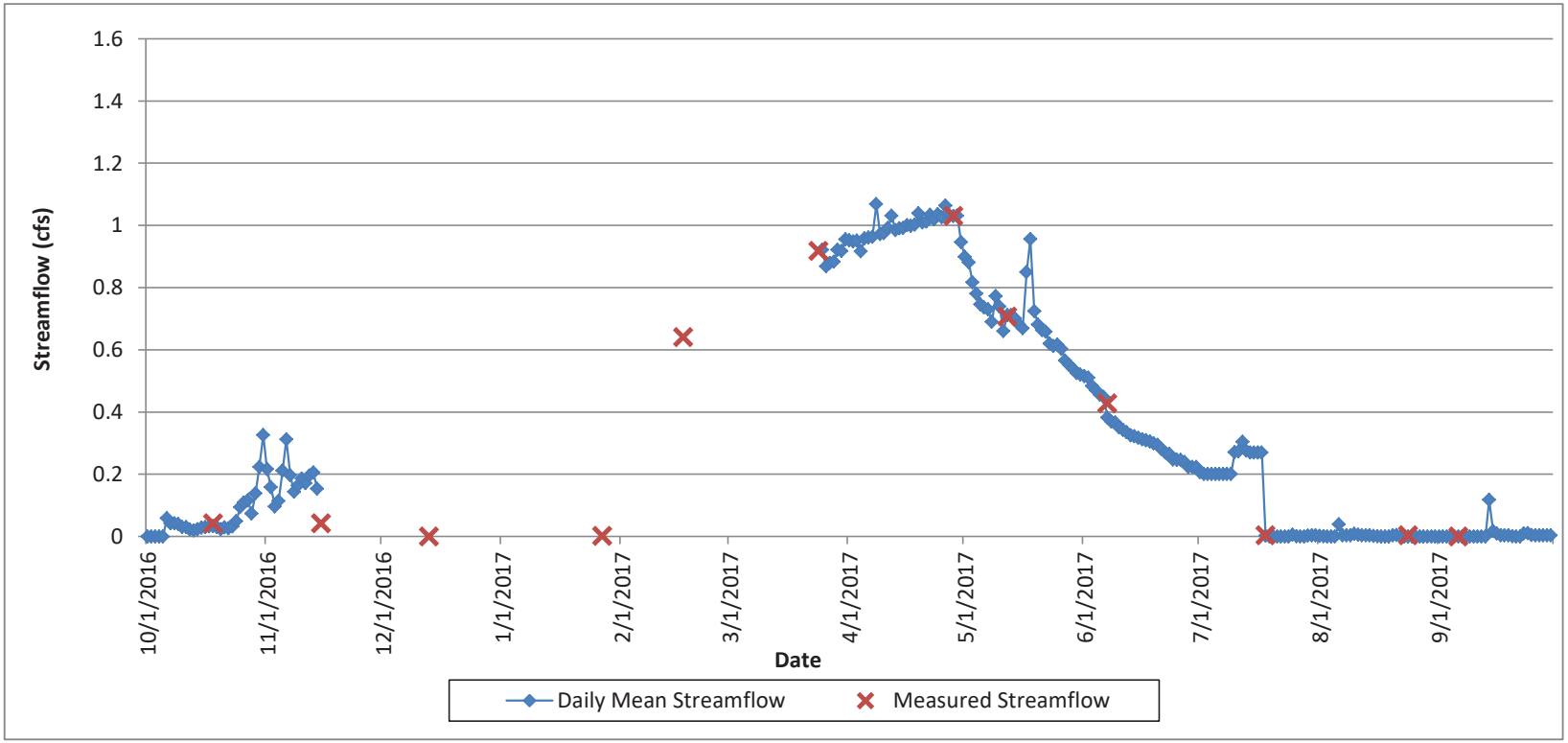
## Lower Minnesota Creek Hydrograph
## WY 2017



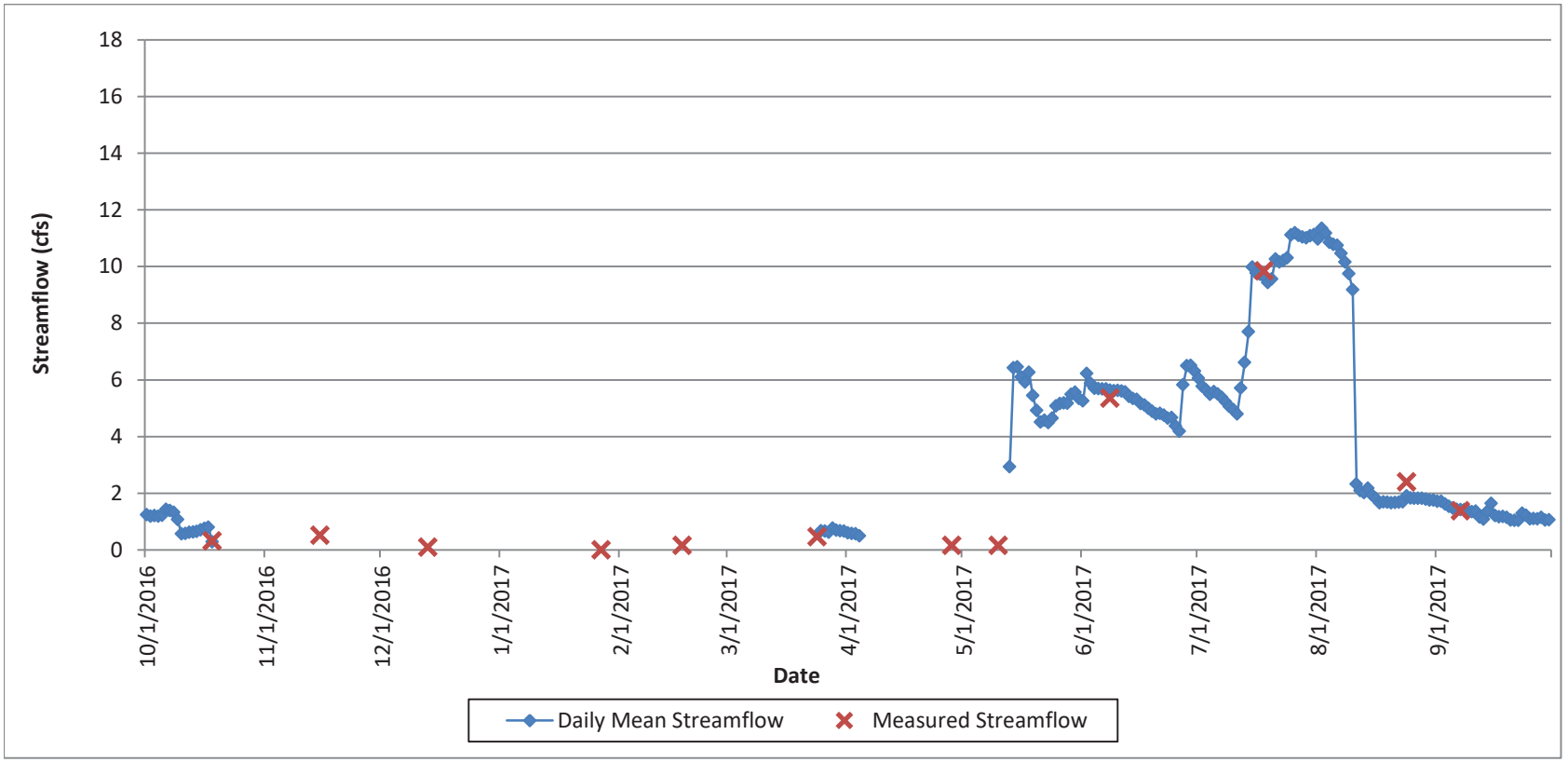
## Upper Minnesota Creek Hydrograph
## WY 2017



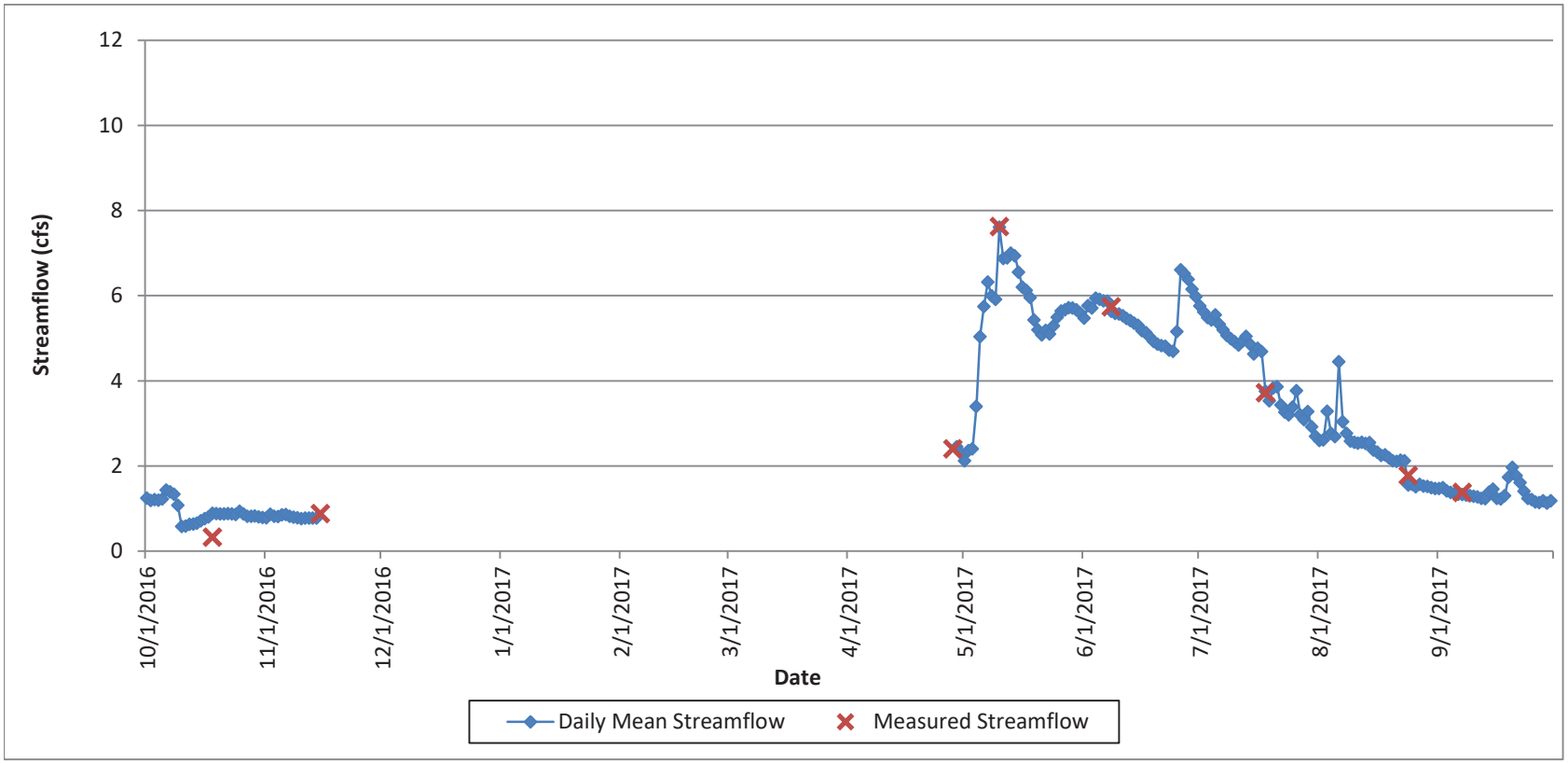
## Middle Sylvester Gulch Hydrograph
## WY 2017



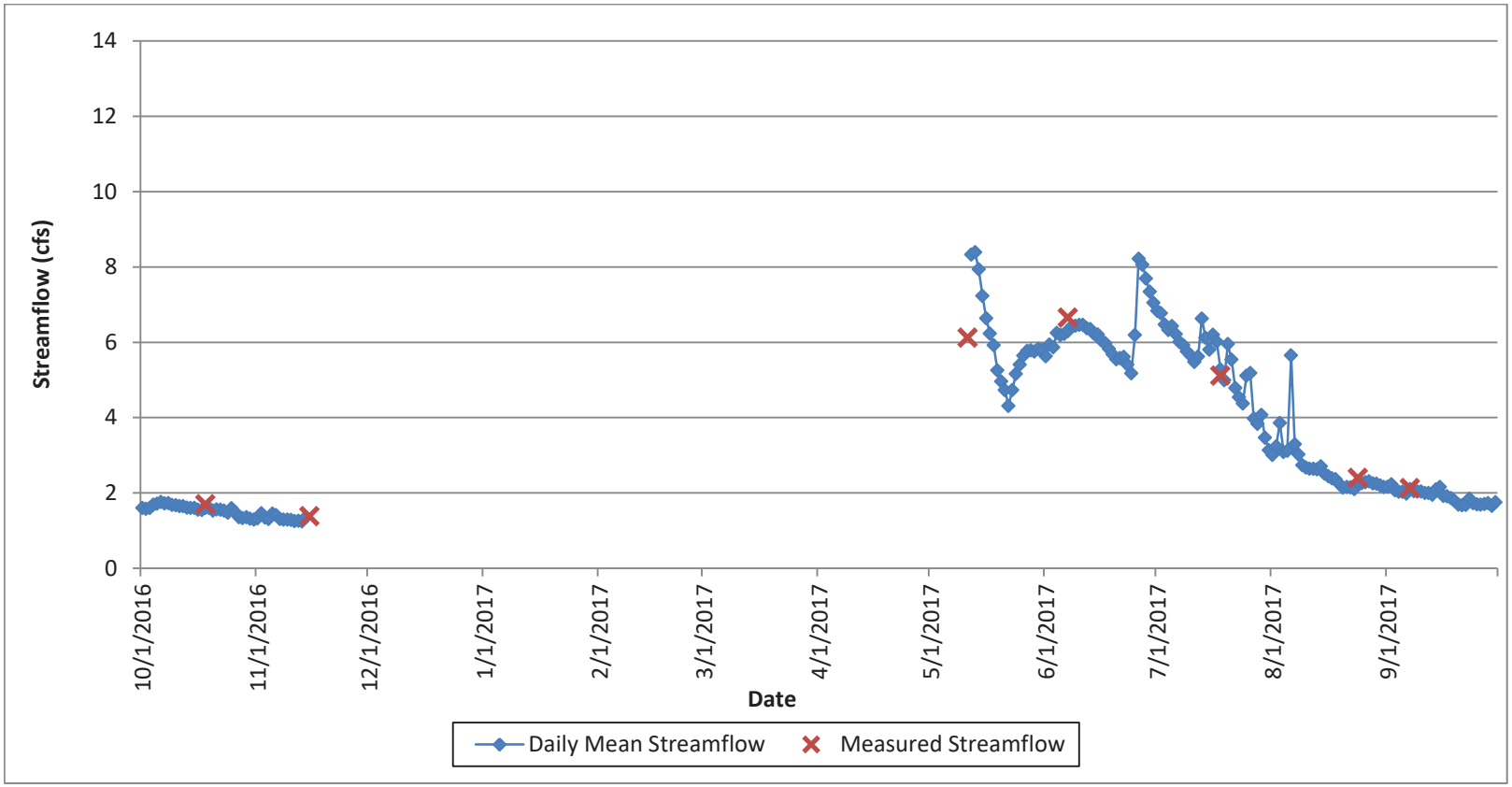
## Lower Dry Fork Hydrograph
## WY 2017



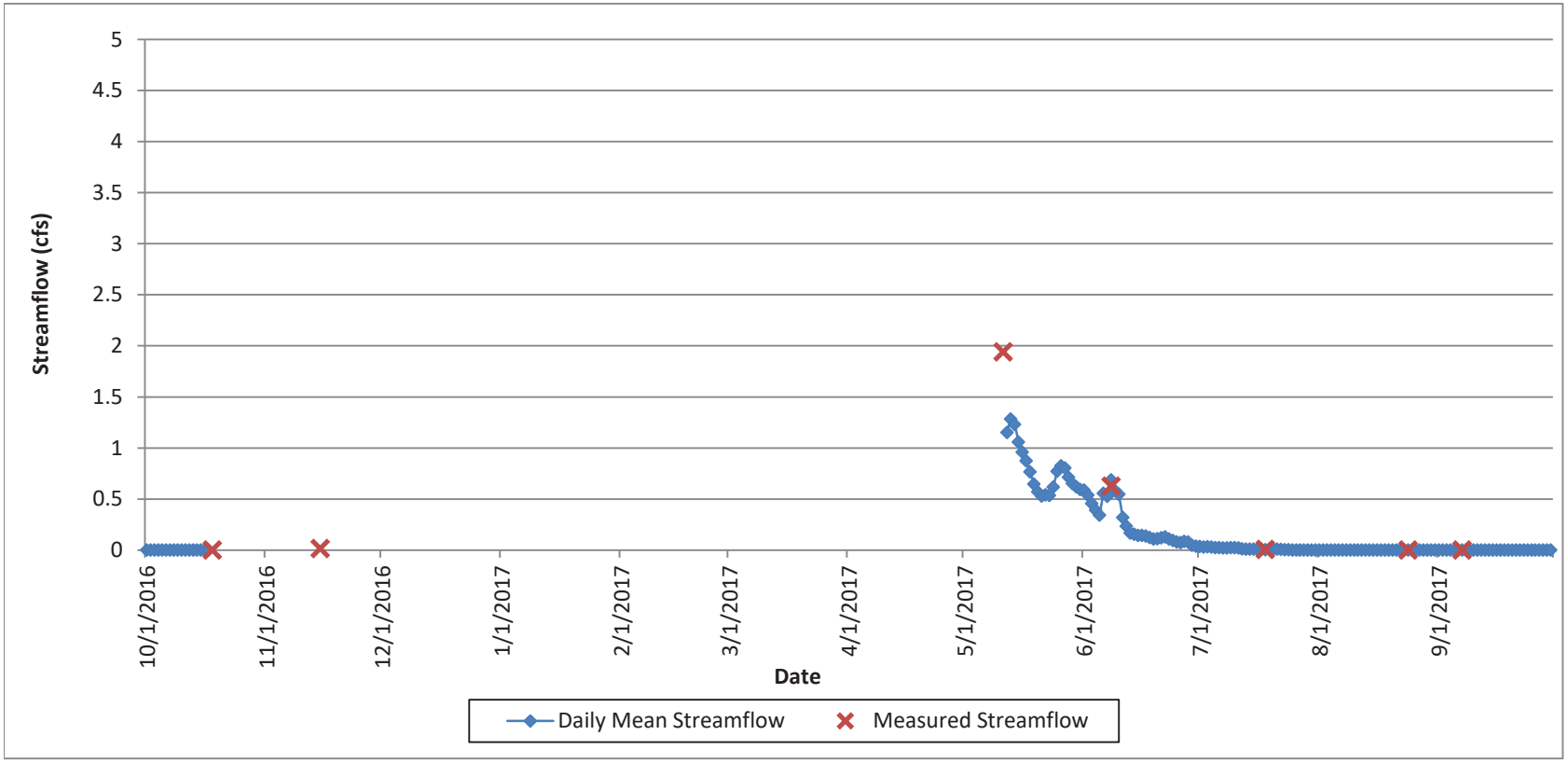
## Middle Dry Fork Hydrograph
## WY 2017



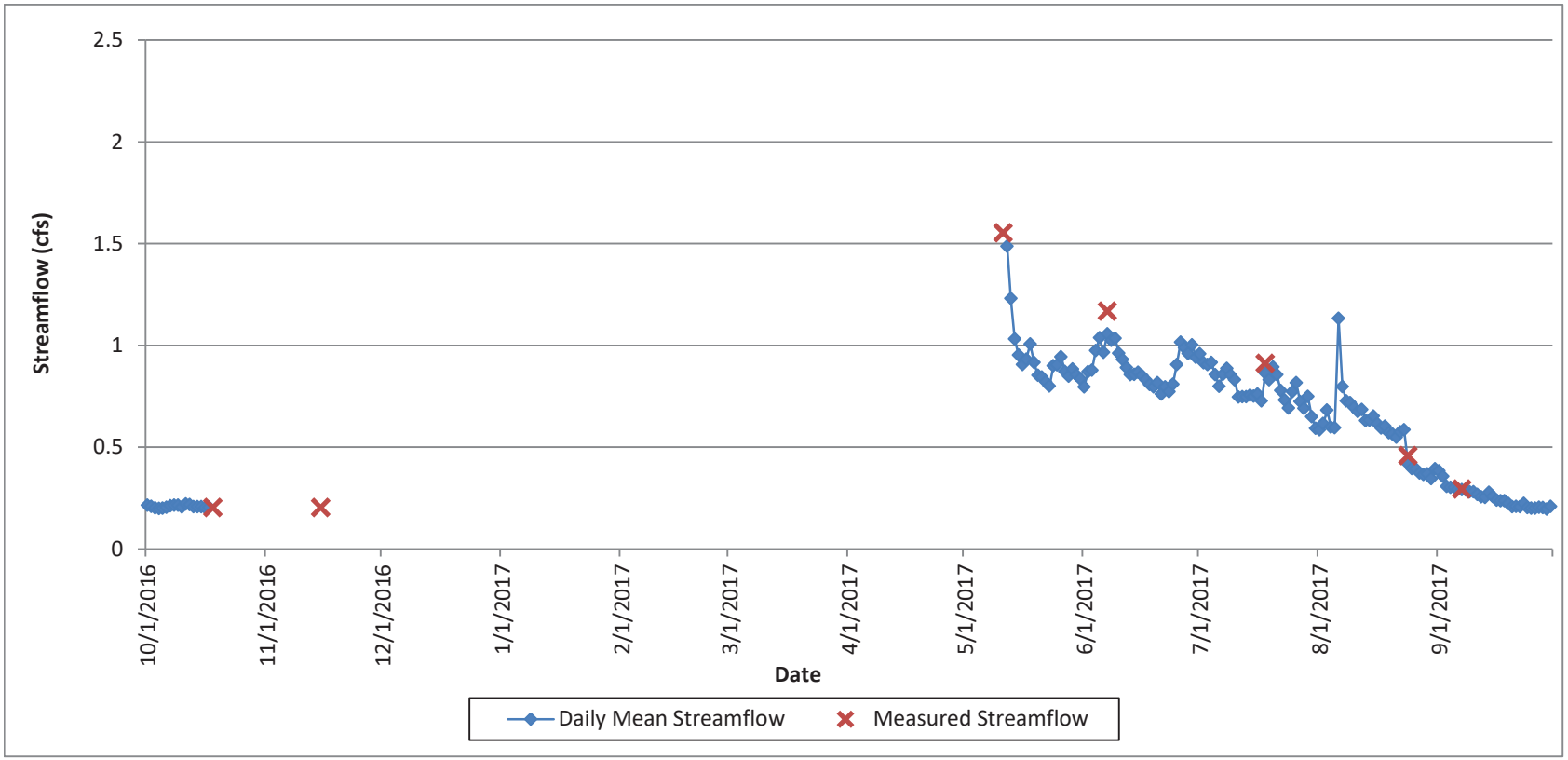
## Upper Dry Fork Hydrograph
## WY 2017



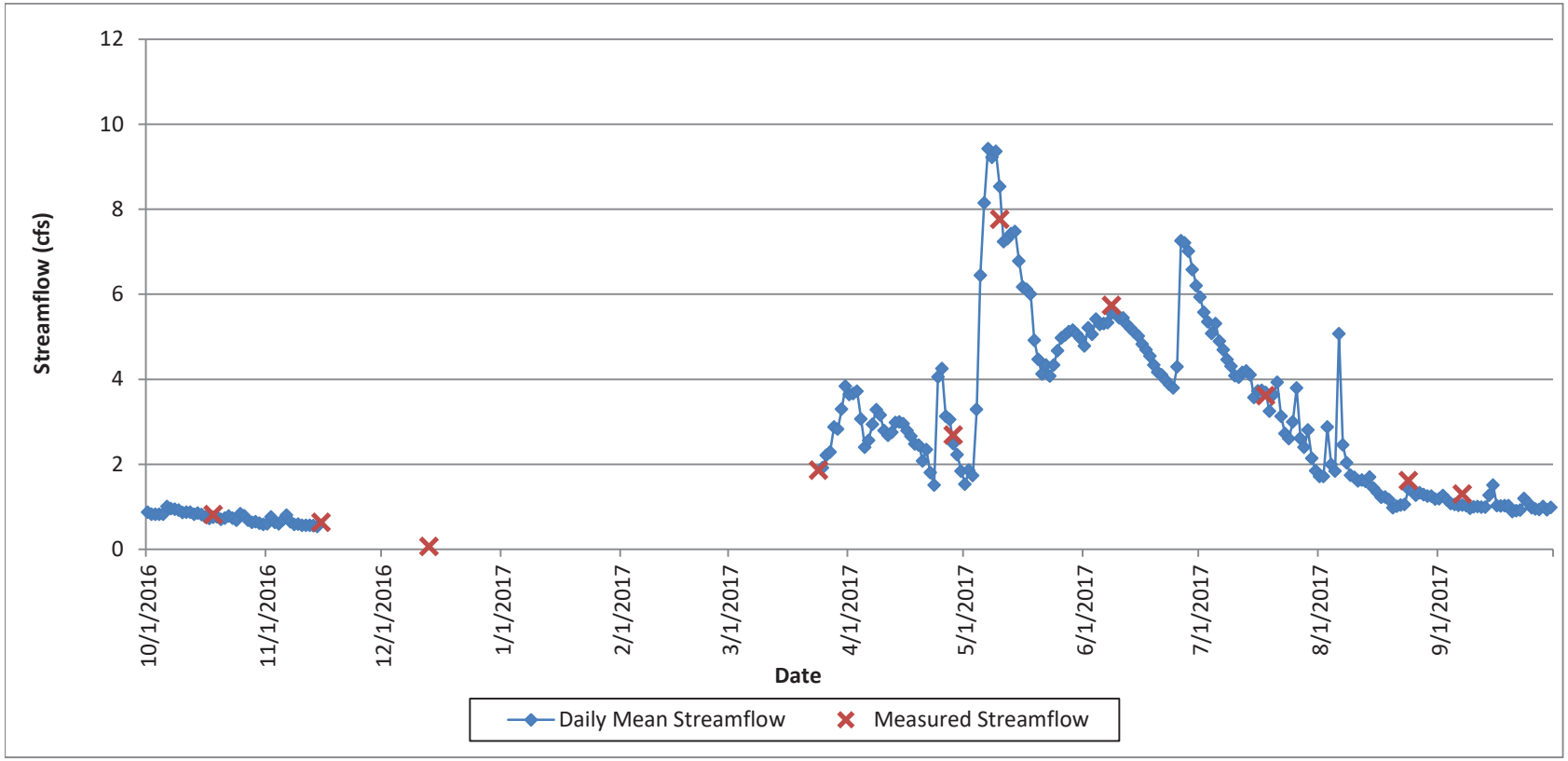
## Lick Creek Hydrograph
## WY 2017



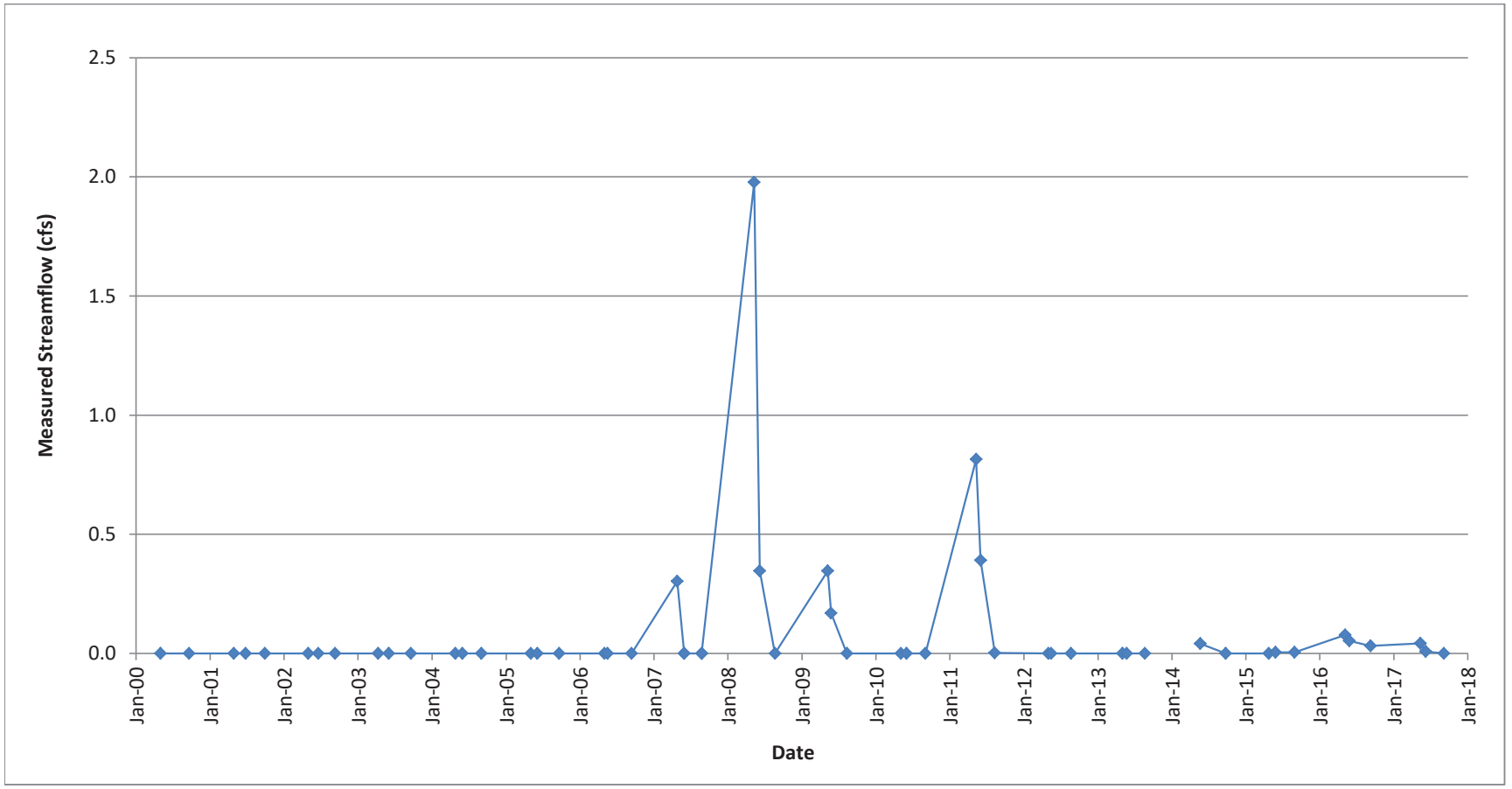
## Deep Creek Ditch Hydrograph
## WY 2017



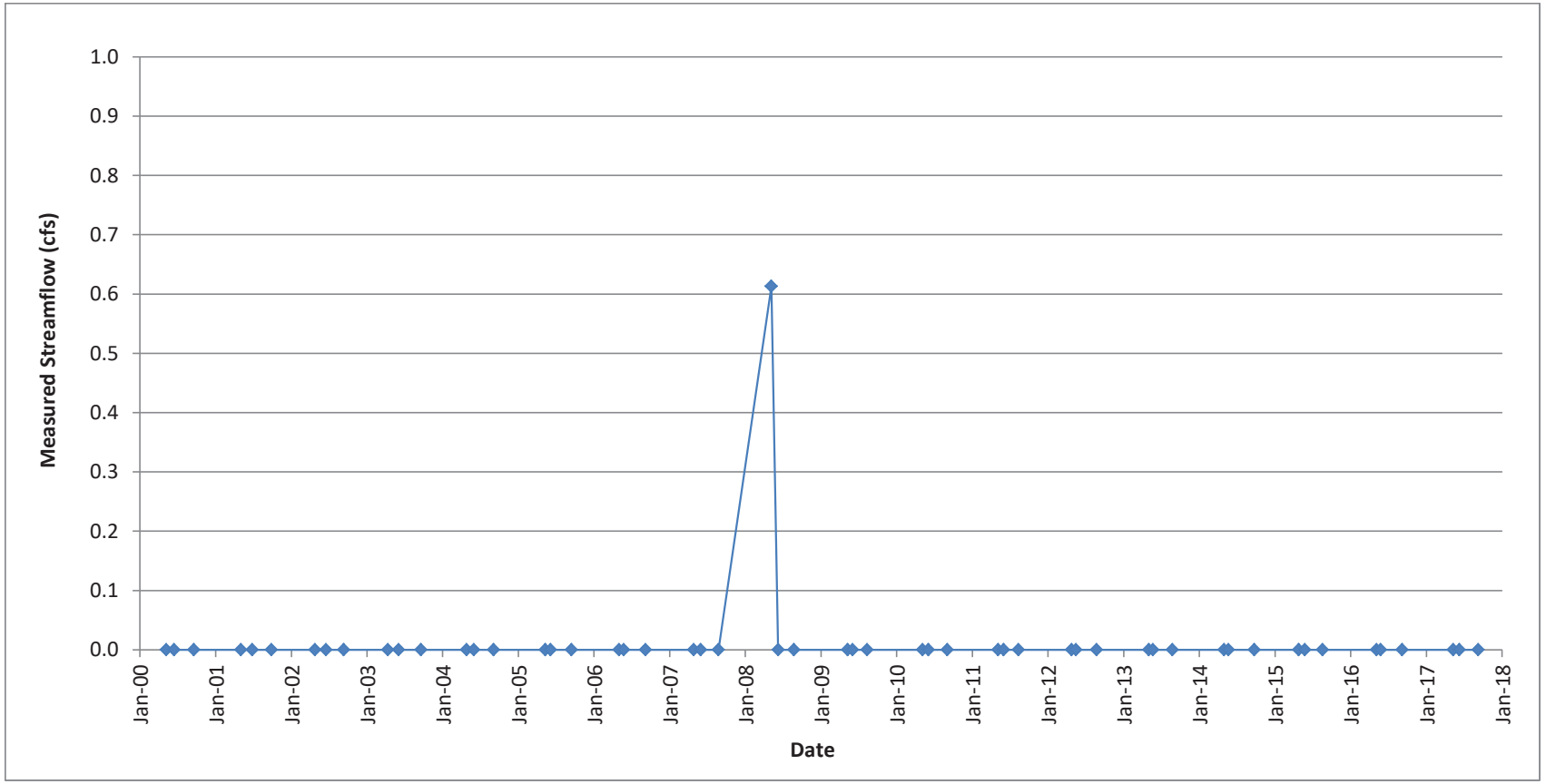
## Minnesota Reservoir Flume Hydrograph
## WY 2017



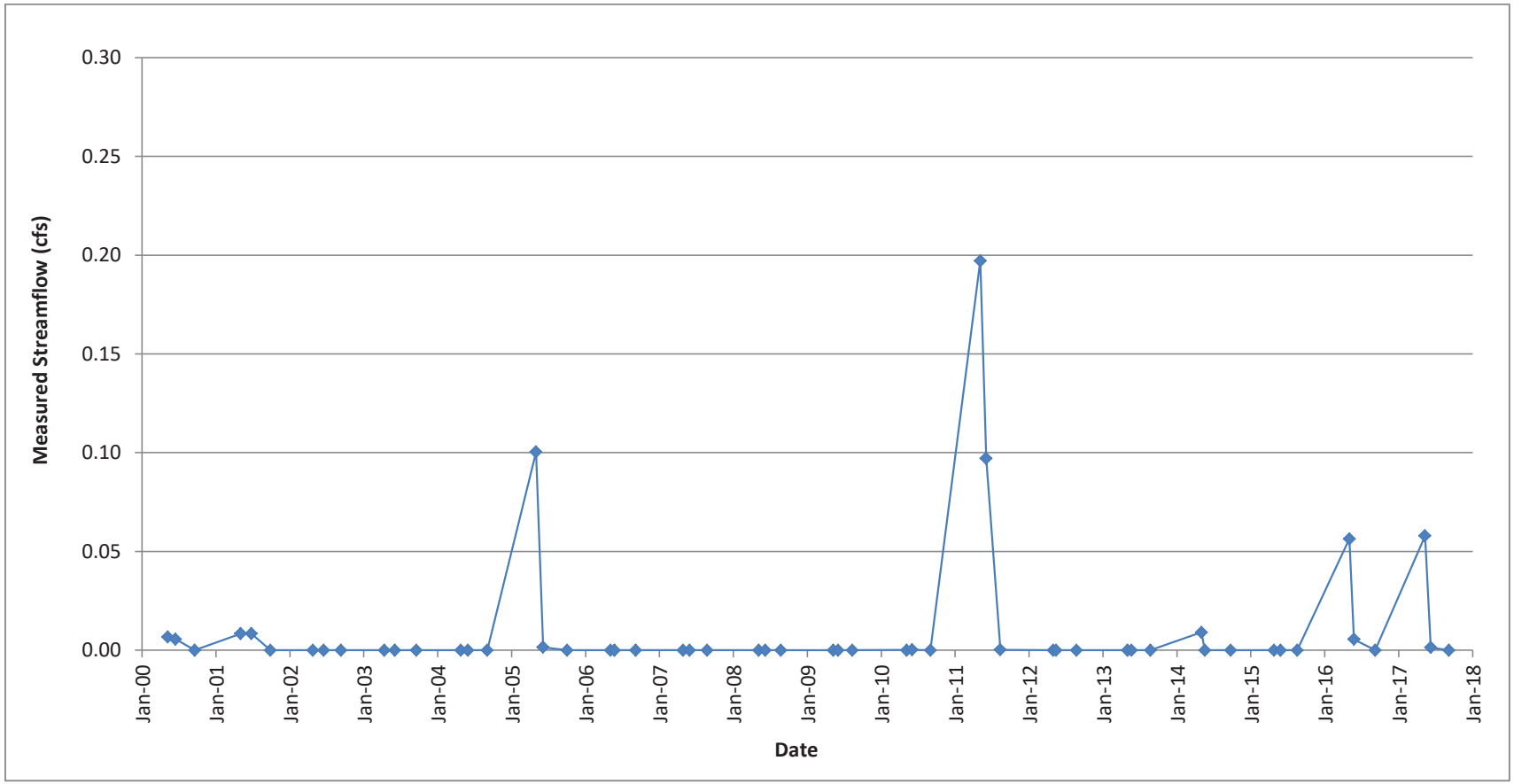
## Upper Sylvester Gulch Flume
## Hydrograph



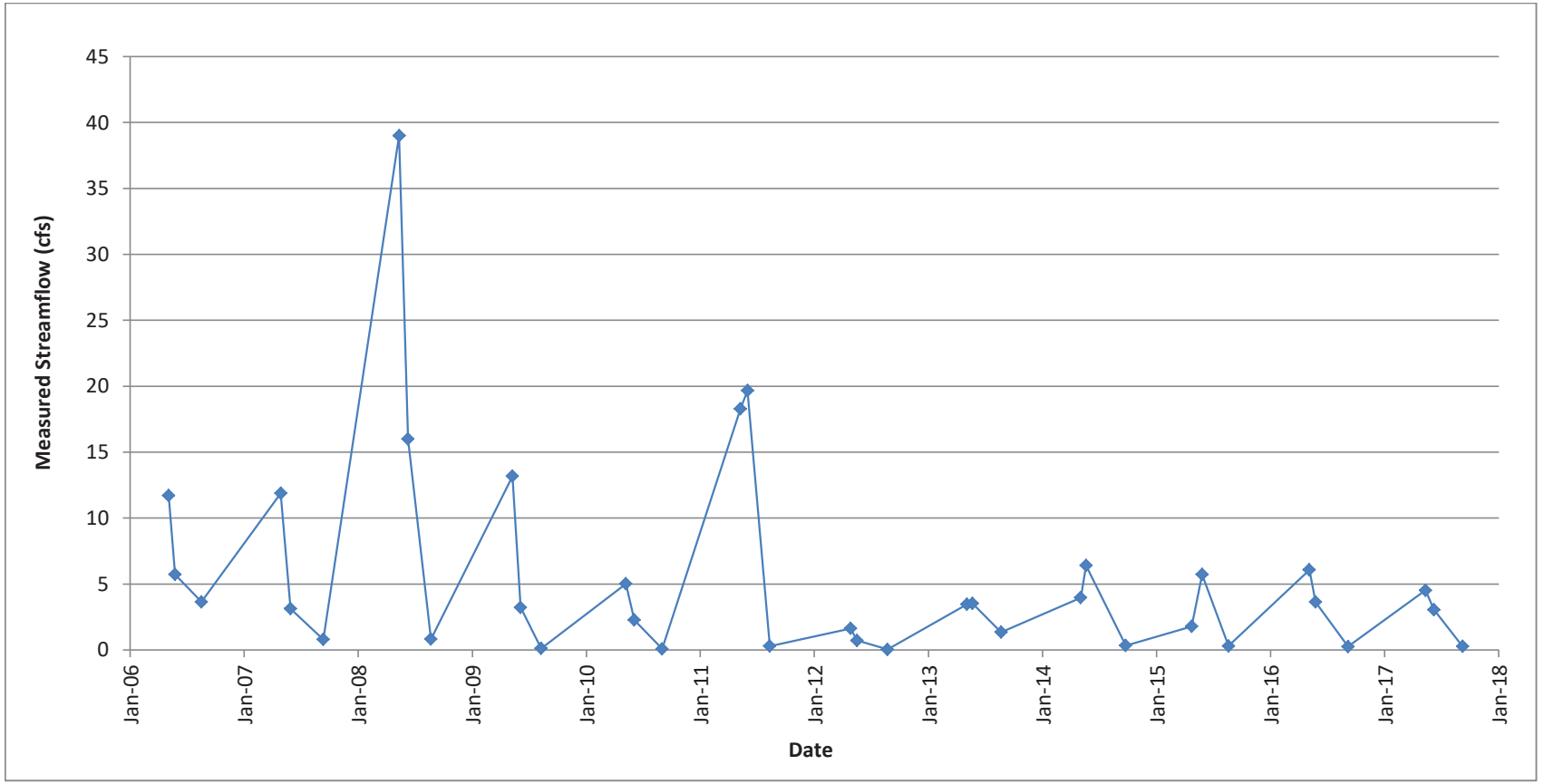
## Horse Gulch
## Hydrograph



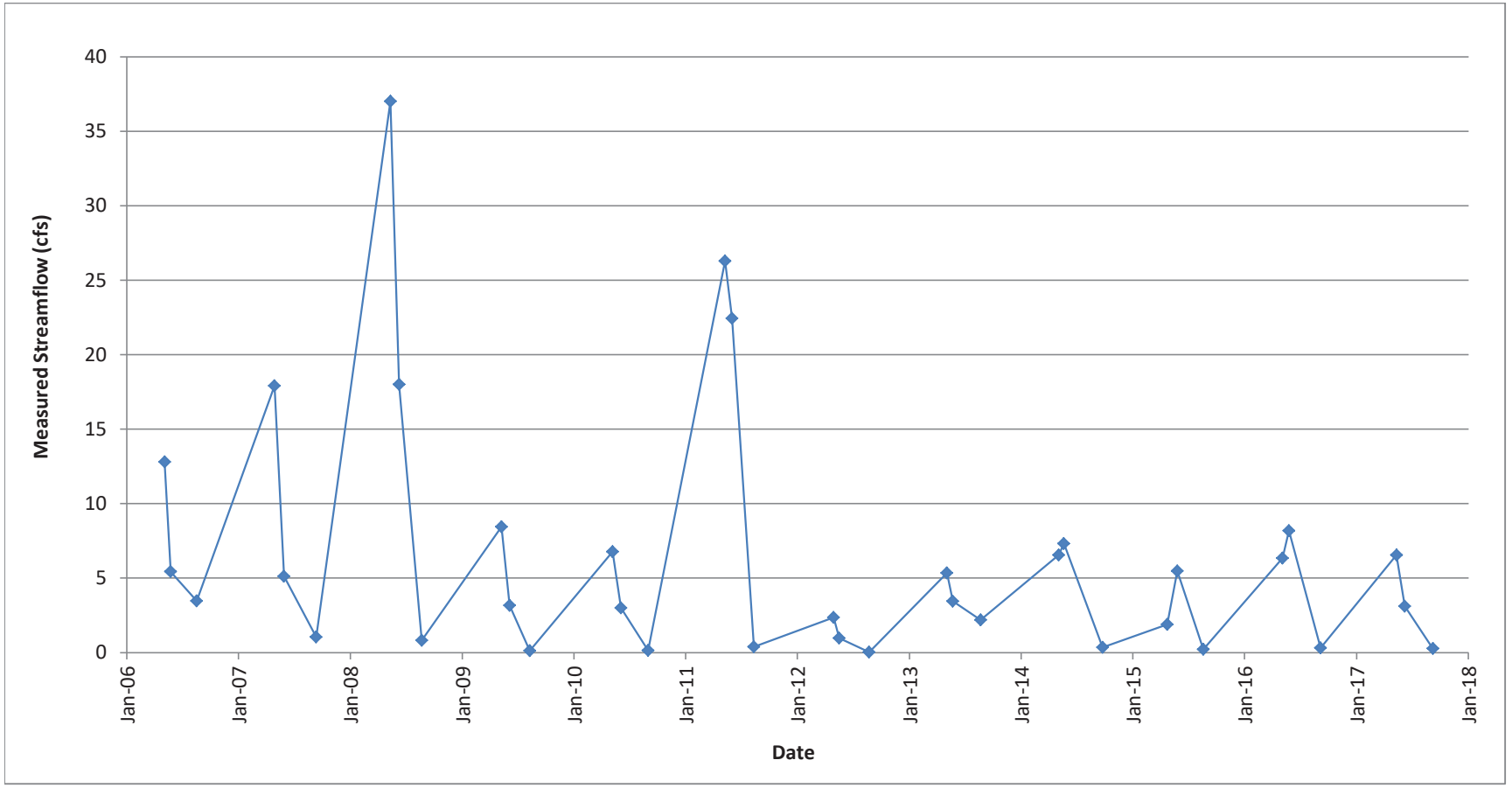
## East Gulch east of Horse Gulch
## Hydrograph



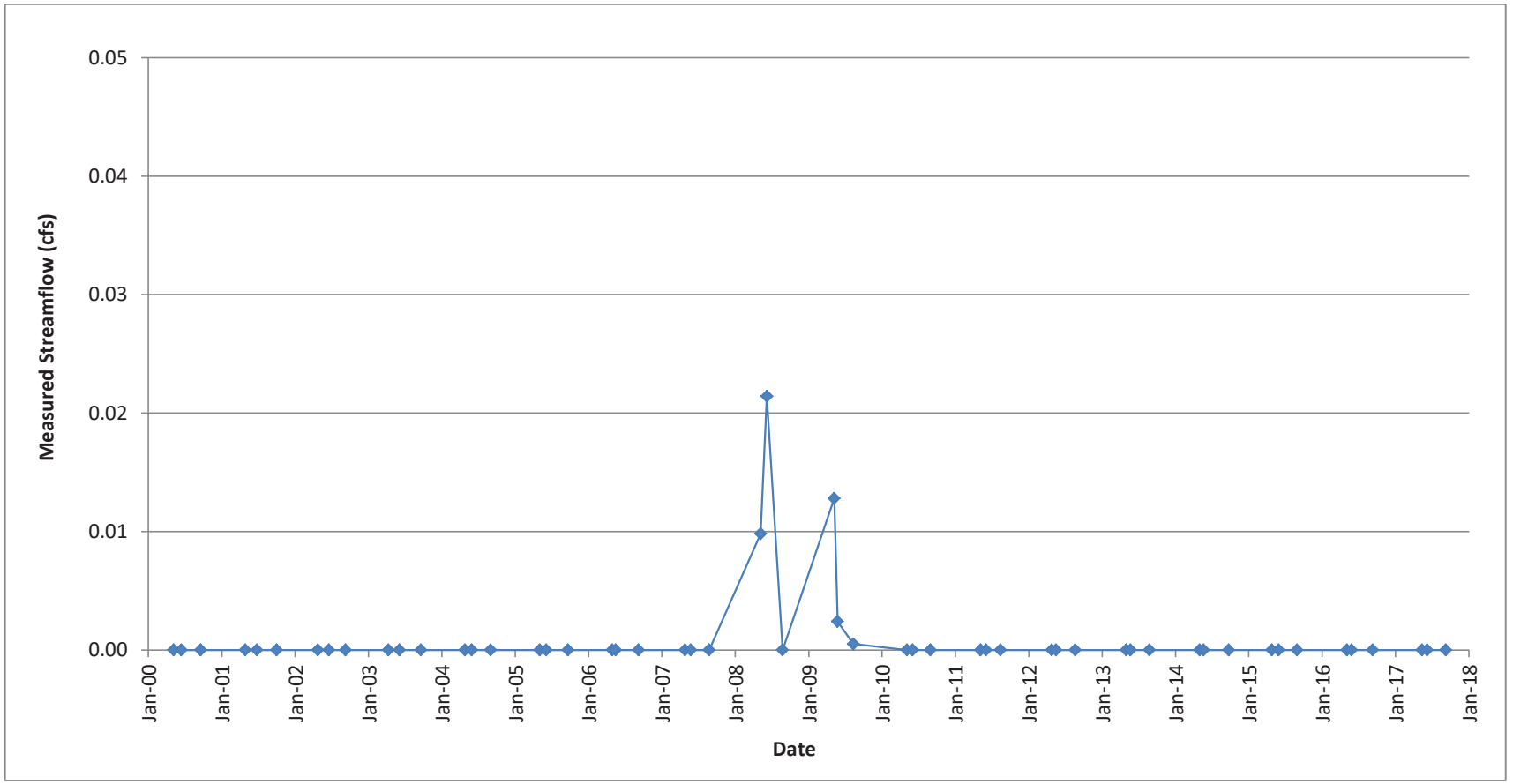
## Upper Deep Creek
## Hydrograph



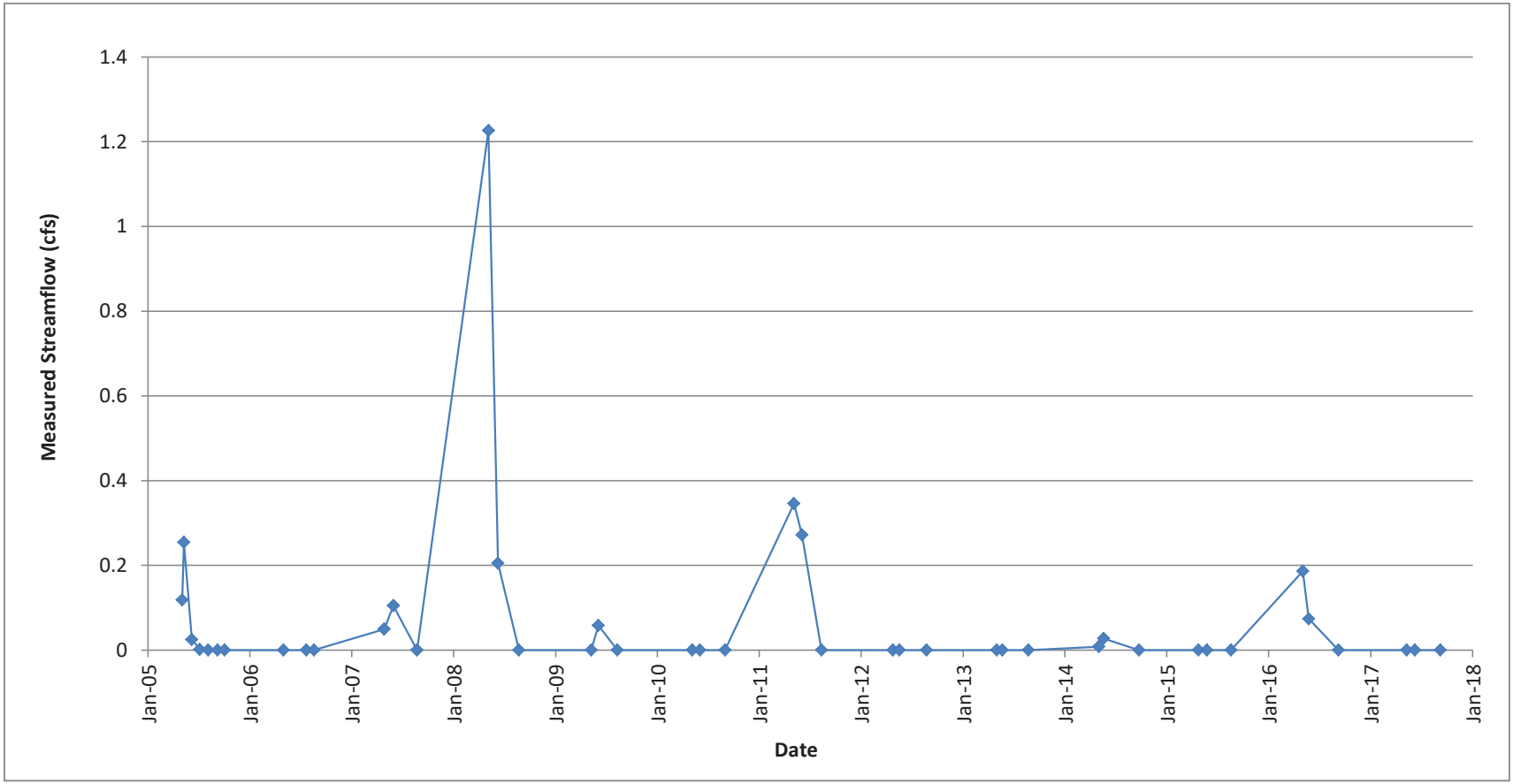
## Lower Deep Creek
## Hydrograph



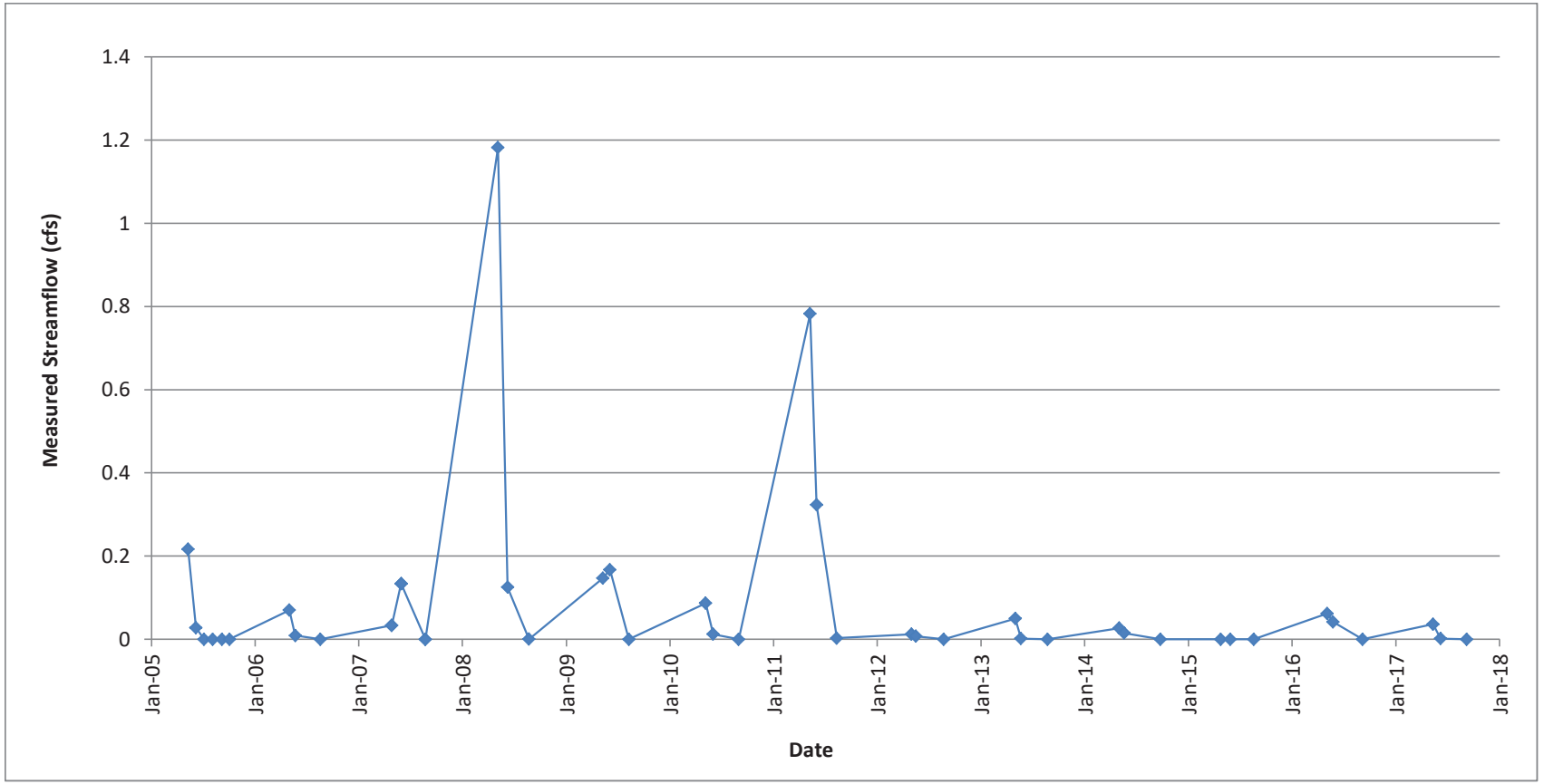
## Box Canyon
## Hydrograph



## Deer Creek
## Hydrograph



## Poison Gulch
## Hydrograph



# 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 2017 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Upper North Fork (USGS)** | | **Baseline [1]** | | | **2017 Water Year** | | | | | | | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/7/2017 | Q[4] | 6/7/2017 (Duplicate) | Q[4] | 9/6/2017 | Q[4] | 9/6/2017 (Duplicate) | Q[4] |
| **Field Parameters** | | | | | | | | | | | | | |
| Flow | staff gage | | | | NA | NA | | -- | | NA | | -- | |
| Conductivity (Field) | µmhos/cm | | | | 100.8 | 80.0 | | -- | | 181.6 | | -- | |
| pH (Field) | SU | | | | 8.16 | 8.22 | | -- | | 8.73 | | -- | |
| Temperature (Field) | °C | | | | 10.5 | 11.9 | | -- | | 16.4 | | -- | |
| Comment | | | | | | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | ACZ | | ACZ | | ACZ | |
| Lab Reference # | | | | | | L37661-02 | | L37661-01 | | L39748-10 | | L39748-12 | |
| Sample Date | | | | | | 6/7/2017 | | 6/7/2017 | | 9/6/2017 | | 9/6/2017 | |
| Lab Test Date | | | | | | 6/9-7/7 | | 6/9-7/7 | | 9/8-9/29 | | 9/8-9/29 | |
| Sampled By | | | | | | PH | | PH | | PH | | PH | |
| Alkalinity (Total CaCO3) | mg/L | | | | | 35.9 | | 37.1 | | 98.4 | | 96.1 | |
| Aluminum, dissolved | mg/L | | | | | -0.03 | U | -0.03 | U | -0.03 | U | -0.03 | U |
| Sum of Anions | meq/L | | | | | 0.803 | | 0.982 | | 2.3 | | 2.1 | |
| Arsenic, dissolved | mg/L | | | | | -0.0002 | U | -0.0002 | U | 0.0003 | B | -0.0002 | U |
| Arsenic, total recoverable | mg/L | 0.001 | 0.001 | 0.001 | | 0.0015 | | 0.0014 | | 0.0006 | B | 0.0005 | B |
| Bicarbonate as CaCO3 | mg/L | 40.9 | 167 | 81.3 | | 35.9 | | 37.1 | | 94.6 | | 95.1 | |
| Boron, dissolved | mg/L | | | | | -0.01 | U | -0.01 | U | 0.02 | B | 0.01 | B |
| Boron, total | mg/L | | | | | 0.02 | B | 0.01 | B | 0.02 | B | 0.01 | B |
| Cadmium, dissolved | mg/L | | | | | -0.005 | U | -0.005 | U | -0.005 | U | -0.005 | U |
| Cadmium, potentially dissolved | mg/L | | | | | -0.005 | U | -0.005 | U | -0.005 | U | -0.005 | U |
| Calcium, dissolved | mg/L | | | | | 11.0 | | 10.7 | | 26.9 | | 27.3 | |
| Carbonate as CaCO3 | mg/L | | | | | -2 | U | -2 | U | 3.8 | B | -2.0 | U |
| Cation - Anion Balance | % | | | | | 1.5 | | -10.2 | | -4.5 | | 0 | |
| Sum of Cations | meq/L | | | | | 0.827 | | 0.8 | | 2.1 | | 2.1 | |
| Chloride | mg/L | | 10 | 3 | | 1.0 | B | 1.0 | B | 1.9 | B | 2.0 | |
| Chromium, total | mg/L | | | | | 0.01 | B | 0.01 | B | -0.01 | U | -0.01 | U |
| Conductivity @25C | µmhos/cm | 76 | 241 | 169 | | 88.8 | | 92.3 | | 195 | | 195 | |
| Copper, dissolved | mg/L | 0.01 | 0.01 | 0.01 | | -0.01 | U | -0.01 | U | -0.01 | U | -0.01 | U |
| Cyanide, total | mg/L | | | | | -0.003 | U | -0.003 | U | -0.003 | U | -0.003 | U |
| Hardness as CaCO3 | mg/L | 40 | 107 | 70 | | 35 | | 33 | | 86 | | 87 | |
| Hydroxide as CaCO3 | mg/L | | | | | -2 | U | -2 | U | -2 | U | -2 | U |
| Iron, dissolved | mg/L | | 0.38 | 0.09 | | 0.03 | B | 0.04 | B | -0.02 | U | 0.03 | B |
| Iron, total | mg/L | | 26.3 | 1.6 | | 4.86 | | 4.77 | | 0.41 | | 0.44 | |
| Iron, total recoverable | mg/L | | | | | 4.9 | | 5.02 | | 0.5 | | 0.1 | |
| Lead, dissolved | mg/L | | 0.02 | 0.01 | | -0.03 | U | -0.03 | U | -0.03 | U | -0.03 | U |
| Magnesium, dissolved | mg/L | 2 | 3.4 | 2.9 | | 1.7 | | 1.6 | | 4.5 | | 4.5 | |
| Manganese, dissolved | mg/L | | 0.009 | 0.006 | | -0.005 | U | -0.005 | U | -0.005 | U | -0.005 | U |
| Manganese, total | mg/L | | 0.19 | 0.04 | | 0.115 | | 0.114 | | 0.025 | B | 0.024 | B |
| Mercury, total | mg/L | | | | | -0.0002 | U | -0.0002 | U | -0.0002 | U | -0.0002 | U |
| Molybdenum, dissolved | mg/L | | | | | -0.02 | U | -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 | -0.008 | U |
| Nickel, total | mg/L | | | | | -0.008 | U | -0.008 | U | -0.008 | U | -0.008 | U |
| Nitrate/Nitrite (as N) | mg/L | | 0.19 | 0.06 | | 0.07 | B | 0.06 | B | -0.02 | U | -0.02 | U |
| Nitrogen, ammonia | mg/L | | | | | -0.1 | U | -0.1 | U | -0.05 | U | -0.05 | U |
| pH | SU | 6.7 | 9 | 7.8 | | 7.7 | H | 7.9 | H | 8.4 | H | 8.3 | H |
| Phosphate | mg/L | | | | | 0.16 | B | 0.16 | B | -0.06 | U | -0.06 | U |
| Phosphorus, ortho dissolved | mg/L | | 1.61 | 0.12 | | 0.05 | | 0.05 | | -0.02 | UH | -0.02 | UH |
| Potassium, dissolved | mg/L | | | | | 0.5 | B | 0.5 | B | 1.2 | | 1.2 | |
| Selenium, total recoverable | mg/L | | | | | 0.0003 | | 0.0002 | B | -0.0002 | U | 0.0001 | B |
| Silver, total | mg/L | | | | | -0.00005 | U | -0.00005 | U | -0.0001 | U | -0.00005 | U |
| Sodium Adsorption Ratio (SAR) | calc. | 0.2 | 1.62 | 0.5 | | 0.21 | | 0.21 | | 0.34 | | 0.34 | |
| Sodium, dissolved | mg/L | 3.4 | 5.7 | 4.6 | | 2.8 | | 2.7 | | 7.1 | | 7.2 | |
| Sulfate | mg/L | | 70 | 10 | | 2.7 | B | 10.1 | | 13.8 | | 4.7 | B |
| TDS (ratio - measured/calculated) | mg/L | | | | | 1.73 | | 1.38 | | 1.04 | | 1.16 | |
| TDS (calculated) | calc. | | | | | 41.6 | | 49.3 | | 115 | | 105 | |
| Residue, Filterable (TDS) @180C | mg/L | 30 | 650 | 109 | | 72 | | 68 | | 120 | | 122 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 636 | 55 | | 154 | | 153 | | 8.0 | B | 8.0 | B |
| Zinc, dissolved | mg/L | | | | | -0.01 | U | -0.01 | U | -0.01 | U | 0.02 | B |

[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 2017 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower North Fork** | | **Baseline [1]** | | | **2017 Water Year** | | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/7/2017 | Q [4] | 9/6/2017 | Q [4] |
| **Field Parameters** | | | | | | | | | |
| Flow | staff gage | | | | not measured | not measured | | not measured | |
| Conductivity (Field) | µmhos/cm | | | | 92.5 | 80 | | 181 | |
| pH (Field) | SU | | | | 8.08 | 8.42 | | 8.70 | |
| Temperature (Field) | °C | | | | 10.2 | 11.2 | | 15.8 | |
| Comment | | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | ACZ | |
| Lab Reference # | | | | | | L37661-04 | | L39748-11 | |
| Sample Date | | | | | | 6/7/2017 | | 9/6/2017 | |
| Lab Test Date | | | | | | 6/9-7/7 | | 9/8-9/29 | |
| Sampled By | | | | | | PH | | PH | |
| Alkalinity (Total CaCO3) | mg/L | | | | | 36.7 | | 112 | |
| Aluminum, dissolved | mg/L | | | | | -0.03 | U | -0.03 | U |
| Sum of Anions | meq/L | | | | | 0.825 | | 2.4 | |
| Arsenic, dissolved | mg/L | | | | | -0.0002 | U | -0.0002 | U |
| Arsenic, total recoverable | mg/L | | | | | 0.0015 | | 0.0006 | B |
| Bicarbonate as CaCO3 | mg/L | 41 | 138 | 78 | | 36.7 | | 112 | |
| Boron, dissolved | mg/L | | | | | -0.01 | U | 0.01 | B |
| Boron, total | mg/L | | | | | 0.02 | B | 0.02 | B |
| Cadmium, dissolved | mg/L | | | | | -0.005 | U | -0.005 | U |
| Cadmium, potentially dissolved | mg/L | | | | | -0.005 | U | -0.005 | U |
| Calcium, dissolved | mg/L | | | | | 10.8 | | 27.1 | |
| Carbonate as CaCO3 | mg/L | | | | | -2 | U | -2 | U |
| Cation - Anion Balance | % | | | | | -0.1 | | -6.7 | |
| Sum of Cations | meq/L | | | | | 0.823 | | 2.1 | |
| Chloride | mg/L | 1.6 | 8 | 3.8 | | 1 | B | 2 | |
| Chromium, total | mg/L | | | | | 0.01 | B | -0.01 | U |
| Conductivity @25C | µmhos/cm | | | | | 88.7 | | 195 | |
| Copper, dissolved | mg/L | | | | | -0.01 | U | -0.01 | U |
| Cyanide, total | mg/L | | | | | -0.003 | U | -0.003 | U |
| Hardness as CaCO3 | mg/L | 39.3 | 109 | 68.7 | | 34 | | 86 | |
| Hydroxide as CaCO3 | mg/L | | | | | -2 | U | -2 | U |
| Iron, dissolved | mg/L | | 0.126 | 0.065 | | 0.05 | | -0.02 | U |
| Iron, total | mg/L | 0.09 | 3.8 | 0.92 | | 5.61 | | 0.49 | |
| Iron, total recoverable | mg/L | | | | | 5.88 | | 0.11 | |
| Lead, dissolved | mg/L | | | | | -0.03 | U | -0.03 | U |
| Magnesium, dissolved | mg/L | | | | | 1.7 | | 4.5 | |
| Manganese, dissolved | mg/L | 0.0002 | 0.05 | 0.01 | | -0.005 | U | -0.005 | U |
| Manganese, total | mg/L | | | | | 0.134 | | 0.026 | B |
| Mercury, total | mg/L | | | | | -0.0002 | U | -0.0002 | U |
| Molybdenum, dissolved | mg/L | | | | | -0.02 | U | -0.02 | U |
| Nickel, dissolved or potentially dissolved | mg/L | | | | | -0.008 | U | -0.008 | U |
| Nickel, total | mg/L | | | | | -0.008 | U | 0.01 | B |
| Nitrate/Nitrite (as N) | mg/L | | | | | 0.07 | B | -0.02 | U |
| Nitrogen, ammonia | mg/L | | | | | -0.1 | U | -0.05 | U |
| pH | SU | 7 | 8.8 | 8.1 | | 7.9 | H | 8.3 | H |
| Phosphate | mg/L | | | | | 0.06 | B | -0.06 | U |
| Phosphorus, ortho dissolved | mg/L | | 2.74 | 0.25 | | 0.02 | B | -0.02 | UH |
| Potassium, dissolved | mg/L | | | | | 0.5 | B | 1.2 | |
| Selenium, total recoverable | mg/L | | | | | 0.0002 | B | 0.0001 | B |
| Silver, total | mg/L | | | | | 0.00006 | B | -0.00005 | U |
| Sodium Adsorption Ratio (SAR) | calc. | | | | | 0.22 | | 0.33 | |
| Sodium, dissolved | mg/L | | | | | 2.9 | | 7.0 | |
| Sulfate | mg/L | 4 | 25 | 12 | | 3.0 | B | 6.6 | |
| TDS (ratio - measured/calculated) | mg/L | | | | | 1.7 | | 1.03 | |
| TDS (calculated) | calc. | | | | | 42.3 | | 117 | |
| Residue, Filterable (TDS) @180C | mg/L | 36 | 180 | 101 | | 72 | | 120 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 6.4 | 107 | 36 | | 185 | | 10.0 | B |
| Zinc, dissolved | mg/L | | | | | -0.01 | U | 0.01 | B |

[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

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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Upper Sylvester Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q [4] | 9/5/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | 0.26' | 0.64' | 0.45' | 0.06' | 0.02' | | dry |
| Conductivity (Field) | µmhos/cm | 300 | 380 | 340 | 654 | 669 | | |
| pH (Field) | SU | 8.1 | 8.3 | 8.2 | 8.57 | 8.59 | | |
| Temperature (Field) | °C | 8.4 | 9.5 | 9.0 | 10.7 | 16.2 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-12 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 212 | 212 | 212 | | | | |
| Aluminum, dissolved | mg/L | 0.03 | 0.03 | 0.03 | | | | |
| Sum of Anions | meq/L | 5.1 | 5.1 | 5.1 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 4.7 | 4.7 | 4.7 | | | | |
| Chloride | mg/L | 2 | 2 | 2 | | | | |
| Conductivity @25C | µmhos/cm | 462 | 462 | 462 | | 631 | | |
| 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 | | 0.07 | | |
| Iron, total | mg/L | 0.07 | 0.07 | 0.07 | | 3.55 | | |
| 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 250 | 260 | 255 | | 416 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 8 | 20 | 14 | | 30.0 | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Middle Sylvester Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/7/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | 0.32' | 0.23' | | dry |
| Conductivity (Field) | µmhos/cm | | | | 791 | 862 | | |
| pH (Field) | SU | | | | 8.77 | 8.87 | | |
| Temperature (Field) | °C | | | | 16.2 | 14.8 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37661-03 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/9-7/7 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | | | | | 338 | | |
| Aluminum, dissolved | mg/L | | | | | -0.03 | U | |
| Sum of Anions | meq/L | | | | | 9.0 | | |
| Arsenic, dissolved | mg/L | | | | | 6 | B | |
| Arsenic, total recoverable | mg/L | | | | | 0.0004 | B | |
| Bicarbonate as CaCO3 | mg/L | | 448 | 310 | | 299 | | |
| Boron, dissolved | mg/L | | | | | 0.09 | | |
| Boron, total | mg/L | | | | | 0.11 | | |
| Cadmium, dissolved | mg/L | | | | | -0.005 | U | |
| Cadmium, potentially dissolved | mg/L | | | | | -0.005 | U | |
| Calcium, dissolved | mg/L | | | | | 37.8 | | |
| Carbonate as CaCO3 | mg/L | | | | | 38.9 | | |
| Cation - Anion Balance | % | | | | | -0.6 | | |
| Sum of Cations | meq/L | | | | | 8.9 | | |
| Chloride | mg/L | 3 | 10 | 5 | | 16.3 | | |
| Chromium, total | mg/L | | | | | 0.01 | B | |
| Conductivity @25C | µmhos/cm | 480 | 800 | 606 | | 798 | | |
| Copper, dissolved | mg/L | | | | | -0.01 | U | |
| Cyanide, total | mg/L | | | | | -0.003 | U | |
| Hardness as CaCO3 | mg/L | 159 | 234 | 194 | | 187 | | |
| Hydroxide as CaCO3 | mg/L | | | | | -2 | U | |
| Iron, dissolved | mg/L | | 0.4 | 0.1 | | 0.06 | | |
| Iron, total | mg/L | 0.05 | 10.5 | 2.0 | | 0.8 | | |
| Iron, total recoverable | mg/L | | | | | 0.85 | | |
| Lead, dissolved | mg/L | | | | | -0.03 | U | |
| Magnesium, dissolved | mg/L | | | | | 22.4 | | |
| Manganese, dissolved | mg/L | | | | | -0.005 | U | |
| Manganese, total | mg/L | | 0.56 | 0.05 | | 0.036 | | |
| Mercury, total | mg/L | | | | | -0.0002 | U | |
| Molybdenum, dissolved | mg/L | | | | | -0.02 | U | |
| Nickel, dissolved or potentially dissolved | mg/L | | | | | -0.008 | U | |
| Nickel, total | mg/L | | | | | -0.008 | U | |
| Nitrate/Nitrite (as N) | mg/L | | 0.08 | 0.02 | | 0.04 | B | |
| Nitrogen, ammonia | mg/L | | | | | -0.1 | U | |
| pH | SU | 7.35 | 8.70 | 8.08 | | 8.6 | H | |
| Phosphate | mg/L | | | | | 0.09 | B | |
| Phosphorus, ortho dissolved | mg/L | | 0.875 | 0.110 | | 0.03 | B | |
| Potassium, dissolved | mg/L | | | | | 2.4 | | |
| Selenium, total recoverable | mg/L | | | | | 0.0006 | | |
| Silver, total | mg/L | | | | | -0.00005 | U | |
| Sodium Adsorption Ratio (SAR) | calc. | 2.29 | 3.02 | 2.70 | | 3.8 | | |
| Sodium, dissolved | mg/L | | | | | 117 | | |
| Sulfate | mg/L | 28.2 | 80 | 46.1 | | 87.1 | | |
| TDS (ratio - measured/calculated) | mg/L | | | | | 1.03 | | |
| TDS (calculated) | calc. | | | | | 489 | | |
| Residue, Filterable (TDS) @180C | mg/L | 3.68 | 584 | 381 | | 506 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 4.2 | 5,740 | 419 | | 33.0 | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower Sylvester Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | 0.07 | 0.07 | 0.07 | not measured | not measured | | dry |
| Conductivity (Field) | µmhos/cm | 620 | 700 | 653 | 782 | 811 | | |
| pH (Field) | SU | 8.50 | 9.70 | 8.90 | 8.80 | 8.80 | | |
| Temperature (Field) | °C | 7.9 | 10.2 | 9 | 15.9 | 18.0 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-11 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| Sampled By | | | | | | PH | | |
| 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 | | | | |
| Sum of Cations | meq/L | 7.5 | 7.5 | 7.5 | | | | |
| Chloride | mg/L | 4 | 4 | 4 | | | | |
| Conductivity @25C | µmhos/cm | 597 | 597 | 597 | | 753 | | |
| 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 | | 0.07 | | |
| Iron, total | mg/L | 0.17 | 0.17 | 0.17 | | 0.83 | | |
| 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 | | 8.7 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 400 | 430 | 410 | | 486 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 5 | 120 | 74 | | -5 | U | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower Minnesota Creek** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | 1.34' | 1.68' | | 0.36' |
| Conductivity (Field) | µmhos/cm | | | | 181.7 | 154.6 | | 246 |
| pH (Field) | SU | | | | 7.94 | 8.42 | | 8.39 |
| Temperature (Field) | °C | | | | 10.4 | 11.0 | | 12.0 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-16 | | |
| Sample Date | | | | | | 5/25/2015 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | 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 | | 168 | | |
| Hardness as CaCO3 | mg/L | 65 | 106 | 82 | | | | |
| Iron, dissolved | mg/L | 0.23 | 0.58 | 0.41 | | 0.07 | | |
| Iron, total | mg/L | 0.45 | 82 | 8.9 | | 12.7 | | |
| 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 | | | | | 8.3 | H | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 100 | 584 | 231 | | 118 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 16 | 1,300 | 292 | | 580 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: U. Minnesota Ck Flume (USFS)** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | flooding | flooding | | 0.59' |
| Conductivity (Field) | µmhos/cm | | | | 176.4 | 136.8 | | 180.4 |
| pH (Field) | SU | | | | 8.26 | 8.32 | | 8.59 |
| Temperature (Field) | °C | | | | 10.1 | 11.0 | | 12.8 |
| Comment | | | | | flooding spillways | flooding spillways | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-17 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Conductivity @25C | µmhos/cm | | | | | 148 | | |
| Iron, dissolved | mg/L | | | | | 0.07 | | |
| Iron, total | mg/L | | | | | 15.9 | | |
| pH | SU | | | | | 8.2 | H | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | 120 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | 552 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower Dry Fork Flume** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | 0.07' | 0.67' | | 0.28' |
| Conductivity (Field) | µmhos/cm | | | | 1,453 | 405 | | 316 |
| pH (Field) | SU | | | | 8.67 | 8.66 | | 8.64 |
| Temperature (Field) | °C | | | | 13.3 | 15.3 | | 12.5 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-19 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | 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 | | 363 | | |
| Hardness as CaCO3 | mg/L | 125 | 726 | 360 | | | | |
| Iron, dissolved | mg/L | | 0.178 | 0.049 | | 0.06 | | |
| Iron, total | mg/L | 0.02 | 84 | 5.6 | | 2.1 | | |
| 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 | |
| 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 | | 252 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 1.2 | 1,098 | 144 | | 57.0 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Middle Dry Fork Flume** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | 0.84' | 0.70' | | 0.28' |
| Conductivity (Field) | µmhos/cm | 30 | 480 | 213 | 149.5 | 114.5 | | 133 |
| pH (Field) | SU | 7.80 | 8.50 | 8.20 | 8.23 | 8.26 | | 8.29 |
| Temperature (Field) | °C | 3.6 | 19.8 | 12 | 9.3 | 14.5 | | 12.0 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-18 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 34 | 270 | 142 | | | | |
| Aluminum, dissolved | mg/L | 0.07 | 0.07 | 0.07 | | | | |
| Sum of Anions | meq/L | 1.1 | 1.1 | 1.1 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 0.7 | 0.7 | 0.7 | | | | |
| Chloride | mg/L | | 4 | 1 | | | | |
| Conductivity @25C | µmhos/cm | 76 | 76 | 76 | | 123 | | |
| Hardness as CaCO3 | mg/L | 23 | 208 | 115 | | | | |
| Iron, dissolved | mg/L | 0.11 | 0.11 | 0.11 | | 0.24 | | |
| Iron, total | mg/L | 0.16 | 14.2 | 3.14 | | 5.9 | | |
| 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 | | 8.2 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 50 | 300 | 172 | | 98 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 278 | 72 | | 183 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Upper Dry Fork Flume** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | 0.08' | 0.58' | 0.28' | 0.73' | 0.77' | | 0.37' |
| Conductivity (Field) | µmhos/cm | 114 | 699 | 310 | 81.3 | 64.6 | | 62.2 |
| pH (Field) | SU | 7.01 | 8.42 | 7.76 | 8.15 | 8.07 | | 8.15 |
| Temperature (Field) | °C | 11.9 | 16.0 | 13.5 | 6.5 | 15.3 | | 12.0 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-10 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 24 | 100 | 57 | | | | |
| Aluminum, dissolved | mg/L | 0.04 | 0.34 | 0.13 | | | | |
| Sum of Anions | meq/L | 0.5 | 2.2 | 1.4 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 0.4 | 2.4 | 1.3 | | | | |
| Chloride | mg/L | 1 | 8 | 3 | | | | |
| Conductivity @25C | µmhos/cm | 47 | 246 | 135 | | 69 | | |
| 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 | | 0.09 | | |
| Iron, total | mg/L | 1.70 | 3.64 | 2.75 | | 2.04 | | |
| 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 | | 8.0 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | mg/L | 1.22 | 1.74 | 1.52 | | | | |
| TDS (calculated) | calc. | 23 | 123 | 73 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 40 | 160 | 105 | | 60 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 24 | 88 | 42 | | 49.0 | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lick Creek Flume** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | staff gage | | | | 0.48' | 0.23' | | dry |
| Conductivity (Field) | µmhos/cm | | | | 127.2 | 137.2 | | |
| pH (Field) | SU | | | | 8.22 | 8.30 | | |
| Temperature (Field) | °C | | | | 10.4 | 12.1 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-07 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| 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 | | 148 | | |
| Hardness as CaCO3 | mg/L | 45 | 169 | 87 | | | | |
| Iron, dissolved | mg/L | | 0.56 | 0.13 | | 0.07 | | |
| Iron, total | mg/L | 0.49 | 11.3 | 4.06 | | 1.69 | | |
| 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 | | 8.2 | H | |
| Phosphorus, ortho dissolved | mg/L | | 1.67 | 0.19 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 90 | 552 | 169 | | 94 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 4 | 614 | 157 | | 60.0 | | |

[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.

## Horse Gulch
## Surface Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Horse Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | 9/7/2017 |
| **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 | | | |
| Sum of Anions | meq/L | 6.5 | 6.5 | 6.5 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 5.9 | 5.9 | 5.9 | | | |
| 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 | | | |
| 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 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 170 | 440 | 354 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: E. Gulch, E. of Horse Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | Q[4] | 9/5/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 25.96 | 0.62 | | dry |
| Conductivity (Field) | µmhos/cm | 260 | 480 | 402 | 560 | 545 | | |
| pH (Field) | SU | 7.7 | 8.4 | 8.0 | 8.60 | 8.93 | | |
| Temperature (Field) | °C | 4.8 | 14.8 | 10.0 | 13.9 | 21.9 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-11 | | |
| Sample Date | | | | | | 5/28-6/3 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 135 | 245 | 202 | | | | |
| Aluminum, dissolved | mg/L | 0.03 | 0.03 | 0.03 | | | | |
| Sum of Anions | meq/L | 4.9 | 4.9 | 4.9 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 4.9 | 4.9 | 4.9 | | | | |
| Chloride | mg/L | 1 | 4 | 2 | | | | |
| Conductivity @25C | µmhos/cm | 453 | 453 | 453 | | 500 | | |
| Hardness as CaCO3 | mg/L | 95 | 190 | 156 | | | | |
| Iron, dissolved | mg/L | 0.05 | 0.05 | 0.05 | | 0.04 | B | |
| Iron, total | mg/L | 0.41 | 3.59 | 1.07 | | 1.85 | | |
| 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 | | 8.8 | H | |
| 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 | | | | |
| Sodium Adsorption Ratio (SAR) | calc. | 0.94 | 1.65 | 1.5 | | | | |
| Sodium, dissolved | mg/L | 20.9 | 47.8 | 40.2 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 170 | 290 | 252 | | 340 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 50 | 17 | | 16.0 | B | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Upper Deep Creek** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 2,029 | 1,367 | | 116 |
| Conductivity (Field) | µmhos/cm | 80 | 310 | 192 | 229 | 261 | | 460 |
| pH (Field) | SU | 8.10 | 8.80 | 8.50 | 8.31 | 8.39 | | 8.63 |
| Temperature (Field) | °C | 0.2 | 18.6 | 10.0 | 10.5 | 16.7 | | 13.9 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-04 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | | 160 | 103.4 | | | | |
| Sum of Anions | meq/L | 1.5 | 2.6 | 2.1 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 1.4 | 2.5 | 2.0 | | | | |
| Chloride | mg/L | | 2 | 0.2 | | | | |
| Conductivity @25C | µmhos/cm | 139 | 242 | 191 | | 243 | | |
| Hardness as CaCO3 | mg/L | 47 | 138 | 91 | | | | |
| Iron, dissolved | mg/L | 0.02 | 0.04 | 0 | | 0.06 | | |
| Iron, total | mg/L | 0.14 | 9.43 | 2.63 | | 1.67 | | |
| 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 | | 8.4 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 60 | 210 | 133 | | 162 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | 96.0 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower Deep Creek** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 2,939 | 1,397 | | 119 |
| Conductivity (Field) | µmhos/cm | 120 | 380 | 246 | 271 | 292 | | 470 |
| pH (Field) | SU | 8.10 | 8.80 | 8.50 | 8.48 | 8.47 | | 8.75 |
| Temperature (Field) | °C | 0.1 | 16.4 | 10.0 | 11.2 | 8.7 | | 14.1 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-15 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 61 | 183 | 126 | | | | |
| Aluminum, dissolved | mg/L | | 0.03 | 0.02 | | | | |
| Sum of Anions | meq/L | 1.8 | 3.2 | 2.5 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 1.7 | 2.8 | 2.25 | | | | |
| Chloride | mg/L | | 2 | 1 | | | | |
| Conductivity @25C | µmhos/cm | 162 | 270 | 216 | | 267 | | |
| Iron, dissolved | mg/L | 0.03 | 0.43 | 0.23 | | 0.03 | B | |
| Iron, total | mg/L | 0.11 | 5.83 | 1.68 | | 1.91 | | |
| 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 | | 8.5 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 90 | 250 | 165 | | 182 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 448 | 93 | | -5 | 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 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Box Canyon** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/7/2017 |
| **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)] | | | |
| Sum of Anions | meq/L | 10.3 | 12.1 | 11.1 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 9.5 | 12.23 | 11.1 | | | |
| 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 | | | |
| 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 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 540 | 620 | 586 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 0 | 38 | 19 | | | |
| 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Deer Creek** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/10/2017 | 6/8/2017 | 9/7/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | 0.72 | 114 | 44.7 | dry | dry | dry |
| Conductivity (Field) | µmhos/cm | 537 | 796 | 659 | | | |
| pH (Field) | SU | 8.3 | 8.4 | 8.4 | | | |
| Temperature (Field) | °C | 11.2 | 16.9 | 13.1 | | | |
| Comment | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | |
| Name of Certified Lab [3] | | | | | | | |
| Lab Reference # | | | | | | | |
| Sample Date | | | | | | | |
| Lab Test Date | | | | | | | |
| Sampled By | | | | | | | |
| Alkalinity (Total CaCO3) | mg/L | 247 | 274 | 263 | | | |
| Aluminum, dissolved | mg/L | -0.03 | -0.03 | -0.03 | | | |
| Sum of Anions | meq/L | 5.6 | 6.2 | 5.9 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 5.0 | 6.8 | 5.9 | | | |
| Chloride | mg/L | 3 | 3 | 3 | | | |
| Conductivity @25C | µmhos/cm | 487 | 547 | 517 | | | |
| 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 | | | |
| Iron, total | mg/L | 0.36 | 2.92 | 1.64 | | | |
| 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 | | | |
| 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 | | | |
| 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 | | | |
| TDS (ratio - measured/calculated) | mg/L | 0.92 | 0.96 | 0.94 | | | |
| TDS (calculated) | calc. | 292 | 346 | 319 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 280 | 330 | 310 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 16 | 68 | 42 | | | |
| 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
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 Ye | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Poison Gulch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 16.29 | 0.80 | | dry |
| Conductivity (Field) | µmhos/cm | 271 | 479 | 383 | 565 | 546 | | |
| pH (Field) | SU | 6.56 | 7.08 | 6.74 | 7.56 | 7.32 | | |
| Temperature (Field) | °C | 10.9 | 12.9 | 12.2 | 12.2 | 12.7 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-06 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 119 | 152 | 136 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | -0.03 | -0.03 | | | | |
| Sum of Anions | meq/L | 2.4 | 3.0 | 2.7 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 2.3 | 3.5 | 2.9 | | | | |
| Chloride | mg/L | 1 | 1 | 1 | | | | |
| Conductivity @25C | µmhos/cm | 240 | 295 | 268 | | 500 | | |
| 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 | | 0.03 | B | |
| Iron, total | mg/L | 0.41 | 0.43 | 0.42 | | 0.09 | | |
| 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 | | 8.2 | H | |
| 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | mg/L | 1.04 | 1.08 | 1.06 | | | | |
| TDS (calculated) | calc. | 120 | 163 | 142 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 130 | 170 | 150 | | 308 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 28 | 15 | | -5 | U | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Deep Creek Ditch** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm / staff | 69.77 | 1527.27 | 562.69 | 0.52' | 0.44' | | 0.19' |
| Conductivity (Field) | µmhos/cm | 75.9 | 131 | 107 | 60.0 | 57.4 | | 49.9 |
| pH (Field) | SU | 6.32 | 8.20 | 7.27 | 7.97 | 8.23 | | 8.31 |
| Temperature (Field) | °C | 5.0 | 11.9 | 9.6 | 9.9 | 12.7 | | 11.1 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-03 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 25 | 60 | 45 | | | | |
| Aluminum, dissolved | mg/L | 0.05 | 0.15 | 0.10 | | | | |
| Sum of Anions | meq/L | 0.5 | 1.4 | 0.9 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 0.4 | 1.2 | 0.9 | | | | |
| Chloride | mg/L | 1 | 9 | 3 | | | | |
| Conductivity @25C | µmhos/cm | 50 | 113 | 88 | | 61.5 | | |
| 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 | | 0.06 | | |
| Iron, total | mg/L | 1.19 | 2.59 | 1.83 | | 2.19 | | |
| 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 | | 7.9 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | mg/L | 1.38 | 2.05 | 1.64 | | | | |
| TDS (calculated) | calc. | 24 | 68 | 47 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 40 | 100 | 75 | | 48 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 8 | 76 | 32 | | 62.0 | | |
| 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 2017 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Minnesota Reservoir Flume** | | **Baseline [1]** | | | **2017 Water Year** | | | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/10/2017 | 6/8/2017 | Q[4] | 6/8/2017 (Duplicate) | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | | | |
| Flow | gpm / staff | 83 | 3,591 | 1,364 | 0.85' | 0.70' | | -- | | 0.27' |
| Conductivity (Field) | µmhos/cm | 114 | 682 | 360 | 169.4 | 137.6 | | -- | | 144.2 |
| pH (Field) | SU | 7.97 | 8.75 | 8.29 | 8.21 | 8.37 | | -- | | 8.46 |
| Temperature (Field) | °C | 14.8 | 24.1 | 18.5 | 10.6 | 16.3 | | -- | | 12.6 |
| Comment | | | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | ACZ | | |
| Lab Reference # | | | | | | L37738-09 | | L37738-14 | | |
| Sample Date | | | | | | 6/8/2017 | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 46 | 230 | 140 | | | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.08 | 0.05 | | | | | | |
| Sum of Anions | meq/L | 0.90 | 4.80 | 3.06 | | | | | | |
| 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 | | | | | | |
| Carbonate as CaCO3 | mg/L | -2 | 18 | 8 | | | | | | |
| Cation - Anion Balance | % | -5.9 | 2.1 | -1.1 | | | | | | |
| Sum of Cations | meq/L | 0.8 | 4.7 | 3.0 | | | | | | |
| Chloride | mg/L | 1.00 | 3.00 | 1.86 | | | | | | |
| Conductivity @25C | µmhos/cm | 95 | 456 | 295 | | 139 | | 138 | | |
| Copper, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | | | | | |
| Hardness as CaCO3 | mg/L | 31 | 192 | 111 | | | | | | |
| Hydroxide as CaCO3 | mg/L | -2 | -2 | -2 | | | | | | |
| Iron, dissolved | mg/L | 0.03 | 0.26 | 0.10 | | 0.09 | | 0.12 | | |
| Iron, total | mg/L | 0.36 | 3.62 | 1.58 | | 3.33 | | 3.38 | | |
| Lead, dissolved | mg/L | -0.04 | -0.04 | -0.04 | | | | | | |
| Magnesium, dissolved | mg/L | 2.1 | 14.1 | 8.1 | | | | | | |
| 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 | | 8.2 | H | 8.3 | 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 | | | | | | |
| 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 | | | | | | |
| TDS (ratio - measured/calculated) | mg/L | 0.99 | 1.74 | 1.24 | | | | | | |
| TDS (calculated) | calc. | 46 | 244 | 158 | | | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 70 | 250 | 176 | | 106 | | 106 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 60 | 26 | | 77.0 | | 77.0 | | |
| 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.

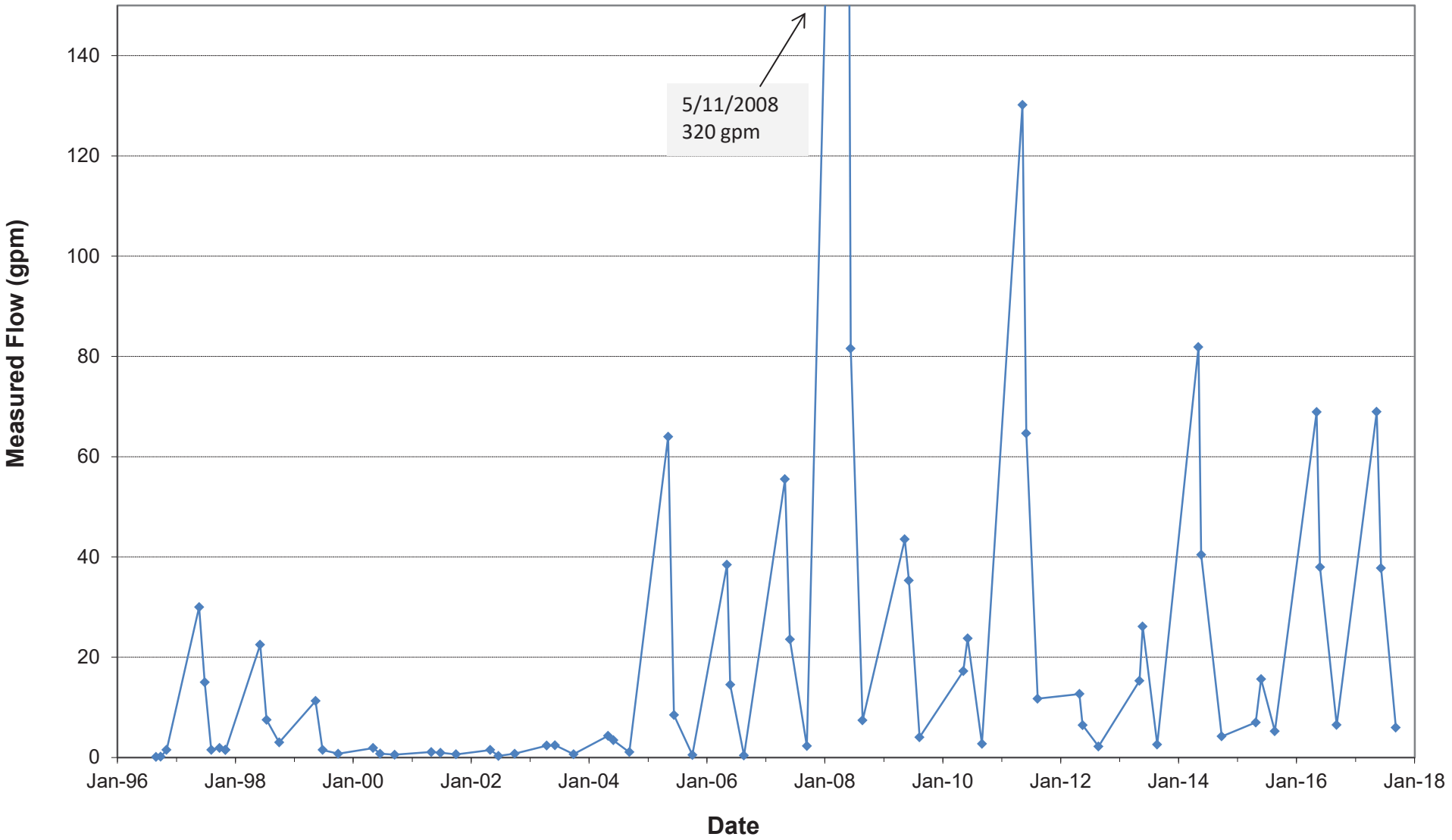
[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte conc detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated value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

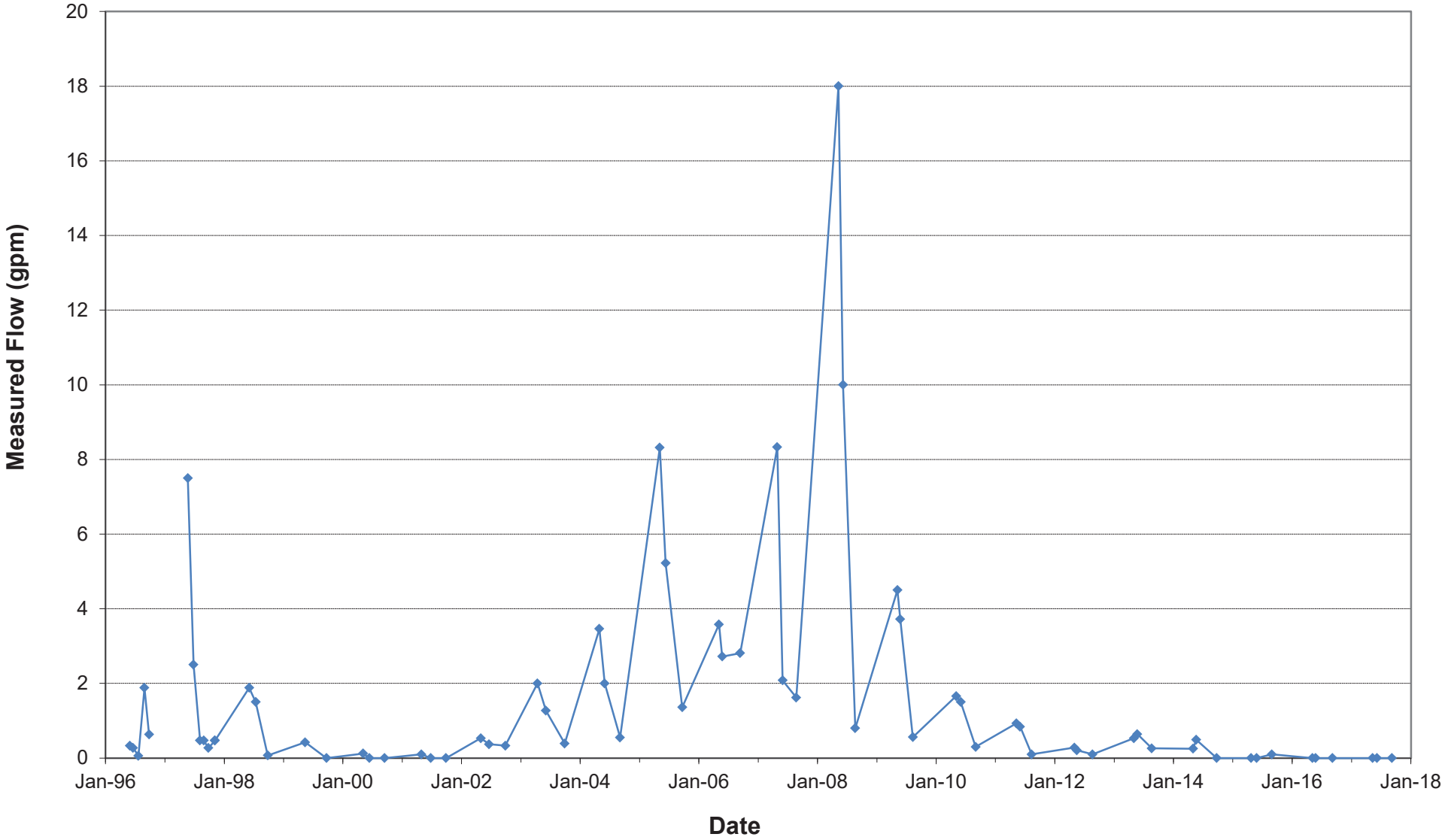
# APPENDIX D

## SPRINGS - HYDROGRAPHS

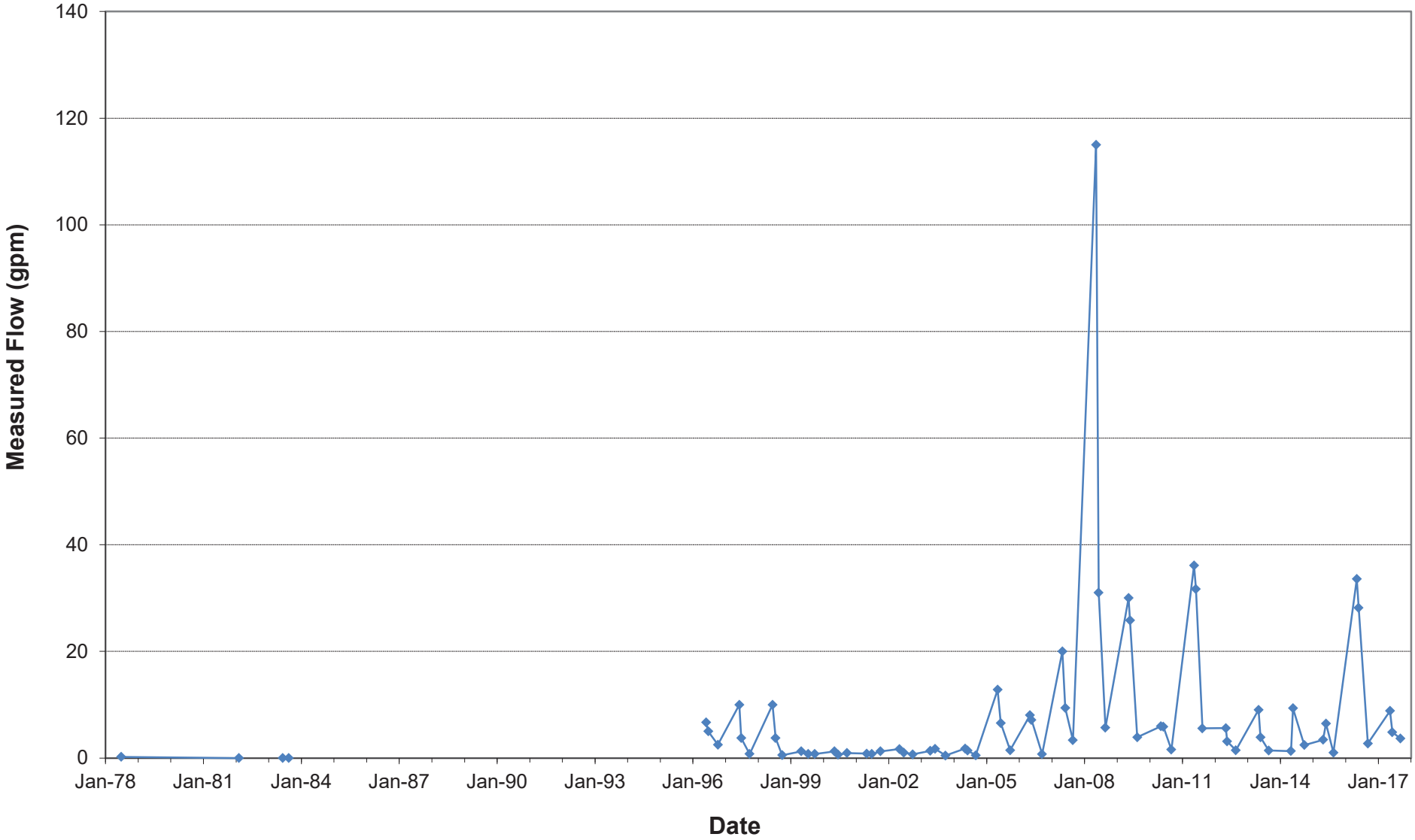
## Spring 26-1
## Source: Above F-Seam



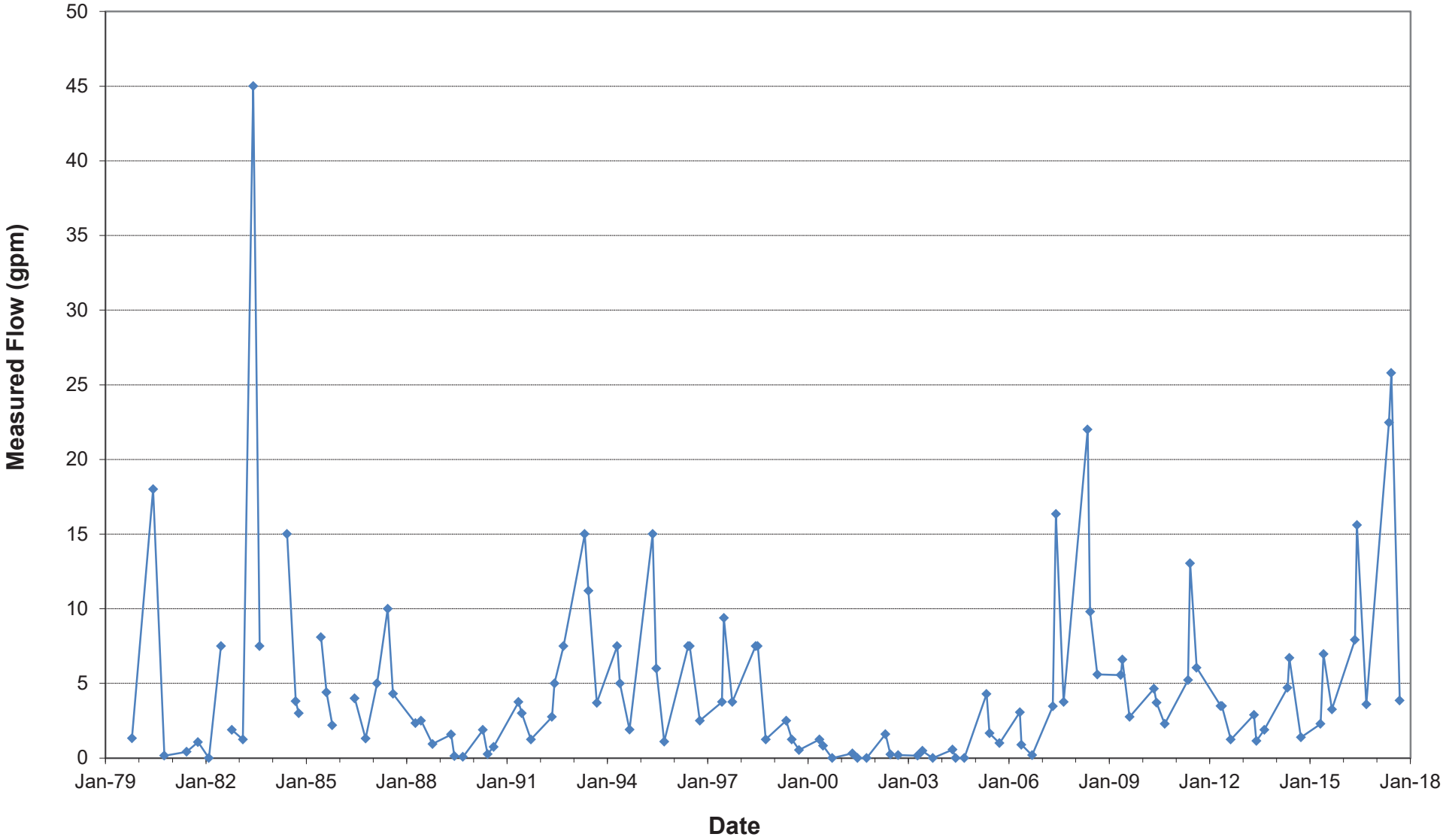
## Spring 27-1
## Source: Above F-Seam



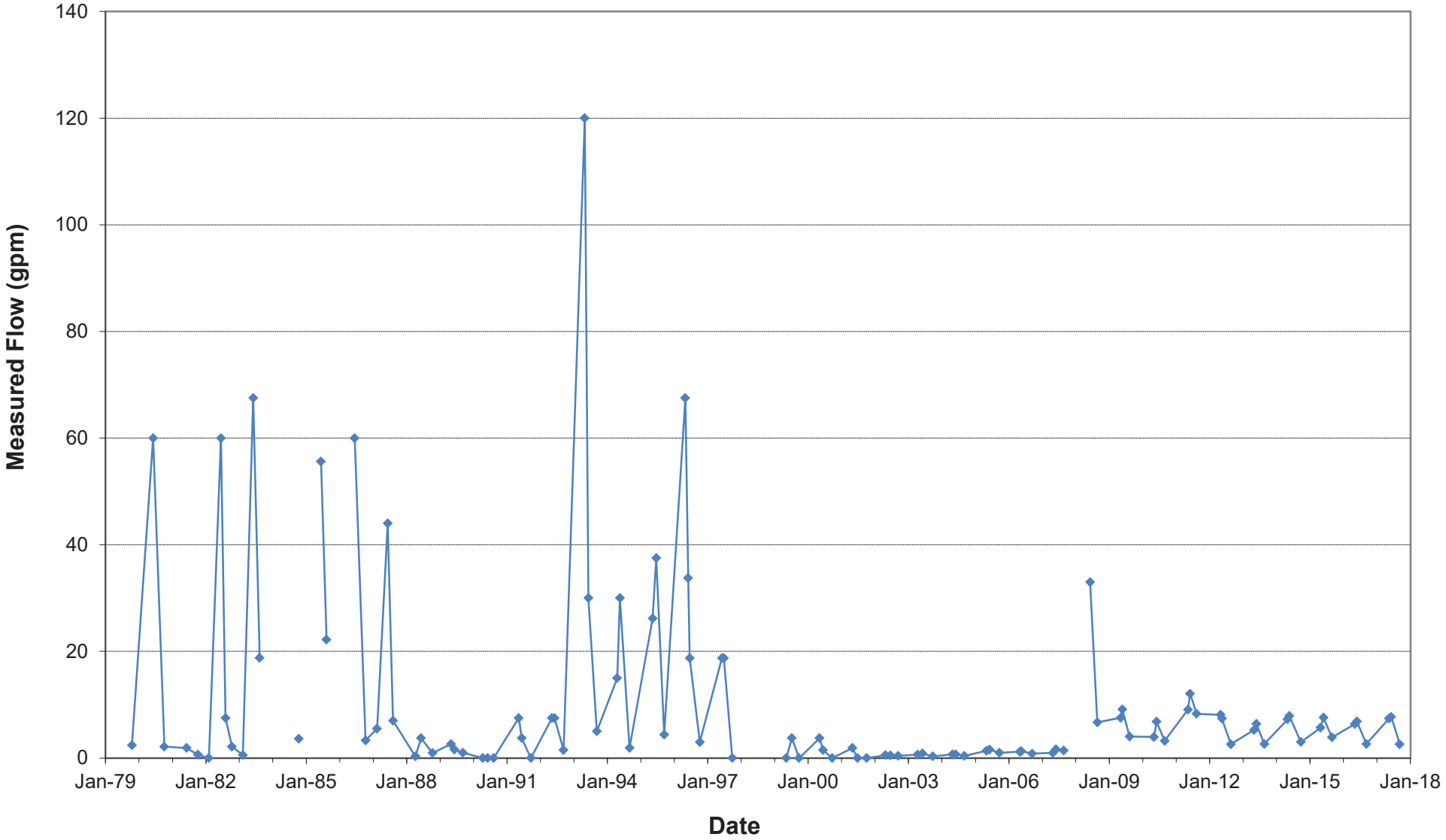
## Spring G-7
## Source: Above F-Seam



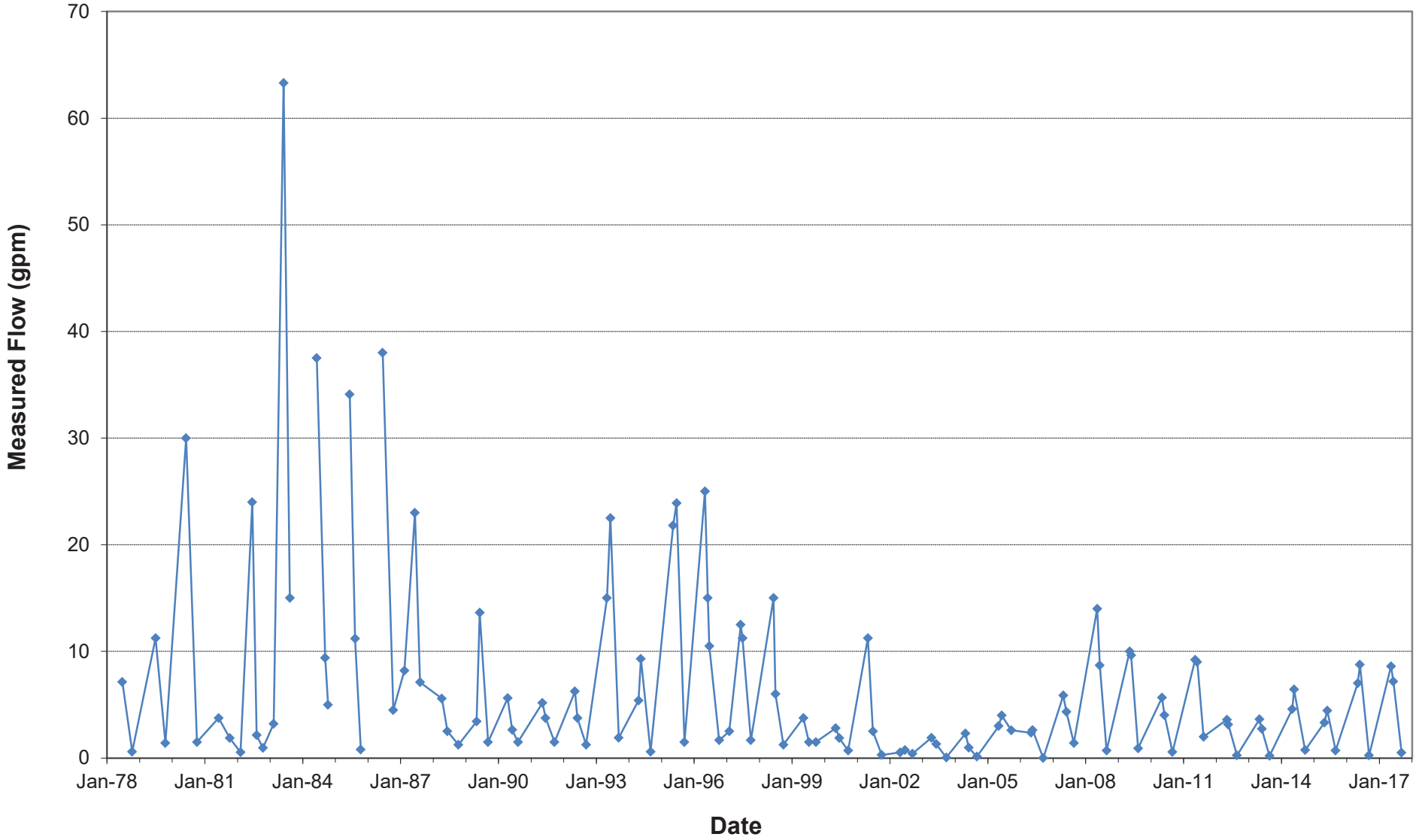
## Spring G-16
## Source: Above F-Seam



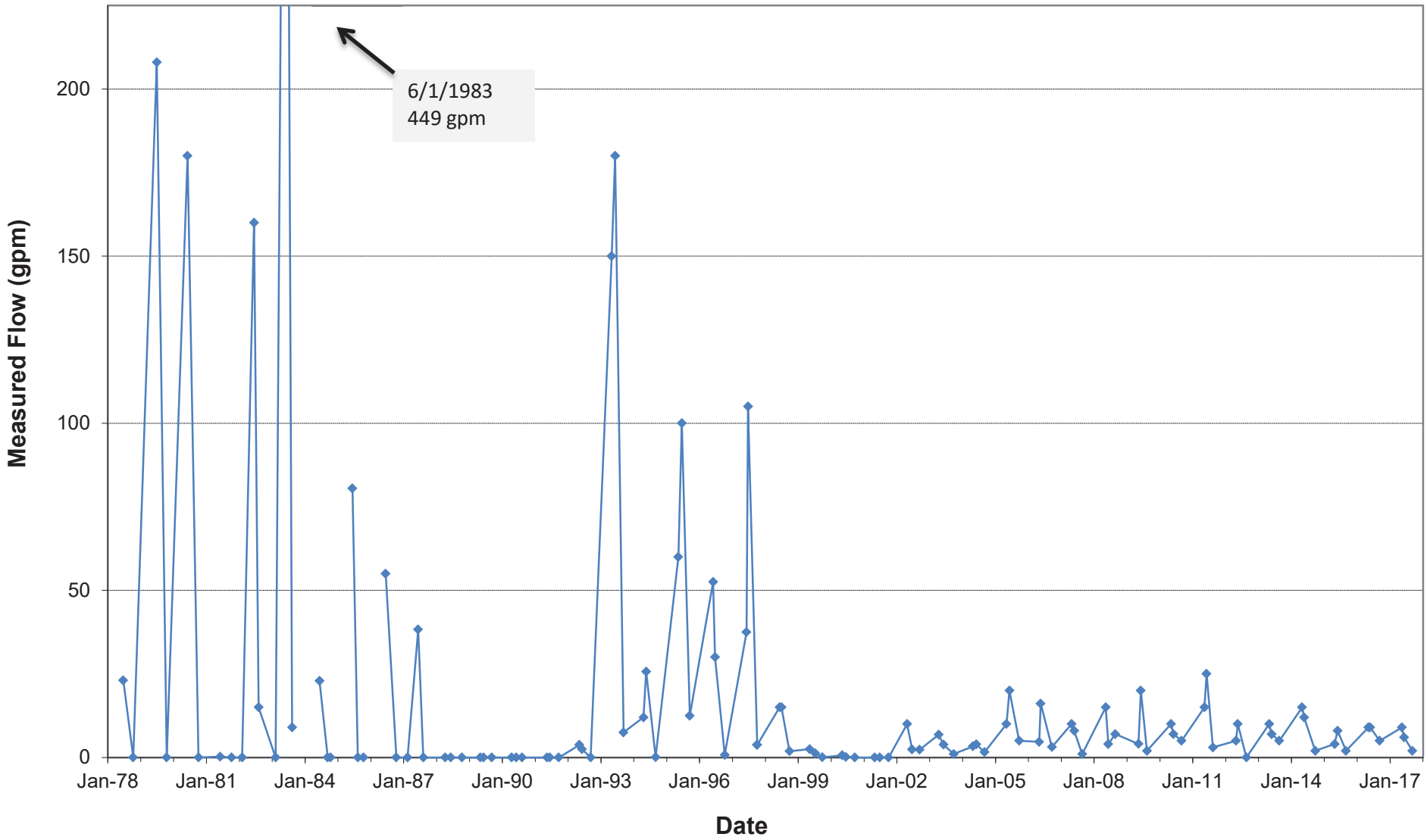
## Spring G-24
## Source: Above F-Seam



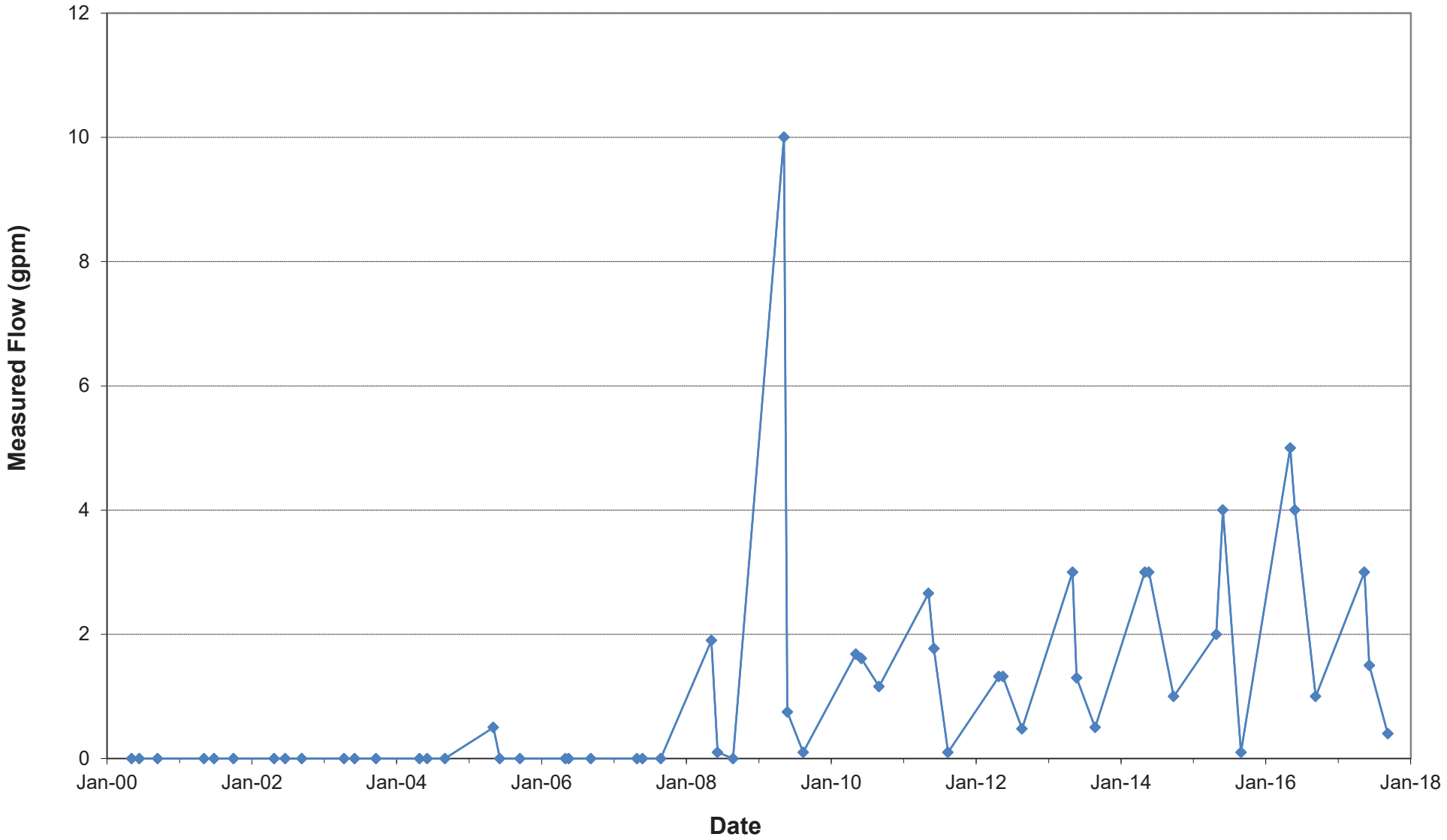
## Spring G-14
## Source: Above F-Seam



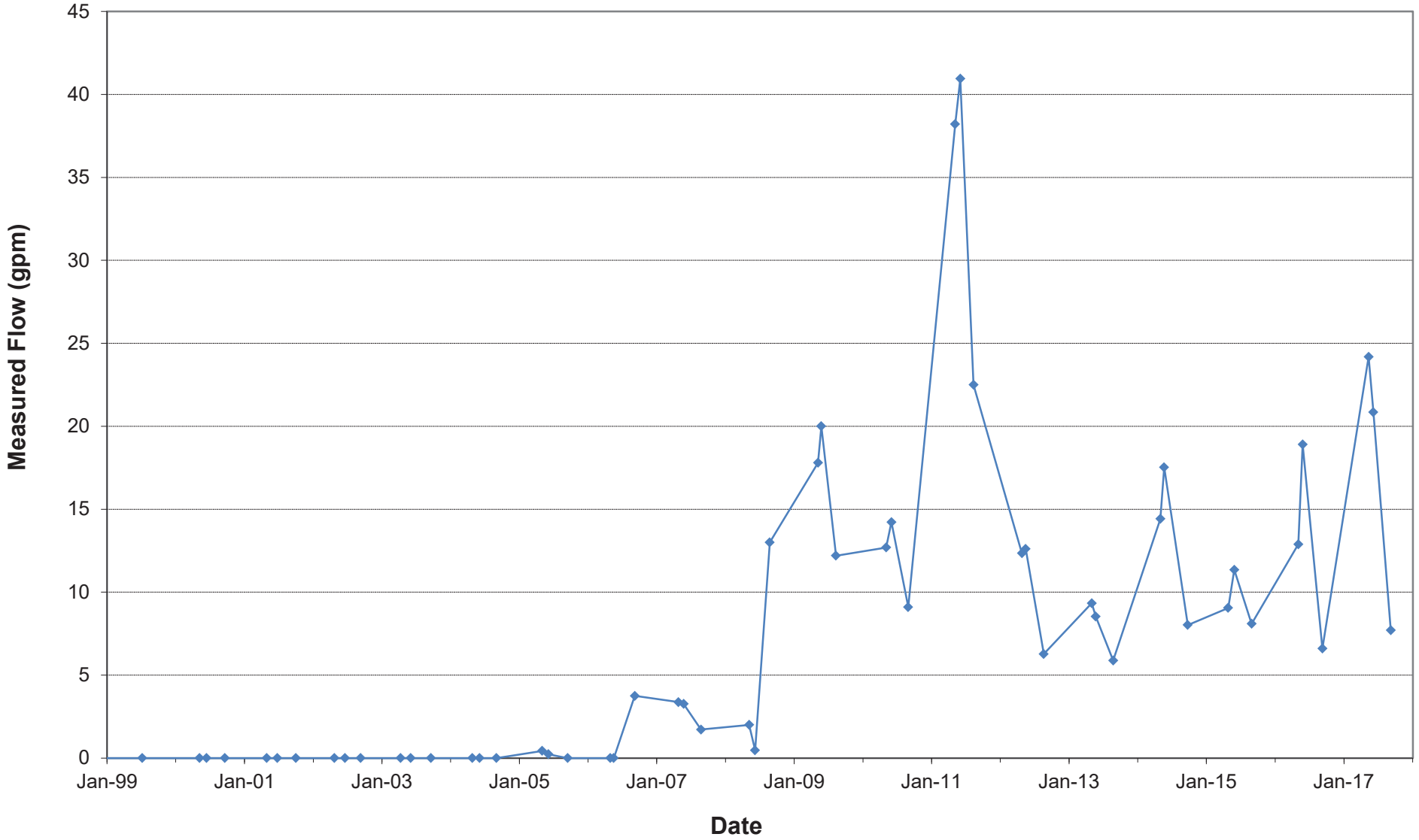
## Spring G-22
## Source: Above F-Seam



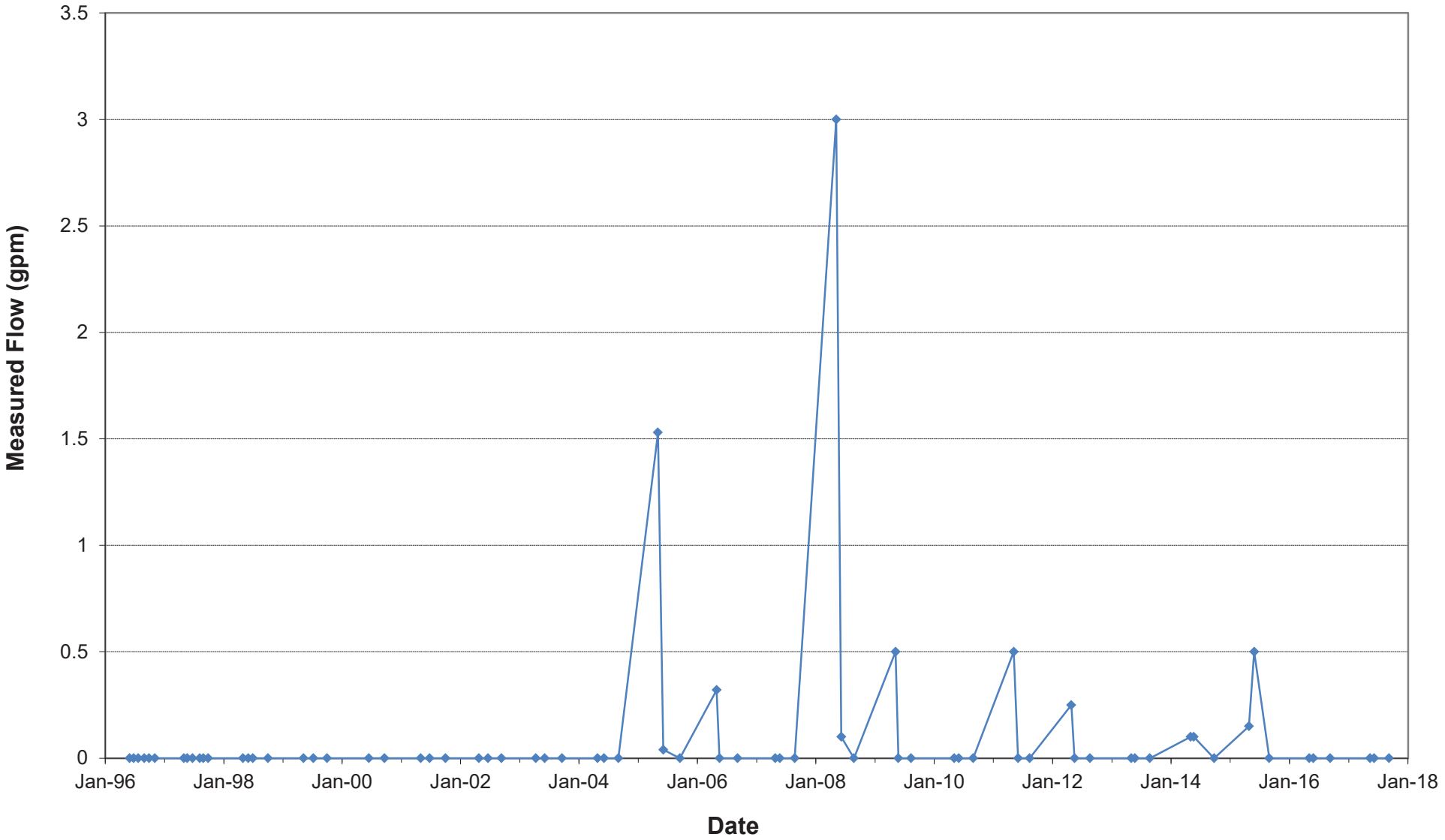
## Spring 11-2
## Source: Below F-Seam



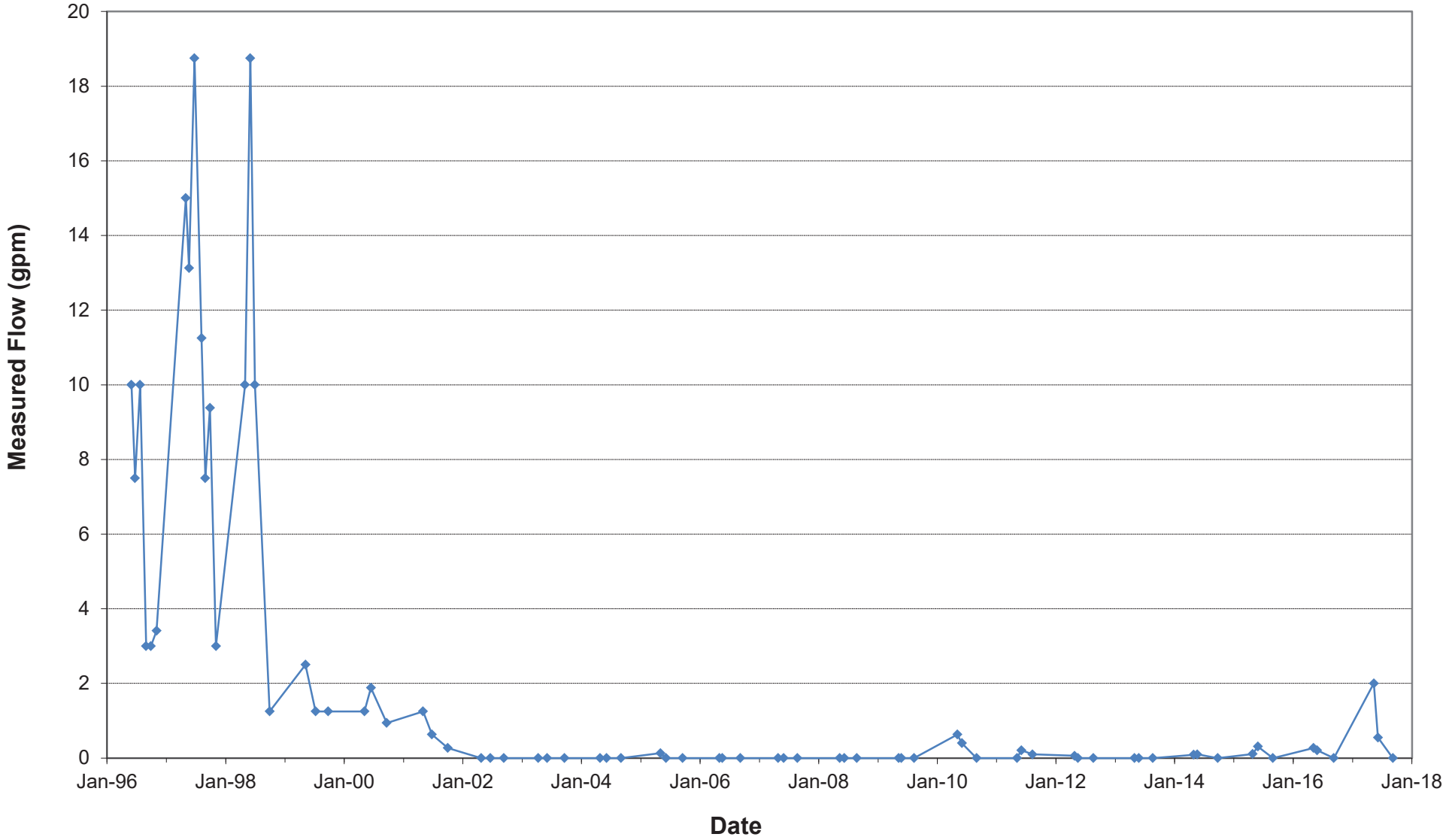
## Spring 10-1
## Source: Below F-Seam



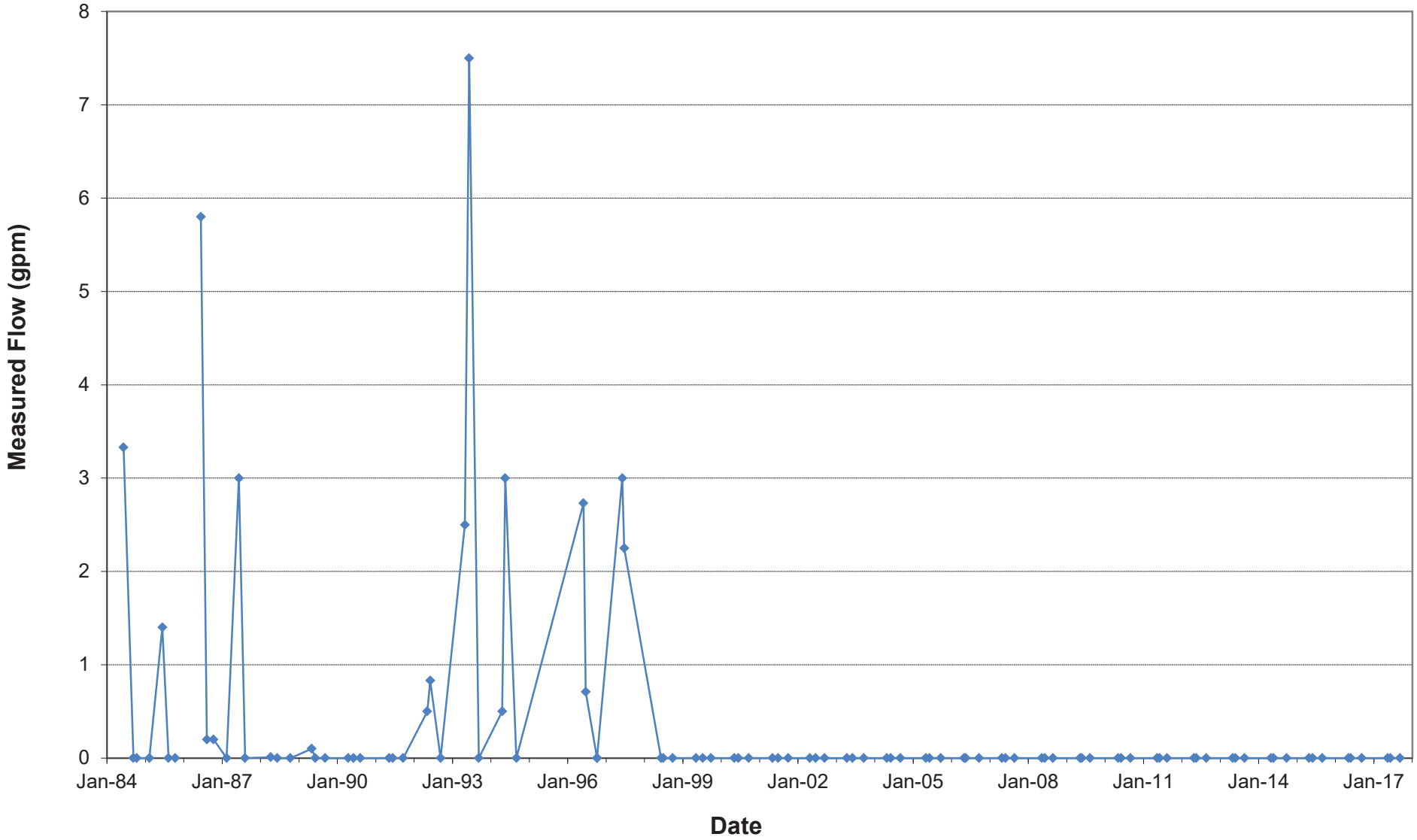
## Spring E10-2
## Source: Below F-Seam



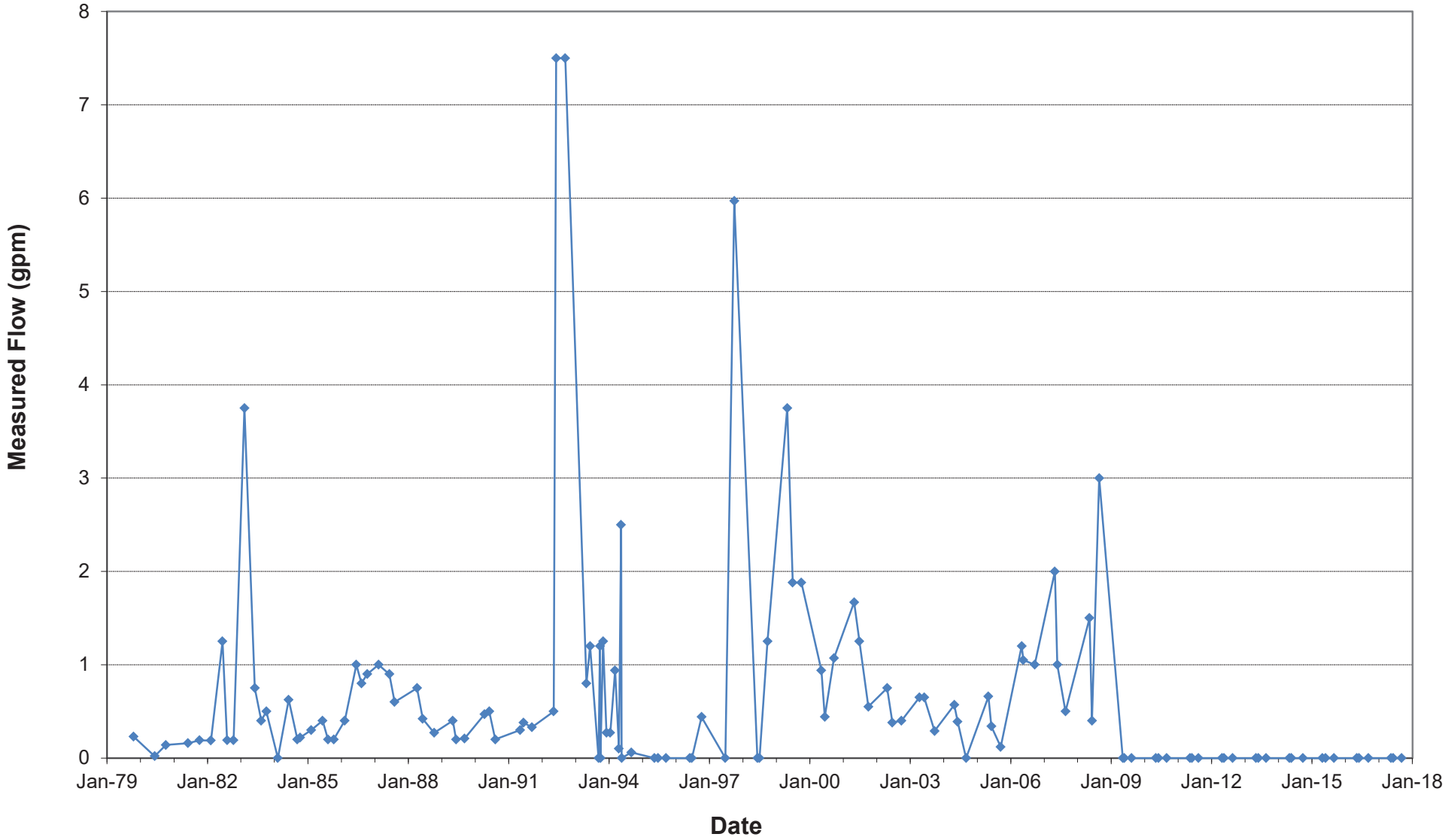
## Spring 15-1
## Source: Below F-Seam



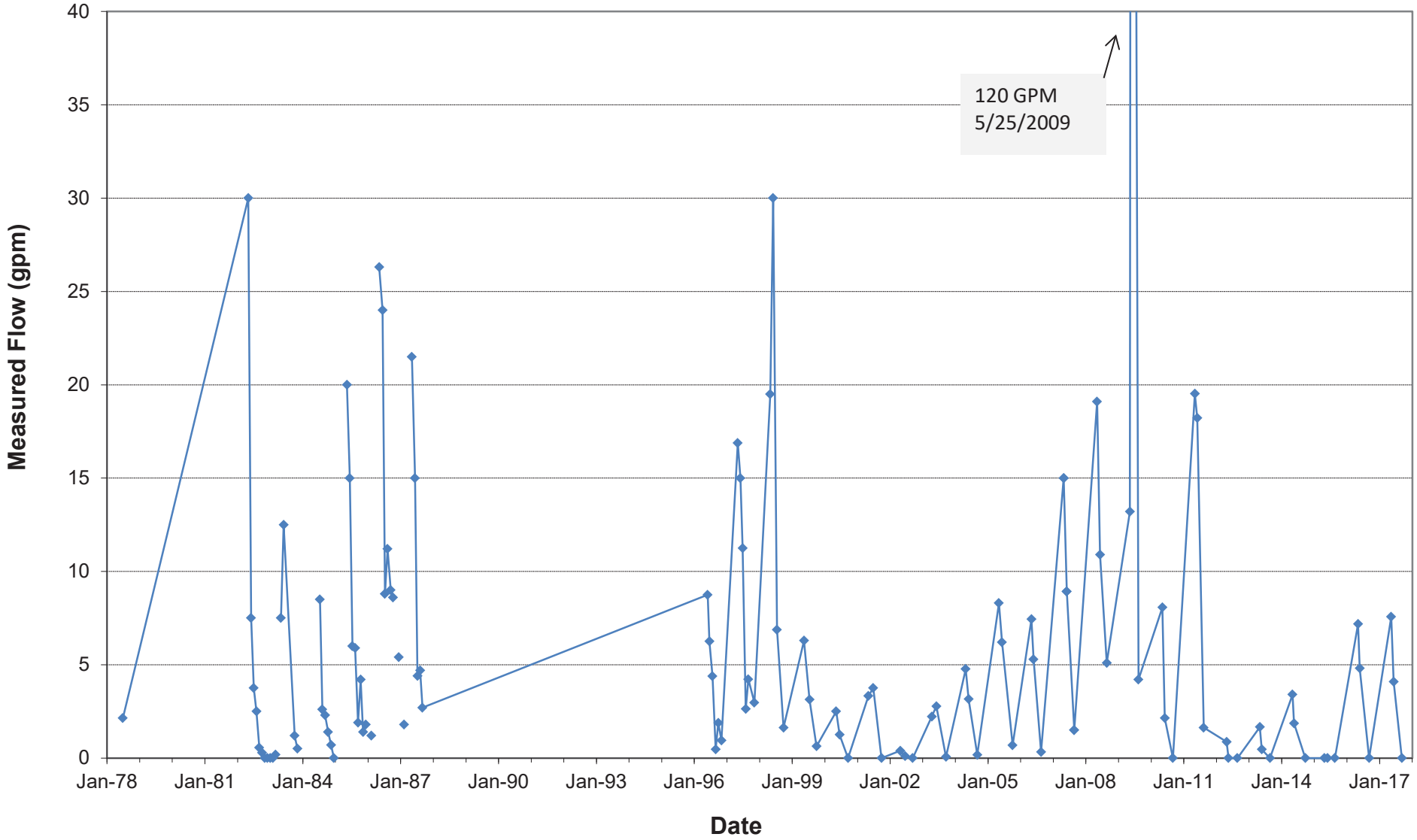
## Spring G-1a
## Source: Below F-Seam



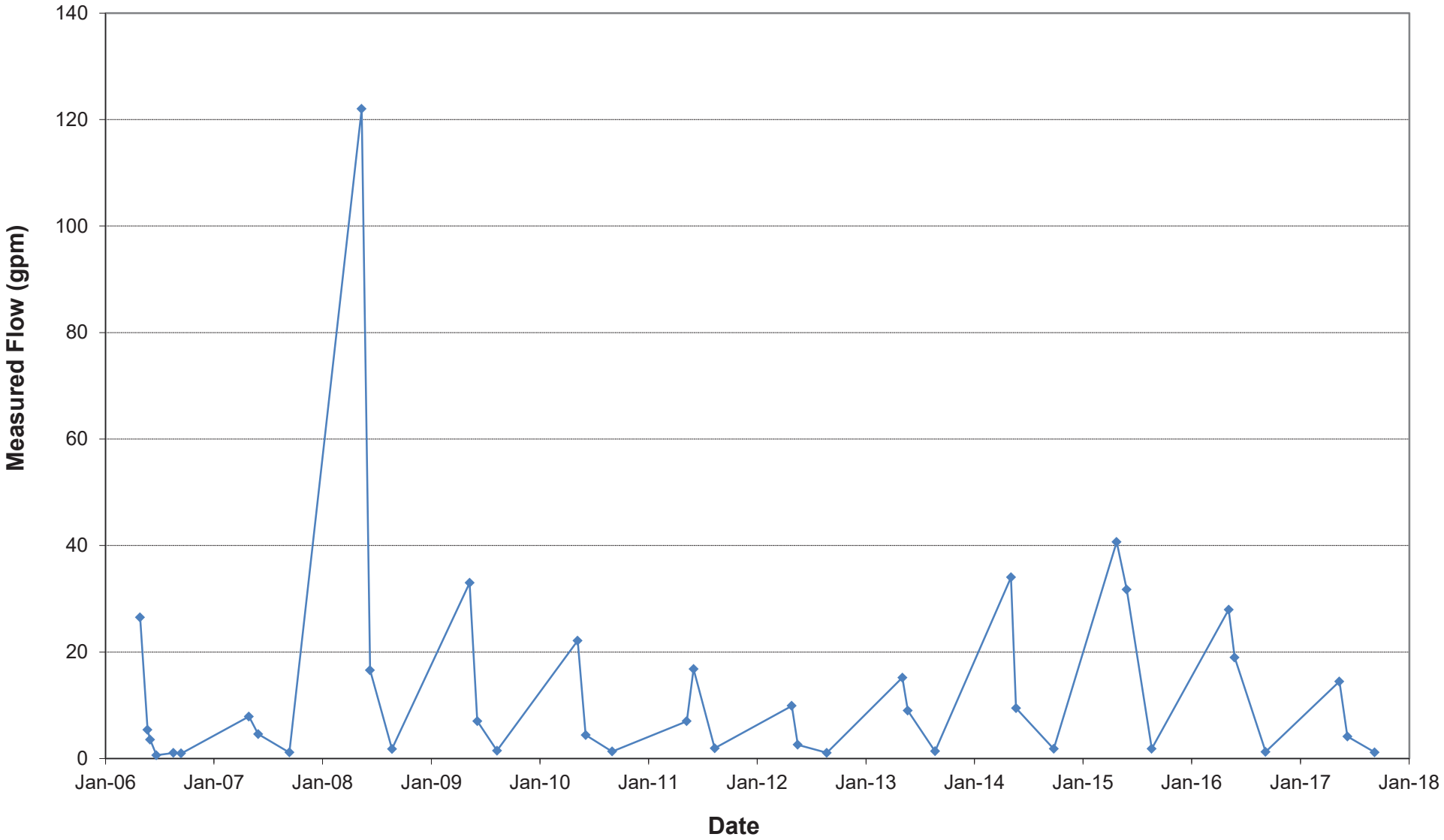
## Spring G-20
## Source: Below F-Seam



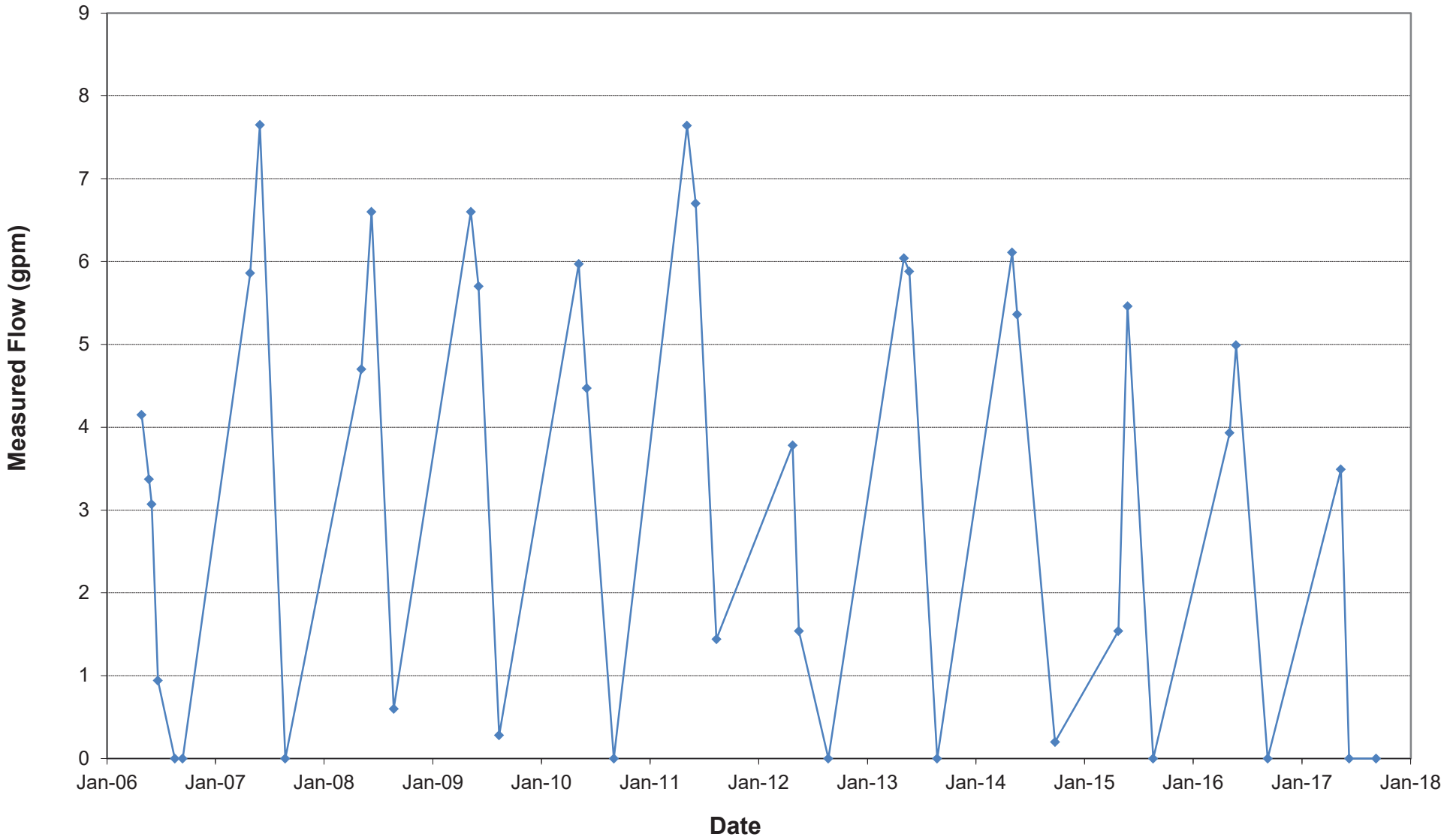
## Spring J-4
## Source: Above E-Seam



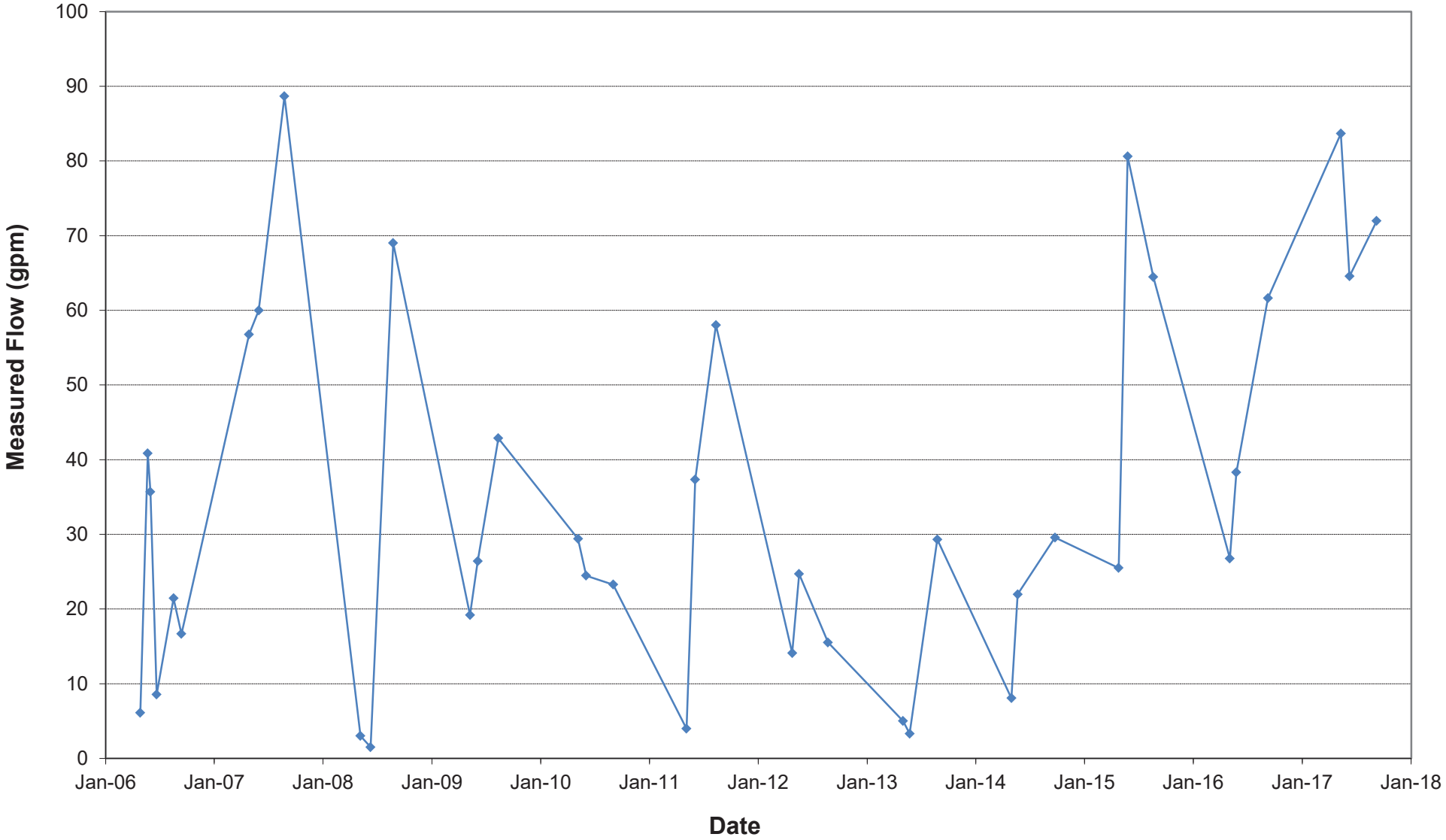
## Spring 35-3
## Source: Above F-Seam



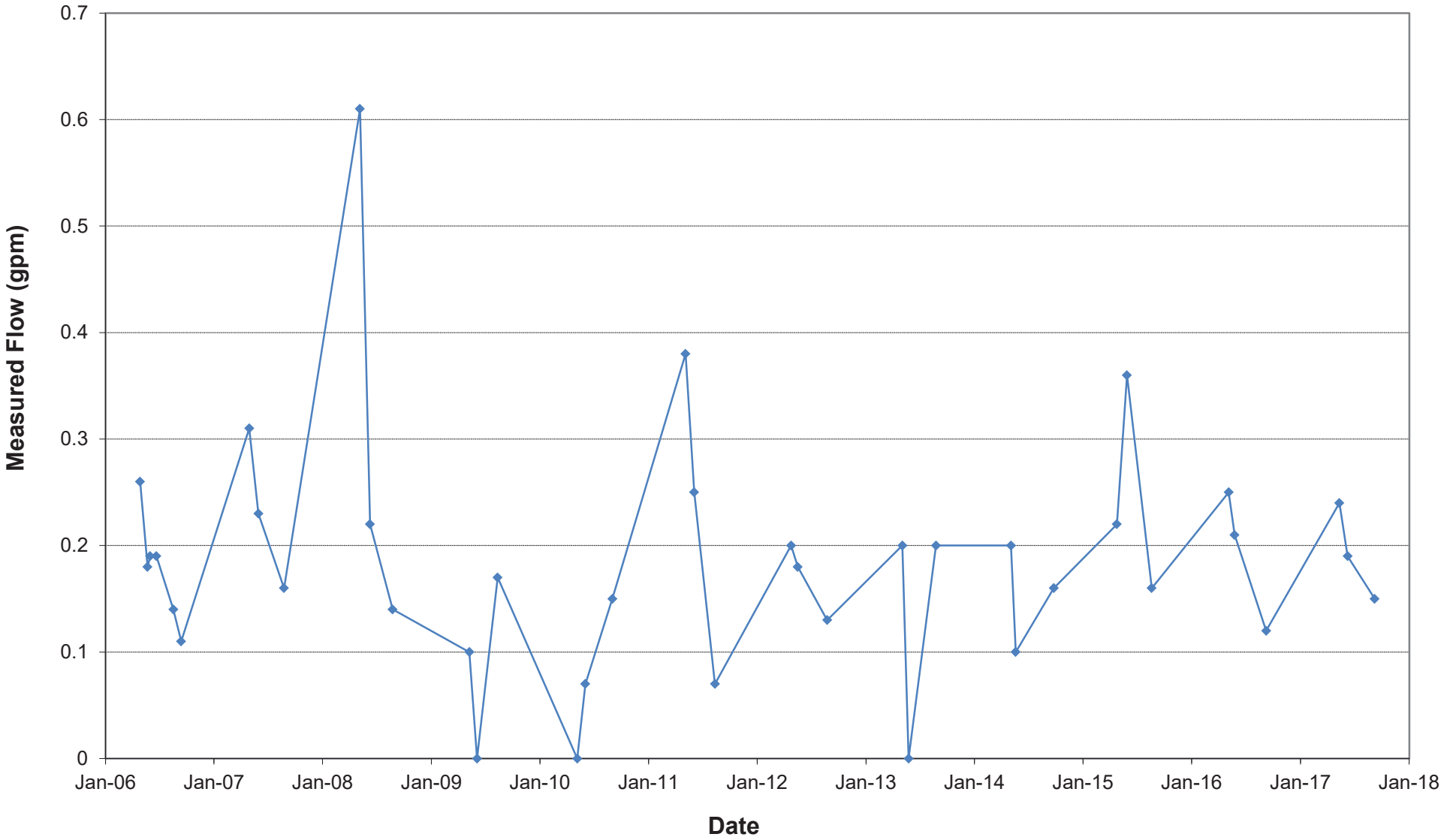
## Deer Creek Spring
## Source: Above E-Seam



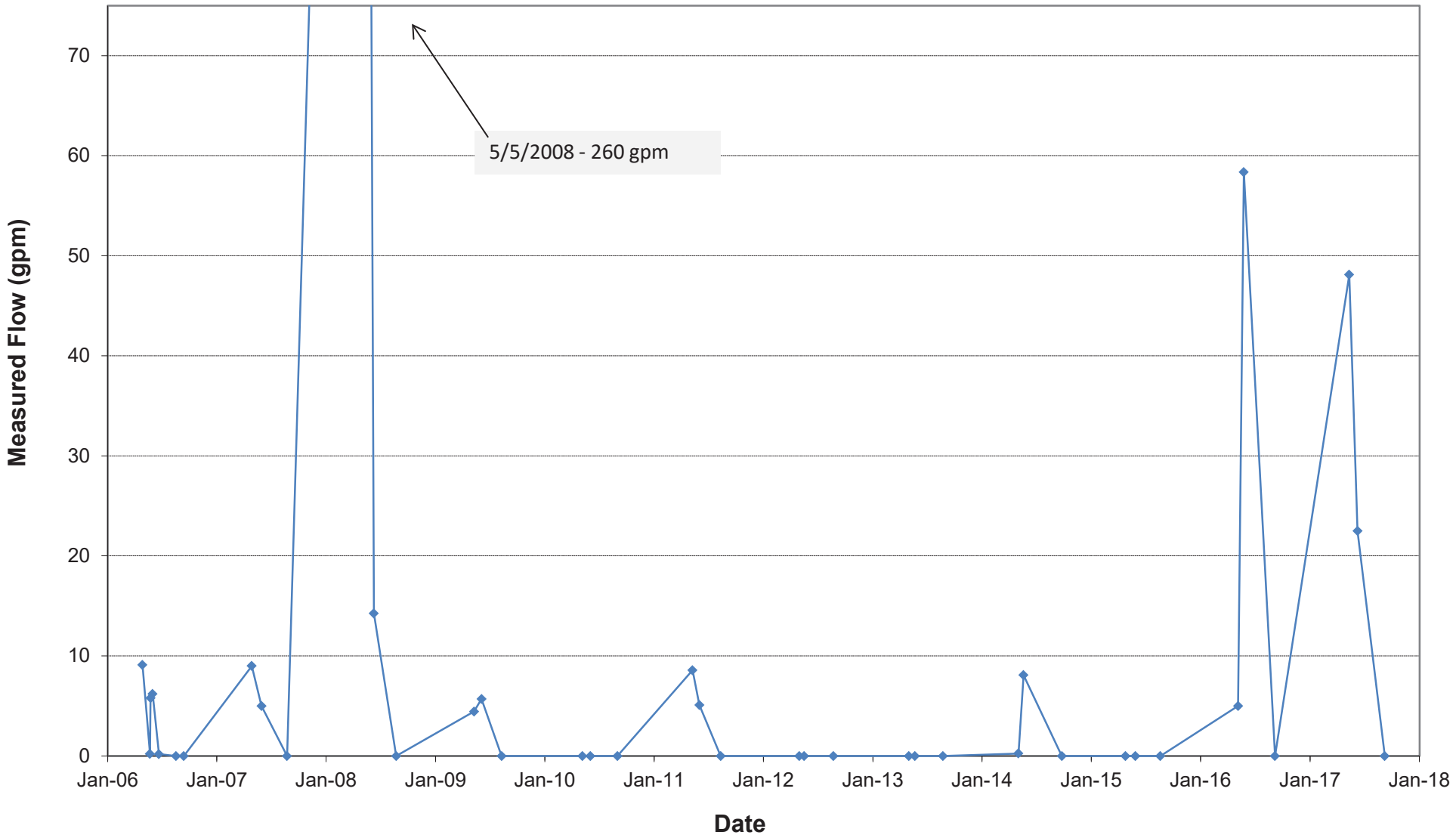
## Spring WCC-24
## Source: Above E-Seam



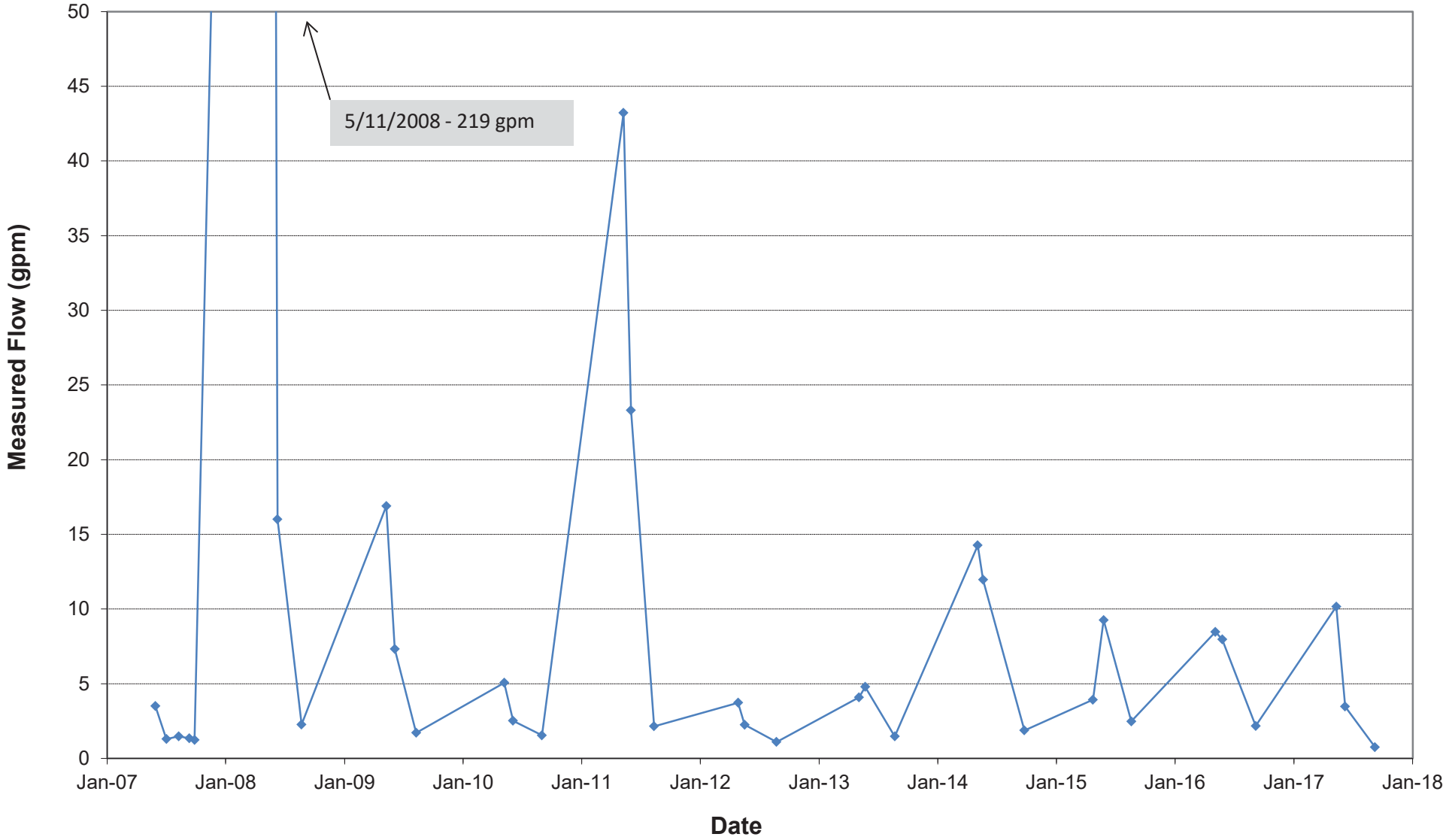
## Spring J-2
## Source: Above E-Seam



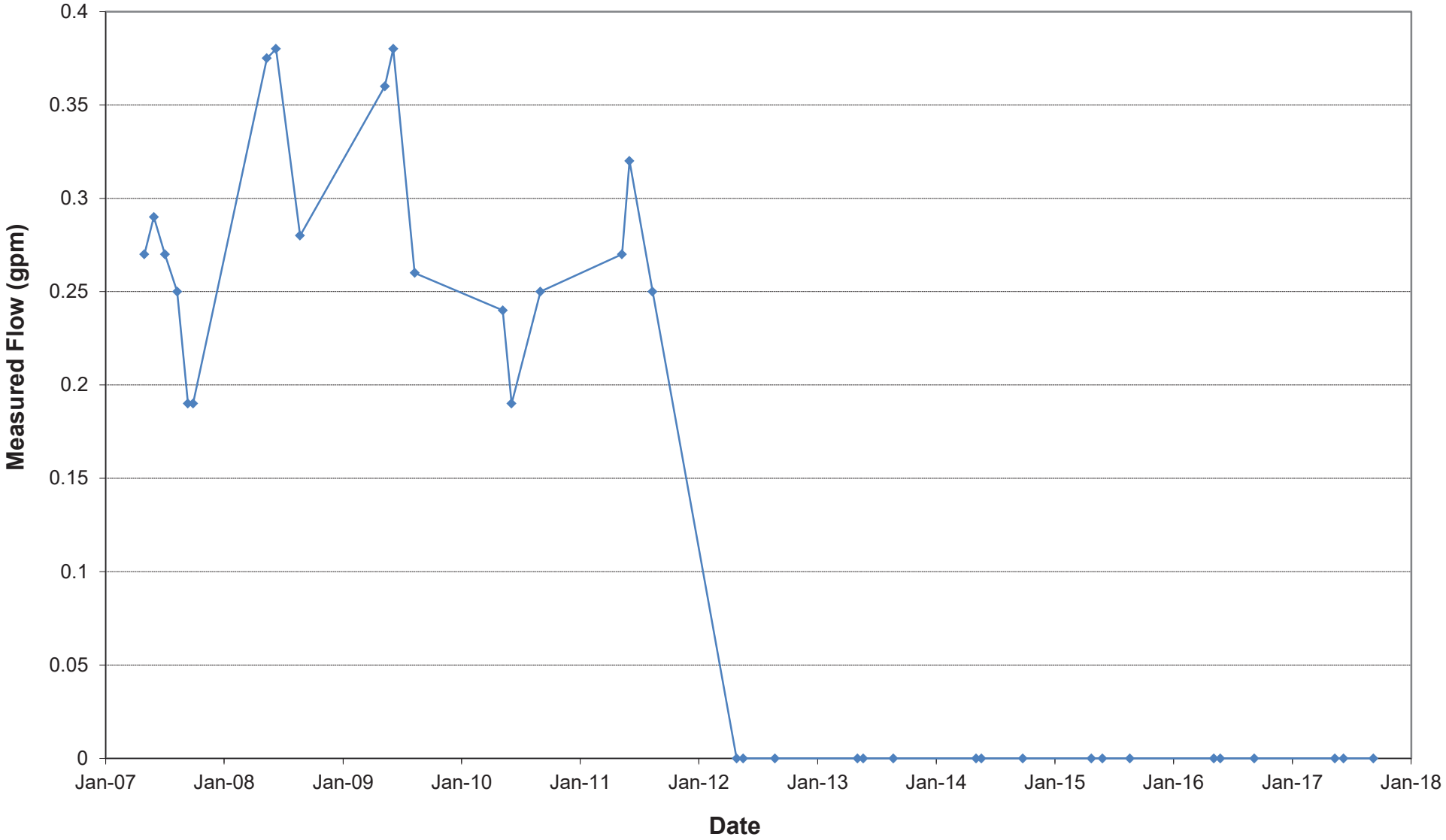
## Spring J-7
## Source: Above E-Seam



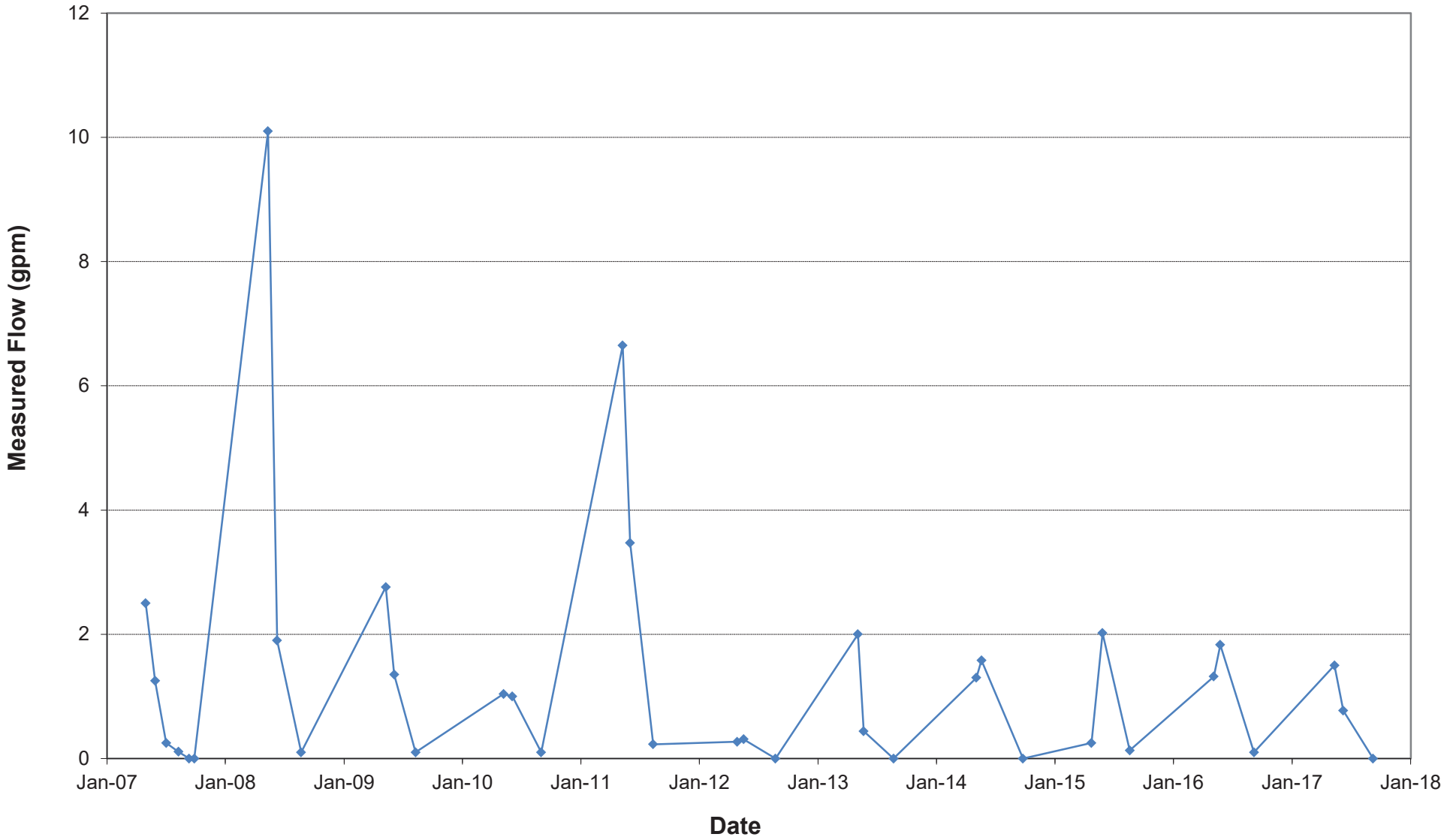
## Deep Creek Trail Spring
## Source: Above F-Seam



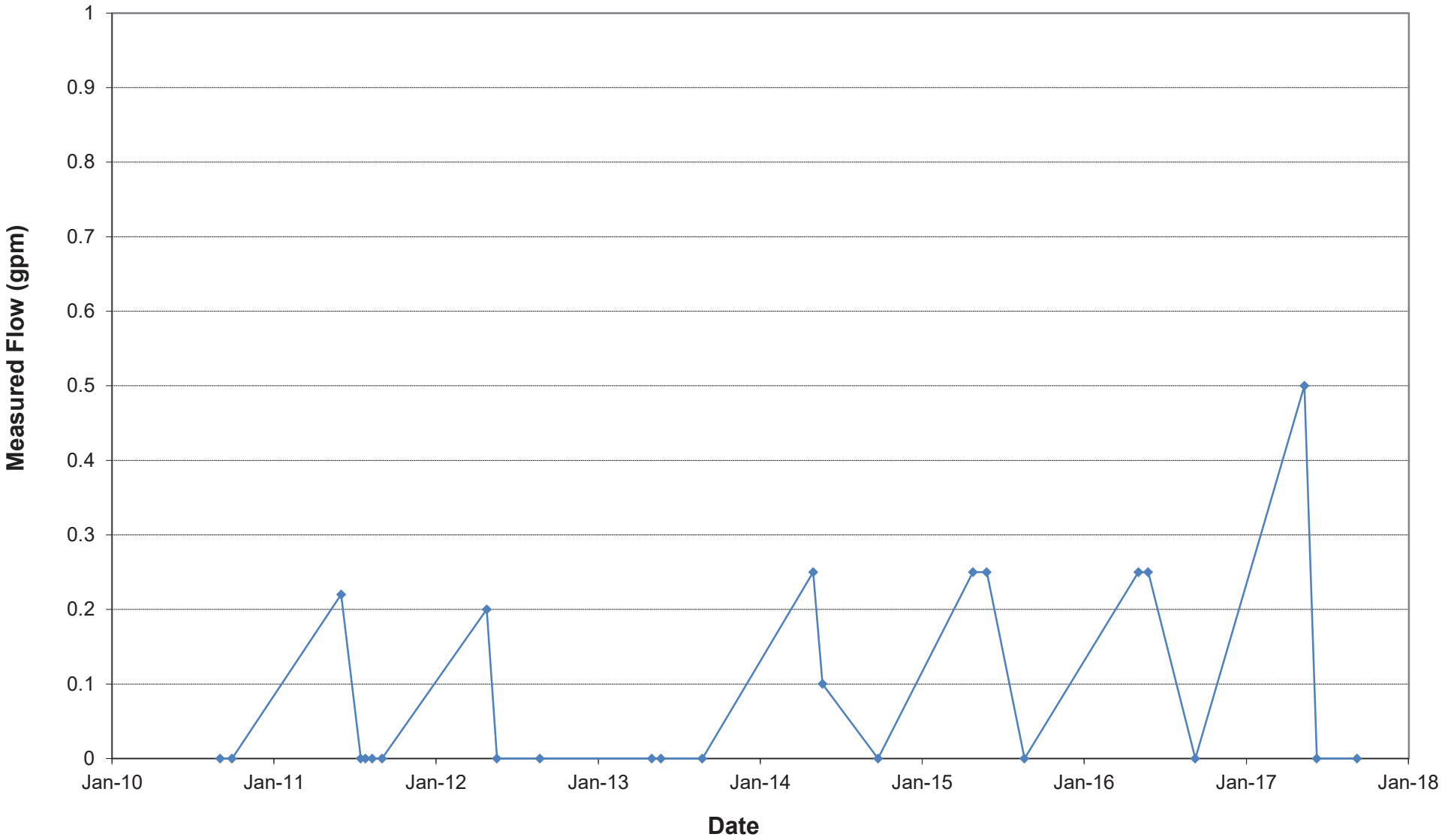
## Deep Creek Spring #2
## Source: Above F-Seam

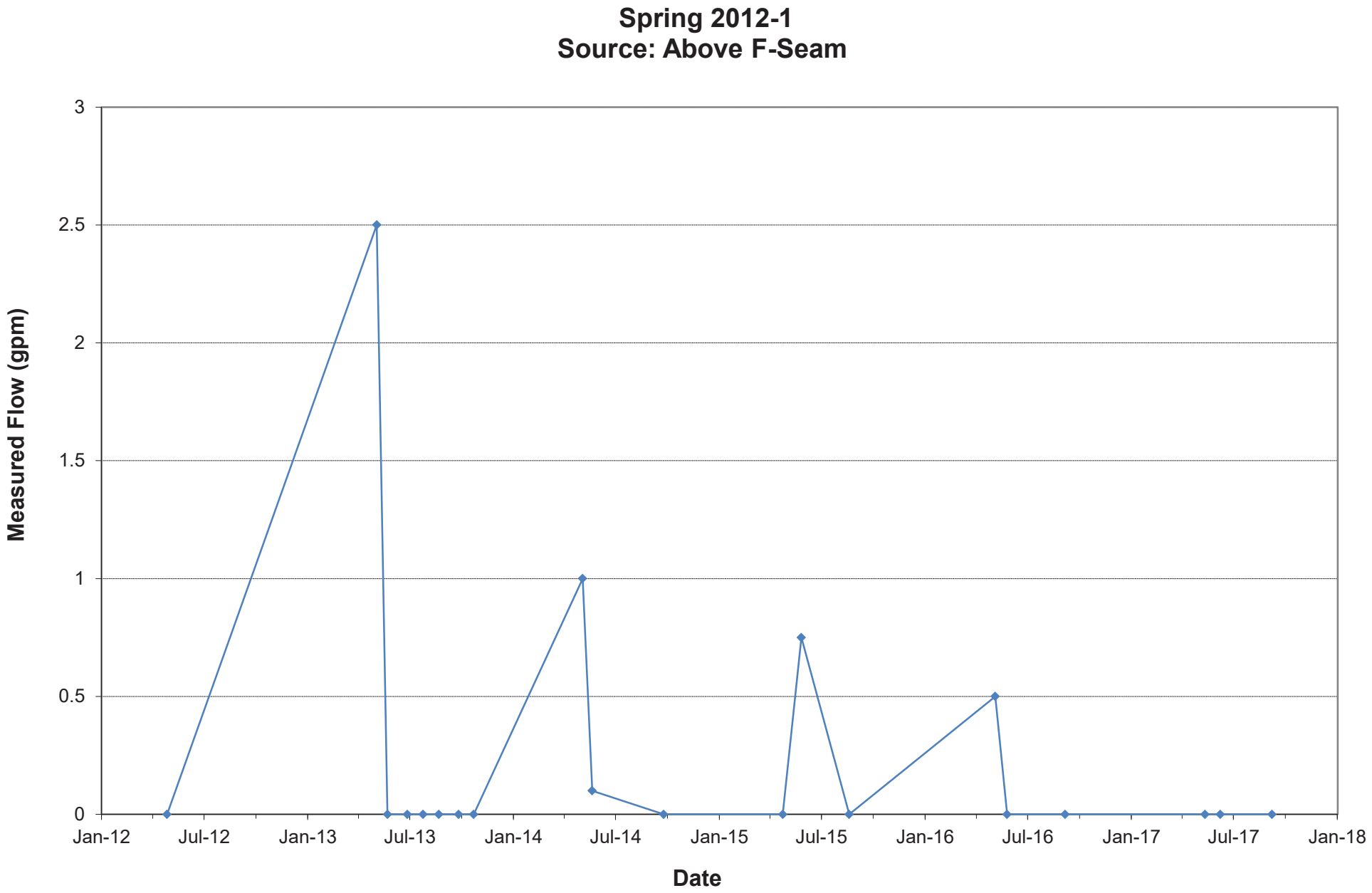


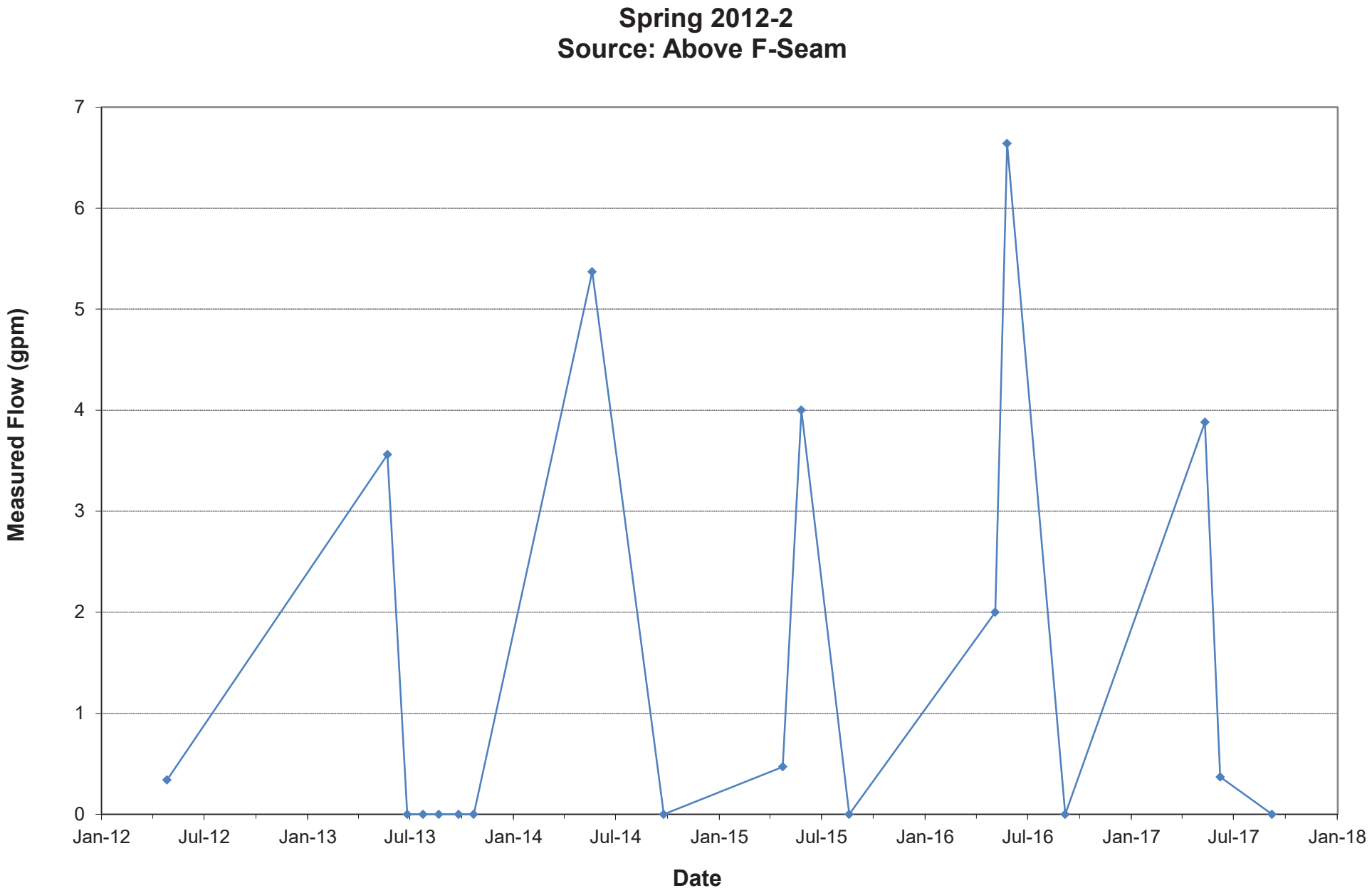
## 96-2-2 Area Spring
## Source: Above F-Seam

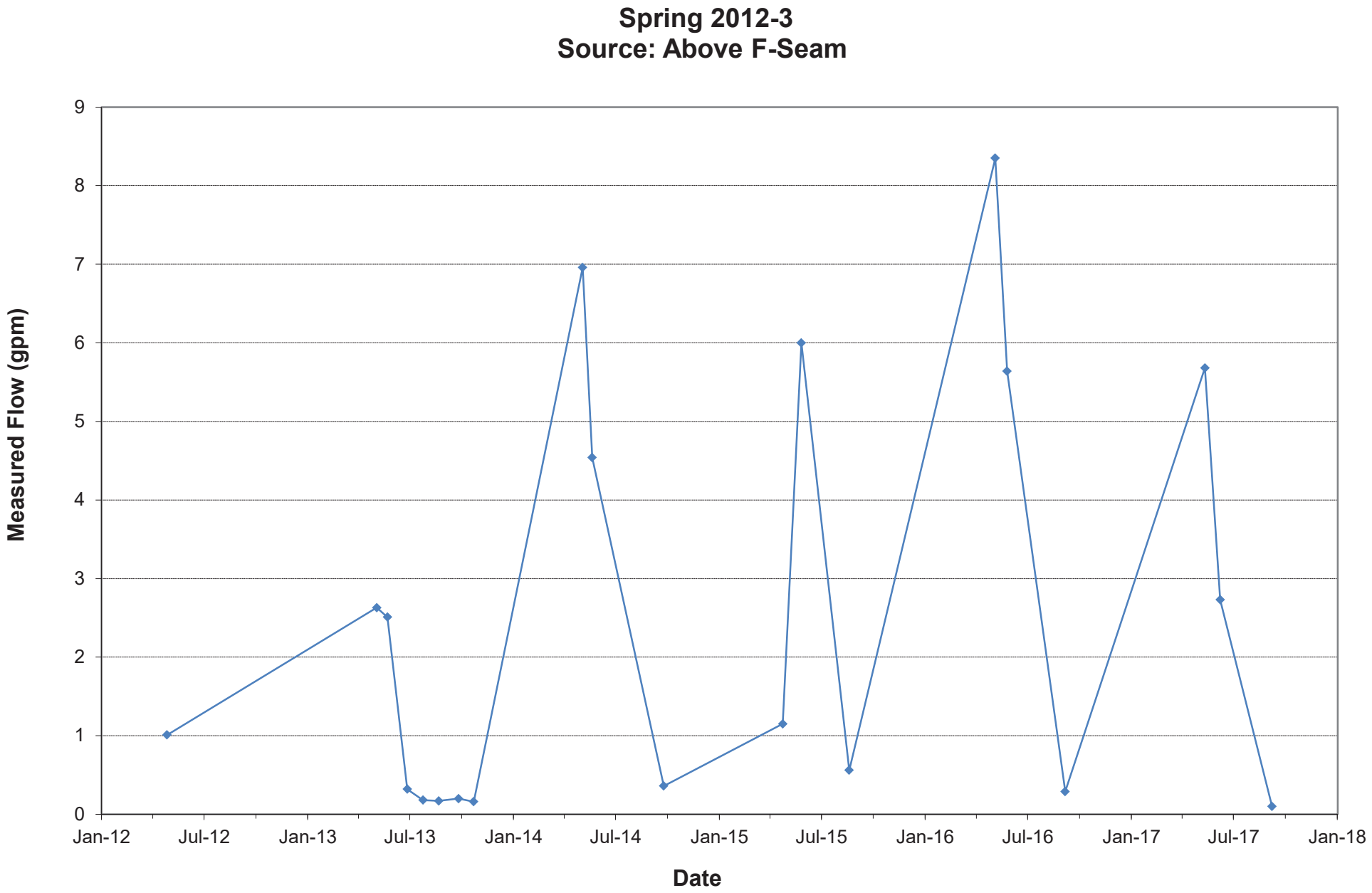


## Spring J-10
## Source: Above E-Seam

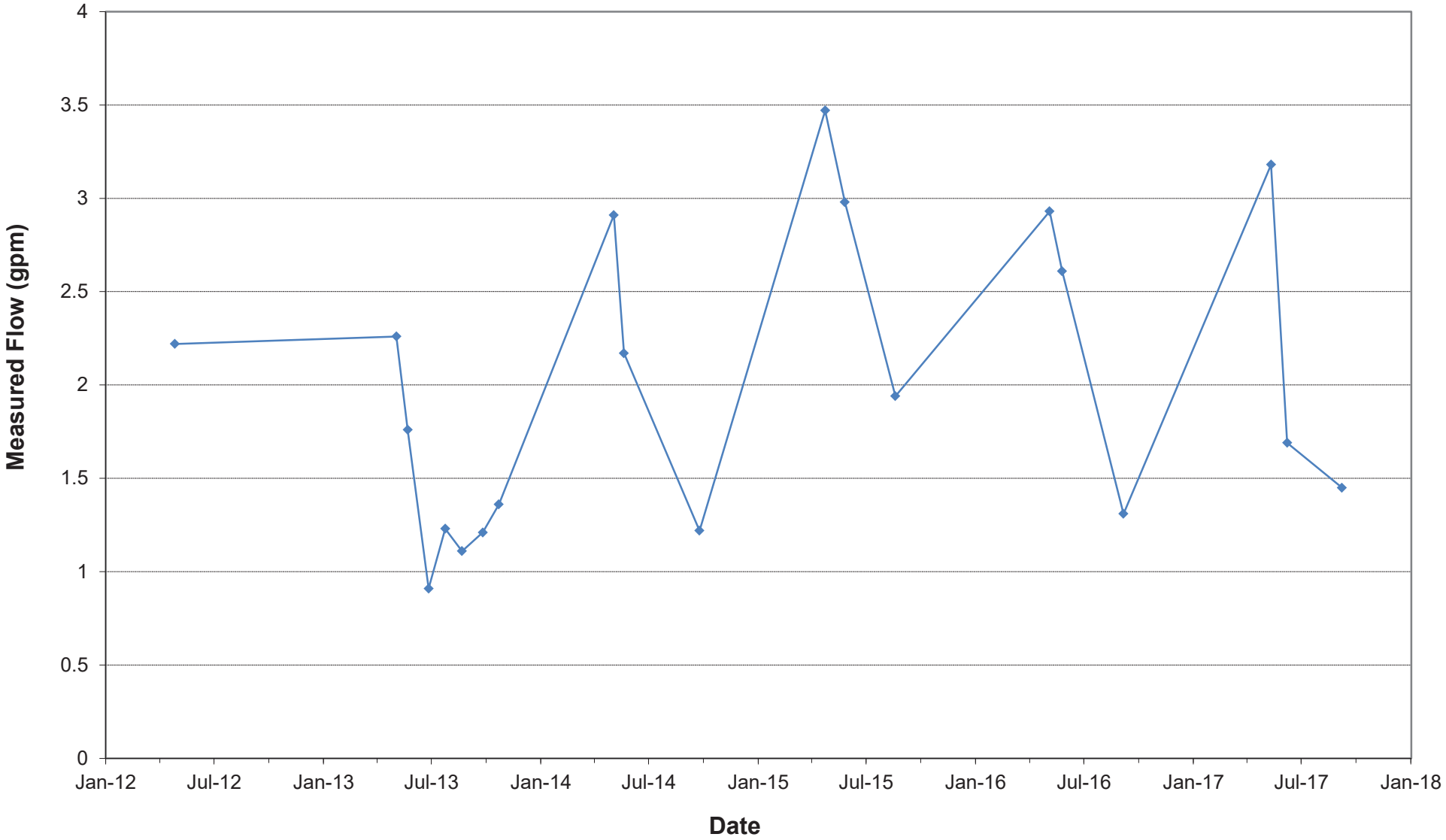



Spring 2012-1
Source: Above F-Seam
Measured Flow (gpm)
3
2.5
2
1.5
1
0.5
0
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Date


Spring 2012-2
Source: Above F-Seam
Measured Flow (gpm)
0
1
2
3
4
5
6
7
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
Date


Spring 2012-3
Source: Above F-Seam
Measured Flow (gpm)
0
1
2
3
4
5
6
7
8
9
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
Date

## Spring 2012-4
## Source: Above F-Seam



# APPENDIX E

## SPRINGS - LABORATORY AND FIELD WATER QUALITY DATA

## Spring 26-1
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 26-1** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 68.94 | 37.76 | | 5.95 |
| Conductivity (Field) | µmhos/cm | 240 | 640 | 482 | 722 | 715 | | 863 |
| pH (Field) | SU | 7.3 | 8.1 | 7.7 | 7.85 | 7.69 | | 7.74 |
| Temperature (Field) | °C | | | | 7.6 | 7.3 | | 8.3 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-13 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 151 | 284 | 222 | | | | |
| Sum of Anions | meq/L | 5.1 | 5.9 | 5.5 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 5.2 | 6.3 | 5.75 | | | | |
| Chloride | mg/L | 2 | 6 | 4.4 | | | | |
| Conductivity @25C | µmhos/cm | 480 | 548 | 514 | | 652 | | |
| Hardness as CaCO3 | mg/L | 81 | 126 | 105 | | | | |
| Iron, dissolved | mg/L | | | | | -0.02 | U | |
| Iron, total | mg/L | | 1.45 | 0.24 | | -0.02 | 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 | | 8.4 | H | |
| Phosphorus, ortho dissolved | mg/L | | 0.007 | 0.001 | | | | |
| Potassium, dissolved | mg/L | 1.2 | 1.4 | 1.3 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 220 | 410 | 327 | | 412 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 16 | 4 | | -5 | U | |
| 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 27-1** | | **Baseline[1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/11/2017 | 6/6/2017 | 9/6/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | | | | seep | damp soil | dry |
| Conductivity (Field) | µmhos/cm | 290 | 460 | 364 | 571 | | |
| pH (Field) | SU | 7.9 | 8.6 | 8.2 | 7.85 | | |
| Temperature (Field) | °C | | | | 16.8 | | |
| Comment | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | |
| Name of Certified Lab [3] | | | | | | | |
| Lab Reference # | | | | | | | |
| Sample Date | | | | | | | |
| Lab Test Date | | | | | | | |
| Sampled By | | | | | | | |
| Alkalinity (Total CaCO3) | mg/L | 136 | 290 | 169 | | | |
| Sum of Anions | meq/L | 3.9 | 4.5 | 4.2 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 4 | 4.9 | 4.45 | | | |
| Chloride | mg/L | 2 | 6 | 3 | | | |
| Conductivity @25C | µmhos/cm | 368 | 437 | 403 | | | |
| Hardness as CaCO3 | mg/L | 64 | 122 | 85 | | | |
| Iron, dissolved | mg/L | | 0.02 | 0.01 | | | |
| Iron, total | mg/L | 0.16 | 9.15 | 1.68 | | | |
| 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 | | | |
| Phosphorus, ortho dissolved | mg/L | | 0.022 | 0.003 | | | |
| Potassium, dissolved | mg/L | 1 | 1.2 | 1.1 | | | |
| 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 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 210 | 300 | 252 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 96 | 42 | | | |

[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-7
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-7** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 8.85 | 4.84 | | 3.64 |
| Conductivity (Field) | µmhos/cm | | | | 494 | 531 | | 608 |
| pH (Field) | SU | | | | 7.31 | 7.61 | | 8.33 |
| Temperature (Field) | °C | | | | 8.0 | 7.4 | | 9.4 |
| Comment | | | | | | | | |
| **Laboratory Parameters[2]** | | | | | | | | |
| Name of Certified Lab[3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-10 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| 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 | | 464 | | |
| Hardness as CaCO3 | mg/L | 134 | 142 | 138 | | | | |
| Iron, dissolved | mg/L | 0.04 | 0.07 | 0 | | -0.02 | U | |
| Iron, total | mg/L | 0.35 | 0.4 | 0.375 | | 0.1 | | |
| 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 230 | 230 | 230 | | 292 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 10 | 30 | 20 | | -5 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-16** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 22.47 | 25.79 | | 3.85 |
| Conductivity (Field) | µmhos/cm | | | | 719 | 752 | | 735 |
| pH (Field) | SU | | | | 7.94 | 8.30 | | 8.37 |
| Temperature (Field) | °C | | | | 7.4 | 9.2 | | 9.2 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-04 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| 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 | | 683 | | |
| Hardness as CaCO3 | mg/L | 160 | 453 | 220 | | | | |
| Iron, dissolved | mg/L | | 0.08 | 0.01 | | -0.02 | U | |
| Iron, total | mg/L | | 4.63 | 0.56 | | 0.09 | | |
| 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 | | 8.6 | H | |
| Phosphorus, ortho dissolved | mg/L | | 0.19 | 0.04 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 274 | 700 | 349 | | 430 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 194 | 21 | | -5 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-24** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 7.39 | 7.73 | | 2.58 |
| Conductivity (Field) | µmhos/cm | | | | 846 | 835 | | 891 |
| pH (Field) | SU | | | | 7.29 | 7.32 | | 7.61 |
| Temperature (Field) | °C | | | | 9.2 | 9.3 | | 10.2 |
| Comment | | Decreed Spring #8 | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-05 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| 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 | | 747 | | |
| Hardness as CaCO3 | mg/L | 176 | 233 | 203 | | | | |
| Iron, dissolved | mg/L | | 0.1 | 0.03 | | -0.02 | U | |
| Iron, total | mg/L | | 2.28 | 0.45 | | -0.02 | U | |
| 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 | | 8.3 | H | |
| Phosphorus, ortho dissolved | mg/L | | 0.105 | 0.027 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 214 | 520 | 362 | | 456 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 102 | 21 | | -5 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-14** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 8.60 | 7.18 | | 0.5 |
| Conductivity (Field) | µmhos/cm | | | | 1,167 | 1,177 | | 1,190 |
| pH (Field) | SU | | | | 7.87 | 7.72 | | 8.27 |
| Temperature (Field) | °C | | | | 7.2 | 8.3 | | 12.5 |
| Comment | | Decreed Spring #7 | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-09 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| 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 | | 1,040 | | |
| Hardness as CaCO3 | mg/L | 215 | 307 | 257 | | | | |
| Iron, dissolved | mg/L | | 0.11 | 0.02 | | -0.02 | U | |
| Iron, total | mg/L | | 3 | 0.1 | | -0.02 | U | |
| 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 | | 8.4 | H | |
| Phosphorus, ortho dissolved | mg/L | | 2.08 | 0.15 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 324 | 708 | 499 | | 716 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 107 | 5 | | -5 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-22** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow[5] | gpm | | | | 9 | 6 | | 2 |
| Conductivity (Field) | µmhos/cm | | | | 1,228 | 1,280 | | 1,341 |
| pH (Field) | SU | | | | 7.28 | 7.32 | | 7.40 |
| Temperature (Field) | °C | | | | 8.3 | 8.5 | | 11.6 |
| Comment | | Decreed Spring #3 | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-07 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| 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 | | 1,140 | | |
| Hardness as CaCO3 | mg/L | 180 | 270 | 234 | | | | |
| Iron, dissolved | mg/L | | 0.05 | 0.01 | | 0.02 | B | |
| Iron, total | mg/L | | 0.2 | 0.08 | | 0.02 | B | |
| 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 | | 8.3 | H | |
| Phosphorus, ortho dissolved | mg/L | | 0.044 | 0.019 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 300 | 516 | 388 | | 750 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 24 | 5 | | 5.0 | B | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 11-2** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow[5] | gpm | | | | 3 | 1.5 | | 0.4 |
| Conductivity (Field) | µmhos/cm | | | | 1,793 | 1,974 | | 2,520 |
| pH (Field) | SU | | | | 8.45 | 8.28 | | 8.53 |
| Temperature (Field) | °C | | | | 10.4 | 12.4 | | 18.8 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-01 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| Sampled By | | | | | | PH | | |
| Conductivity @25C | µmhos/cm | | | | | 1,960 | | |
| Iron, dissolved | mg/L | | | | | -0.02 | U | |
| Iron, total | mg/L | | | | | 0.28 | | |
| pH | SU | | | | | 8.6 | H | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | 1,370 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | 10.0 | B | |

[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 2017 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 10-1** | | **Baseline[1]** | | | **2017 Water Year** | | | | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 6/6/2017 (Duplicate) | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | | | |
| Flow | gpm | | | | 24.19 | 20.84 | | -- | | 7.71 |
| Conductivity (Field) | µmhos/cm | | | | 1,716 | 1,677 | | -- | | 1,674 |
| pH (Field) | SU | | | | 7.79 | 8.24 | | -- | | 8.55 |
| Temperature (Field) | °C | | | | 10.0 | 11.8 | | -- | | 10.9 |
| Comment | | | | | | | | | | |
| **Laboratory Parameters[2]** | | | | | | | | | | |
| Name of Certified Lab[3] | | | | | | ACZ | | ACZ | | |
| Lab Reference # | | | | | | L37713-06 | | L37713-02 | | |
| Sample Date | | | | | | 6/6/2017 | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | 6/10-6/22 | | |
| Sampled By | | | | | | PH | | PH | | |
| Conductivity @25C | µmhos/cm | | | | | 1,560 | | 1,610 | | |
| Iron, dissolved | mg/L | | | | | -0.02 | U | -0.02 | U | |
| Iron, total | mg/L | | | | | 0.04 | B | 0.04 | B | |
| pH | SU | | | | | 8.6 | H | 8.5 | H | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | 1,090 | | 1,080 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | -5.0 | U | -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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring E10-2** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | seep | seep | | dry |
| Conductivity (Field) | µmhos/cm | | | | 1,656 | 1,756 | | |
| pH (Field) | SU | | | | 7.69 | 7.33 | | |
| Temperature (Field) | °C | | | | 14.2 | 17.8 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters[2]** | | | | | | | | |
| Name of Certified Lab[3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-08 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| Sampled By | | | | | | PH | | |
| Conductivity @25C | µmhos/cm | | | | | 1,630 | | |
| Iron, dissolved | mg/L | | | | | 0.04 | B | |
| Iron, total | mg/L | | | | | 1.49 | | |
| pH | SU | | | | | 8.5 | H | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | 1,170 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | 93.0 | | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 15-1** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | Q[4] | 9/6/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 2.00 | 0.55 | | dry |
| Conductivity (Field) | µmhos/cm | 1,060 | 1,240 | 1,137 | 1,967 | 2,000 | | |
| pH (Field) | SU | 7.4 | 8.6 | 8.2 | 7.67 | 7.81 | | |
| Temperature (Field) | °C | 1.1 | 12.8 | 8 | 20.4 | 20.3 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-03 | | |
| Sample Date | | | | | | 6/6/2017 | | |
| Lab Test Date | | | | | | 6/10-6/22 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 375 | 520 | 480 | | | | |
| Sum of Anions | meq/L | | 0.5 | 0.09 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 12.1 | 14.4 | 13.3 | | | | |
| Chloride | mg/L | 4 | 9 | 6.3 | | | | |
| Conductivity @25C | µmhos/cm | 1,080 | 1,120 | 1,100 | | 1,980 | | |
| Copper, dissolved | mg/L | | 0.01 | 0.01 | | | | |
| Hardness as CaCO3 | mg/L | 222 | 307 | 271 | | | | |
| Iron, dissolved | mg/L | | 0.01 | 0.01 | | -0.02 | U | |
| Iron, total | mg/L | 0.01 | 0.73 | 0.12 | | -0.02 | 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 | | 8.4 | H | |
| Phosphorus, ortho dissolved | mg/L | | 0.009 | 0.001 | | | | |
| Potassium, dissolved | mg/L | 2.8 | 3.2 | 3 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 660 | 730 | 701 | | 1,440 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 26 | 9 | | -5 | U | |
| 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-1A** | | **Baseline[1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/6/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | | | | seep | seep | dry |
| Conductivity (Field) | µmhos/cm | | | | 1,223 | 1,320 | |
| pH (Field) | SU | | | | 7.68 | 7.48 | |
| Temperature (Field) | °C | | | | 17.0 | 17.2 | |
| 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 | | | |
| 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 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 312 | 550 | 396 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 66 | 10 | | | |

[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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring G-20** | | **Baseline[1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/6/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | | | | dry | dry | dry |
| Conductivity (Field) | µmhos/cm | | | | | | |
| pH (Field) | SU | | | | | | |
| Temperature (Field) | °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 | | | |
| Sodium Adsorption Ratio (SAR) | calc. | 2.31 | 2.73 | 2.52 | | | |
| Sodium, dissolved | mg/L | 102 | 102 | 102 | | | |
| Sulfate | mg/L | 16 | 117 | 81 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 502 | 686 | 598 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 19.6 | 3.5 | | | |

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

## Spring J-4
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring J-4** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/10/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | | | | 7.57 | 4.09 | | dry |
| Conductivity (Field) | µmhos/cm | 340 | 480 | 392 | 617 | 613 | | |
| pH (Field) | SU | 7.5 | 8.2 | 7.8 | 7.78 | 7.99 | | |
| Temperature (Field) | °C | | | | 9.5 | 12.9 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-15 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 109 | 262 | 195 | | | | |
| Aluminum, dissolved | mg/L | | 0.05 | 0.02 | | | | |
| Sum of Anions | meq/L | 4.5 | 4.7 | 4.6 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 4.6 | 4.91 | 4.8 | | | | |
| Chloride | mg/L | | 3 | 1.9 | | | | |
| Conductivity @25C | µmhos/cm | 412 | 429 | 423 | | 561 | | |
| Copper, dissolved | mg/L | | 0.01 | 0 | | | | |
| Hardness as CaCO3 | mg/L | 125 | 191 | 156 | | | | |
| Iron, dissolved | mg/L | | 0.06 | 0.02 | | 0.02 | B | |
| Iron, total | mg/L | 0.03 | 6.75 | 0.82 | | 0.13 | | |
| 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 230 | 300 | 254 | | 354 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | 26 | 6 | | 5.0 | B | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 35-3** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.63 | 26.5 | 6.3 | 14.47 | 4.13 | | 1.16 |
| Conductivity (Field) | µmhos/cm | 223 | 560 | 428 | 377 | 458 | | 486 |
| pH (Field) | SU | 6.53 | 8.74 | 7.48 | 7.25 | 7.26 | | 7.73 |
| Temperature (Field) | °C | 5.9 | 12.1 | 8.9 | 5.8 | 7.0 | | 7.9 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-01 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 102 | 217 | 170 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.09 | 0.04 | | | | |
| Sum of Anions | meq/L | 2.5 | 4.8 | 3.9 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 2.3 | 4.6 | 3.6 | | | | |
| Chloride | mg/L | 1 | 11 | 3 | | | | |
| Conductivity @25C | µmhos/cm | 216 | 451 | 351 | | 406 | | |
| 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 | | 0.07 | | |
| Iron, total | mg/L | 0.19 | 42.50 | 9.14 | | 0.41 | | |
| 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 | | 8.2 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 0.09 | 1.22 | 0.93 | | | | |
| TDS (calculated) | mg/L | 131 | 248 | 199 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 160 | 250 | 210 | | 258 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 510 | 133 | | 13.0 | B | |
| 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 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Deer Creek Spring** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/8/2017 | 9/7/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | 0.94 | 4.15 | 2.88 | 3.49 | dry | dry |
| Conductivity (Field) | µmhos/cm | 574 | 889 | 735 | 838 | | |
| pH (Field) | SU | 6.72 | 7.77 | 7.10 | 7.67 | | |
| Temperature (Field) | °C | 7.1 | 17.4 | 10.9 | 7.8 | | |
| Comment | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | |
| Name of Certified Lab [3] | | | | | | | |
| Lab Reference # | | | | | | | |
| Sample Date | | | | | | | |
| Lab Test Date | | | | | | | |
| Sampled By | | | | | | | |
| Alkalinity (Total CaCO3) | mg/L | 294 | 302 | 298 | | | |
| Aluminum, dissolved | mg/L | -0.03 | -0.03 | -0.03 | | | |
| Sum of Anions | meq/L | 6.6 | 6.9 | 6.7 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 6.2 | 6.6 | 6.425 | | | |
| Chloride | mg/L | 3 | 4 | 3 | | | |
| Conductivity @25C | µmhos/cm | 587 | 660 | 611 | | | |
| 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 | | | |
| Iron, total | mg/L | -0.02 | 0.20 | 0.10 | | | |
| 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 | | | |
| 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 | | | |
| 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 | | | |
| TDS (ratio - measured/calculated) | calc. | 0.95 | 1.06 | 1.02 | | | |
| TDS (calculated) | mg/L | 329 | 341 | 336 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 320 | 360 | 343 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 14 | 5 | | | |
| 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.

[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 WCC-24
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring WCC-24** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/10/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 6.12 | 40.85 | 23.36 | 83.66 | 64.56 | | 71.97 |
| Conductivity (Field) | µmhos/cm | 1,778 | 3,240 | 2,319 | 1,727 | 1,768 | | 1,649 |
| pH (Field) | SU | 7.30 | 8.64 | 8.05 | 8.48 | 8.48 | | 8.54 |
| Temperature (Field) | °C | 11.4 | 19.0 | 13.1 | 10.7 | 13.3 | | 12.0 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-13 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 323 | 406 | 368 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.04 | 0.02 | | | | |
| Sum of Anions | meq/L | 22.5 | 25.3 | 24.2 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 23.2 | 25.8 | 24.2 | | | | |
| Chloride | mg/L | 2 | 4 | 3 | | | | |
| Conductivity @25C | µmhos/cm | 1,710 | 2,070 | 1,925 | | 1,630 | | |
| 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 | | -0.02 | U | |
| Iron, total | mg/L | -0.02 | 0.53 | 0.20 | | -0.02 | U | |
| 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 1.04 | 1.11 | 1.07 | | | | |
| TDS (calculated) | mg/L | 1,380 | 1,530 | 1,465 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 1,460 | 1,630 | 1,561 | | 1,430 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 48 | 12 | | -5 | U | |
| 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 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring J-2** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.11 | 0.26 | 0.18 | 0.24 | 0.19 | | 0.15 |
| Conductivity (Field) | µmhos/cm | 975 | 1,690 | 1,281 | 1,151 | 1,128 | | 1,101 |
| pH (Field) | SU | 8.26 | 9.10 | 8.59 | 8.78 | 8.64 | | 8.75 |
| Temperature (Field) | °C | 9.6 | 19.6 | 14.4 | 11.6 | 13.5 | | 10.3 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-12 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 605 | 650 | 637 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.20 | 0.12 | | | | |
| Sum of Anions | meq/L | 12.7 | 14.6 | 13.5 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 11.4 | 13.5 | 12.3 | | | | |
| Chloride | mg/L | 4 | 12 | 6 | | | | |
| Conductivity @25C | µmhos/cm | 1,090 | 1,190 | 1,145 | | 1,070 | | |
| 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 | | 0.17 | | |
| Iron, total | mg/L | 1.36 | 37.70 | 8.42 | | 2.9 | | |
| 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 | | 8.8 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 0.96 | 1.21 | 1.04 | | | | |
| TDS (calculated) | mg/L | 664 | 752 | 715 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 650 | 910 | 742 | | 740 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 20 | 754 | 192 | | 85.0 | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring J-7** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.19 | 9.09 | 4.29 | 48.10 | 22.49 | | dry |
| Conductivity (Field) | µmhos/cm | 242 | 496 | 376 | 745 | 725 | | |
| pH (Field) | SU | 6.55 | 8.25 | 7.60 | 8.35 | 7.61 | | |
| Temperature (Field) | °C | 9.7 | 21.0 | 15.4 | 15.8 | 14.7 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-08 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| 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 | | 697 | | |
| 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 | | 0.05 | | |
| Iron, total | mg/L | 0.53 | 1.96 | 1.02 | | 0.56 | | |
| 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 | | 462 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 24 | 10 | | 22.0 | | |
| 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.

[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

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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Deep Creek Trail Spring** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 1.24 | 3.51 | 1.77 | 10.16 | 3.47 | | 0.75 |
| Conductivity (Field) | µmhos/cm | 400 | 479 | 455 | 411 | 460 | | 510 |
| pH (Field) | SU | 7.72 | 8.07 | 7.90 | 7.63 | 7.91 | | 7.57 |
| Temperature (Field) | °C | 5.8 | 11.8 | 8.74 | 6.8 | 7.5 | | 8.2 |
| Comment | | | | | | | | |
| **Laboratory Parameters[2]** | | | | | | | | |
| Name of Certified Lab[3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37713-14 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/12-6/22 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 161 | 236 | 211 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.11 | 0.04 | | | | |
| Sum of Anions | meq/L | 3.7 | 4.9 | 5 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 3.7 | 5.2 | 4.7 | | | | |
| Chloride | mg/L | 1 | 2 | 2 | | | | |
| Conductivity @25C | µmhos/cm | 357 | 463 | 440 | | 408 | | |
| 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 | | -0.02 | U | |
| Iron, total | mg/L | 0.14 | 1.63 | 0.79 | | 0.21 | | |
| 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 0.98 | 1.16 | 1.05 | | | | |
| TDS (calculated) | mg/L | 198 | 262 | 243 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 230 | 270 | 253 | | 252 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 60 | 20 | | -5 | U | |
| 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Deep Creek Spring #2** | | **Baseline[1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean [2] | 5/11/2017 | 6/7/2017 | 9/7/2017 |
| **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 | | | |
| Sum of Anions | meq/L | 3.8 | 4.8 | 4.3 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 4.1 | 4.9 | 4.5 | | | |
| 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 | | | |
| 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 | | | |
| TDS (ratio - measured/calculated) | calc. | 1.01 | 1.16 | 1.06 | | | |
| TDS (calculated) | mg/L | 209 | 257 | 234 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 230 | 260 | 247 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 6 | 302 | 136 | | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: 96-2-2 Area Spring** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.11 | 2.5 | 0.75 | 1.50 | 0.77 | | seep |
| Conductivity (Field) | µmhos/cm | 348 | 430 | 399 | 430 | 438 | | 533 |
| pH (Field) | SU | 7.78 | 8.18 | 7.88 | 7.67 | 7.47 | | 7.74 |
| Temperature (Field) | °C | 6.9 | 12.3 | 10.6 | 6.1 | 9.0 | | 12.6 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-02 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 129 | 172 | 156 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.21 | 0.09 | | | | |
| Sum of Anions | meq/L | 3.2 | 4 | 3.8 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 3.3 | 4.3 | 4.0 | | | | |
| Chloride | mg/L | 2 | 3 | 2 | | | | |
| Conductivity @25C | µmhos/cm | 332 | 421 | 387 | | 393 | | |
| 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 | | 0.11 | | |
| Iron, total | mg/L | 0.84 | 9.08 | 4.55 | | 3.95 | | |
| 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 | | 8.2 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 0.97 | 1.04 | 1.02 | | | | |
| TDS (calculated) | mg/L | 183 | 231 | 216 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 190 | 240 | 220 | | 254 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 22 | 510 | 175 | | 67.0 | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring J-10** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/8/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | dry | 0.22 | seep | 0.5 | seep | | damp soil |
| Conductivity (Field) | µmhos/cm | 770 | 982 | 879 | 750 | 837 | | |
| pH (Field) | SU | 7.14 | 7.92 | 7.42 | 7.89 | 7.85 | | |
| Temperature (Field) | °C | 5.9 | 19.5 | 12.8 | 11.2 | 22.9 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37738-05 | | |
| Sample Date | | | | | | 6/8/2017 | | |
| Lab Test Date | | | | | | 6/13-6/26 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 299 | 463 | 377 | | | | |
| Aluminum, dissolved | mg/L | -0.03 | -0.03 | -0.03 | | | | |
| Sum of Anions | meq/L | 8.0 | 10.4 | 9.2 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 6.9 | 11.1 | 9.0 | | | | |
| Chloride | mg/L | 10 | 19 | 14 | | | | |
| Conductivity @25C | µmhos/cm | 721 | 927 | 822 | | 779 | | |
| 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 | | 0.30 | | |
| Iron, total | mg/L | 0.44 | 10.9 | 3.45 | | 1.05 | | |
| 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | calc. | 1.02 | 1.15 | 1.10 | | | | |
| TDS (calculated) | mg/L | 397 | 522 | 466 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 450 | 600 | 512 | | 490 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 15 | 157 | 53 | | 55.0 | | |
| 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 2012-1** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | 9/7/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | dry | 2.5 | NA | dry | dry | dry |
| Conductivity (Field) | µmhos/cm | 123 | 123 | 123 | | | |
| pH (Field) | SU | 7.79 | 7.79 | 7.79 | | | |
| Temperature (Field) | °C | 7.3 | 7.3 | 7.3 | | | |
| 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 | | | | | | |
| Sum of Anions | meq/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 | | | | | | |
| Sum of Cations | meq/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 | | | | | | |
| Selenium, total recoverable | mg/L | | | | | | |
| Sodium Adsorption Ratio (SAR) | calc. | | | | | | |
| Sodium, dissolved | mg/L | | | | | | |
| Sulfate | mg/L | | | | | | |
| TDS (ratio - measured/calculated) | calc. | | | | | | |
| TDS (calculated) | mg/L | | | | | | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 2012-2** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | dry | 3.56 | 0.59 | 3.88 | 0.37 | | dry |
| Conductivity (Field) | µmhos/cm | 91 | 114 | 103 | 88.0 | 102 | | |
| pH (Field) | SU | 8.00 | 8.32 | 8.16 | 7.27 | 7.62 | | |
| Temperature (Field) | °C | 4.8 | 6.6 | 5.7 | 9.8 | 11.4 | | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37661-05 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/9-7/7 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 38.0 | 38.0 | 38.0 | | 45.8 | | |
| Aluminum, dissolved | mg/L | 0.05 | 0.05 | 0.05 | | -0.03 | U | |
| Sum of Anions | meq/L | 0.837 | 0.837 | 0.837 | | 1.0 | | |
| Arsenic, total recoverable | mg/L | -0.0002 | -0.0002 | -0.0002 | | 0.0004 | B | |
| Bicarbonate as CaCO3 | mg/L | 38.0 | 38.0 | 38.0 | | 45.8 | | |
| Boron, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.01 | U | |
| Cadmium, dissolved | mg/L | -0.005 | -0.005 | -0.005 | | -0.005 | U | |
| Calcium, dissolved | mg/L | 7.5 | 7.5 | 7.5 | | 8.1 | | |
| Carbonate as CaCO3 | mg/L | -2 | -2 | -2 | | -2 | U | |
| Cation - Anion Balance | mg/L | 6.3 | 6.3 | 6.3 | | 0 | | |
| Sum of Cations | meq/L | 0.949 | 0.949 | 0.949 | | 1.0 | | |
| Chloride | mg/L | 2 | 2 | 2 | | 1.2 | B | |
| Conductivity @25C | µmhos/cm | 99 | 99 | 99 | | 110 | | |
| Copper, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.01 | U | |
| Hardness as CaCO3 | mg/L | 25 | 25 | 25 | | 28 | | |
| Hydroxide as CaCO3 | mg/L | -2 | -2 | -2 | | -2 | U | |
| Iron, dissolved | mg/L | 0.11 | 0.11 | 0.11 | | 0.1 | | |
| Iron, total | mg/L | 1.04 | 1.04 | 1.04 | | 1.64 | | |
| Lead, dissolved | mg/L | -0.04 | -0.04 | -0.04 | | -0.03 | U | |
| Magnesium, dissolved | mg/L | 1.6 | 1.6 | 1.6 | | 1.8 | | |
| Manganese, dissolved | mg/L | -0.005 | -0.005 | -0.005 | | -0.005 | U | |
| Manganese, total | mg/L | 0.009 | 0.009 | 0.009 | | 0.027 | B | |
| Mercury, total | mg/L | -0.0002 | -0.0002 | -0.0002 | | -0.0002 | U | |
| Molybdenum, dissolved | mg/L | -0.02 | -0.02 | -0.02 | | -0.02 | U | |
| Nitrate/Nitrite (as N) | mg/L | 0.41 | 0.41 | 0.41 | | -0.02 | U | |
| pH | SU | 7.9 | 7.9 | 7.9 | | 7.7 | H | |
| Phosphate | mg/L | -0.03 | -0.03 | -0.03 | | -0.06 | U | |
| Phosphorus, ortho dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.02 | U | |
| Potassium, dissolved | mg/L | 0.7 | 0.7 | 0.7 | | 0.7 | B | |
| Selenium, total recoverable | mg/L | 0.0002 | 0.0002 | 0.0002 | | 0.0002 | B | |
| Sodium Adsorption Ratio (SAR) | calc. | 0.82 | 0.82 | 0.82 | | 0.87 | | |
| Sodium, dissolved | mg/L | 9.4 | 9.4 | 9.4 | | 10.4 | | |
| Sulfate | mg/L | 1 | 1 | 1 | | -1 | U | |
| TDS (ratio - measured/calculated) | calc. | 1.78 | 1.78 | 1.78 | | 2.11 | | |
| TDS (calculated) | mg/L | 45 | 45 | 45 | | 50.2 | | |
| Residue, Filterable (TDS) @180C | mg/L | 80 | 80 | 80 | | 106 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | -5 | -5 | | 38.0 | | |
| Zinc, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.01 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 2012-3** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.16 | 2.63 | 0.88 | 5.68 | 2.73 | | 0.1 |
| Conductivity (Field) | µmhos/cm | 396 | 525 | 471 | 388 | 413 | | 486 |
| pH (Field) | SU | 7.51 | 8.63 | 8.13 | 7.69 | 8.23 | | 7.69 |
| Temperature (Field) | °C | 2.0 | 9.1 | 6.2 | 6.8 | 7.8 | | 14.8 |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37661-06 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/9-7/7 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 169 | 201 | 183 | | 168 | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.05 | 0.02 | | -0.03 | U | |
| Sum of Anions | meq/L | 4.1 | 5.0 | 4.6 | | 4.1 | | |
| Arsenic, total recoverable | mg/L | -0.0002 | 0.0013 | 0.0005 | | -0.0002 | U | |
| Bicarbonate as CaCO3 | mg/L | 163 | 191 | 173 | | 161 | | |
| Boron, dissolved | mg/L | -0.01 | 0.02 | 0.01 | | 0.01 | B | |
| Cadmium, dissolved | mg/L | -0.005 | -0.005 | 0.003 | | -0.005 | U | |
| Calcium, dissolved | mg/L | 29.3 | 39.7 | 37.2 | | 31.1 | | |
| Carbonate as CaCO3 | mg/L | 6 | 17 | 11 | | 6.4 | B | |
| Cation - Anion Balance | mg/L | -4.2 | 2.3 | 1.5 | | 0 | | |
| Sum of Cations | meq/L | 3.8 | 4.8 | 4.5 | | 4.1 | | |
| Chloride | mg/L | 1 | 2 | 2 | | 1.6 | B | |
| Conductivity @25C | µmhos/cm | 373 | 475 | 436 | | 384 | | |
| Copper, dissolved | mg/L | -0.01 | -0.01 | 0.01 | | -0.01 | U | |
| Hardness as CaCO3 | mg/L | 97 | 130 | 122 | | 102 | | |
| Hydroxide as CaCO3 | mg/L | -2 | -2 | -2 | | -2 | U | |
| Iron, dissolved | mg/L | 0.02 | 0.27 | 0.07 | | -0.02 | U | |
| Iron, total | mg/L | 0.49 | 5.24 | 1.77 | | 0.50 | | |
| Lead, dissolved | mg/L | -0.04 | -0.04 | -0.04 | | -0.03 | U | |
| Magnesium, dissolved | mg/L | 5.7 | 7.5 | 7.1 | | 6.0 | | |
| Manganese, dissolved | mg/L | -0.005 | 0.032 | 0.010 | | -0.005 | U | |
| Manganese, total | mg/L | 0.017 | 0.124 | 0.052 | | 0.022 | B | |
| Mercury, total | mg/L | -0.0002 | -0.0002 | -0.0002 | | -0.0002 | U | |
| Molybdenum, dissolved | mg/L | -0.02 | -0.02 | -0.02 | | -0.02 | U | |
| Nitrate/Nitrite (as N) | mg/L | 0.04 | 0.16 | 0.09 | | 0.10 | | |
| pH | SU | 8.3 | 8.5 | 8.4 | | 8.4 | H | |
| Phosphate | mg/L | -0.03 | 0.16 | 0.07 | | 0.06 | B | |
| Phosphorus, ortho dissolved | mg/L | -0.01 | 0.05 | 0.02 | | 0.02 | B | |
| Potassium, dissolved | mg/L | 1.2 | 1.8 | 1.5 | | 1.2 | | |
| Selenium, total recoverable | mg/L | 0.0003 | 0.0005 | 0.0004 | | 0.0004 | | |
| Sodium Adsorption Ratio (SAR) | calc. | 1.82 | 1.86 | 1.84 | | 2.00 | | |
| Sodium, dissolved | mg/L | 41.5 | 48.2 | 46.2 | | 45.1 | | |
| Sulfate | mg/L | 33 | 51.5 | 42 | | 34.1 | | |
| TDS (ratio - measured/calculated) | calc. | 0.98 | 1.11 | 1.05 | | 1.07 | | |
| TDS (calculated) | mg/L | 214 | 265 | 246 | | 221 | | |
| Residue, Filterable (TDS) @180C | mg/L | 210 | 280 | 260 | | 236 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 13 | 245 | 72 | | 29.0 | | |
| Zinc, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.01 | U | |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Spring 2012-4** | | **Baseline[1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean[5] | 5/11/2017 | 6/7/2017 | Q[4] | 9/7/2017 |
| **Field Parameters** | | | | | | | | |
| Flow | gpm | 0.91 | 2.26 | 1.41 | 3.18 | 1.69 | | 1.45 |
| Conductivity (Field) | µmhos/cm | 444 | 538 | 507 | 456 | 486 | | 504 |
| pH (Field) | SU | 7.02 | 8.24 | 7.93 | 7.84 | 7.95 | | 8.46 |
| Temperature (Field) | °C | 4.7 | 6.2 | 5.4 | 6.0 | 7.0 | | 9.8 |
| Comment | | | | | | | | |
| **Laboratory Parameters[2]** | | | | | | | | |
| Name of Certified Lab[3] | | | | | | ACZ | | |
| Lab Reference # | | | | | | L37661-07 | | |
| Sample Date | | | | | | 6/7/2017 | | |
| Lab Test Date | | | | | | 6/9-7/7 | | |
| Sampled By | | | | | | PH | | |
| Alkalinity (Total CaCO3) | mg/L | 173 | 209 | 196 | | 202 | | |
| Aluminum, dissolved | mg/L | -0.03 | 0.07 | 0.03 | | -0.03 | U | |
| Sum of Anions | meq/L | 4.4 | 5.0 | 4.8 | | 5.0 | | |
| Arsenic, total recoverable | mg/L | -0.0002 | 0.0008 | 0.0003 | | -0.0002 | U | |
| Bicarbonate as CaCO3 | mg/L | 169 | 204 | 189 | | 194 | | |
| Boron, dissolved | mg/L | 0.01 | 0.02 | 0.02 | | 0.01 | B | |
| Cadmium, dissolved | mg/L | -0.005 | -0.005 | -0.005 | | -0.005 | U | |
| Calcium, dissolved | mg/L | 34.8 | 41.1 | 39.5 | | 42.7 | | |
| Carbonate as CaCO3 | mg/L | -2 | 13 | 7 | | 7.7 | B | |
| Cation - Anion Balance | mg/L | -1.1 | 2.1 | 1.0 | | -1.0 | | |
| Sum of Cations | meq/L | 4.3 | 5.06 | 4.9 | | 4.9 | | |
| Chloride | mg/L | 1 | 2 | 2 | | 2.1 | | |
| Conductivity @25C | µmhos/cm | 422 | 496 | 469 | | 443 | | |
| Copper, dissolved | mg/L | -0.01 | -0.01 | -0.01 | | -0.01 | U | |
| Hardness as CaCO3 | mg/L | 113 | 134 | 128 | | 139 | | |
| Hydroxide as CaCO3 | mg/L | -2 | -2 | -2 | | -2 | U | |
| Iron, dissolved | mg/L | -0.02 | 0.45 | 0.11 | | -0.02 | U | |
| Iron, total | mg/L | 0.09 | 2.99 | 0.92 | | 0.56 | | |
| Lead, dissolved | mg/L | -0.04 | -0.04 | -0.04 | | -0.03 | U | |
| Magnesium, dissolved | mg/L | 6.4 | 7.5 | 7.2 | | 7.9 | | |
| Manganese, dissolved | mg/L | -0.005 | 0.013 | 0.004 | | -0.005 | U | |
| Manganese, total | mg/L | -0.005 | 0.05 | 0.02 | | 0.007 | B | |
| Mercury, total | mg/L | -0.0002 | -0.0002 | -0.0002 | | -0.0002 | U | |
| Molybdenum, dissolved | mg/L | -0.02 | -0.02 | -0.02 | | -0.02 | U | |
| Nitrate/Nitrite (as N) | mg/L | -0.02 | 0.03 | 0.02 | | 0.04 | B | |
| pH | SU | 8.2 | 8.5 | 8.4 | | 8.4 | H | |
| Phosphate | mg/L | -0.03 | 0.09 | 0.05 | | -0.06 | U | |
| Phosphorus, ortho dissolved | mg/L | -0.01 | 0.03 | 0.02 | | -0.02 | U | |
| Potassium, dissolved | mg/L | 0.9 | 1.6 | 1.2 | | 1.1 | | |
| Selenium, total recoverable | mg/L | 0.0003 | 0.0004 | 0.0003 | | 0.0003 | | |
| Sodium Adsorption Ratio (SAR) | calc. | 1.93 | 2.03 | 2.01 | | 1.70 | | |
| Sodium, dissolved | mg/L | 46.6 | 53.1 | 51.6 | | 46.5 | | |
| Sulfate | mg/L | 37 | 45 | 40 | | 43.0 | | |
| TDS (ratio - measured/calculated) | calc. | 1.03 | 1.12 | 1.06 | | 1.02 | | |
| TDS (calculated) | mg/L | 234 | 268 | 259 | | 266 | | |
| Residue, Filterable (TDS) @180C | mg/L | 240 | 298 | 274 | | 270 | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | -5 | 112 | 34 | | 50.0 | | |
| Zinc, dissolved | mg/L | -0.01 | 0.16 | 0.02 | | -0.01 | U | |

[1] Baseline Monitoring May Through October 2013.

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

[3] ACZ Laboratory, Steamboat Springs, CO.

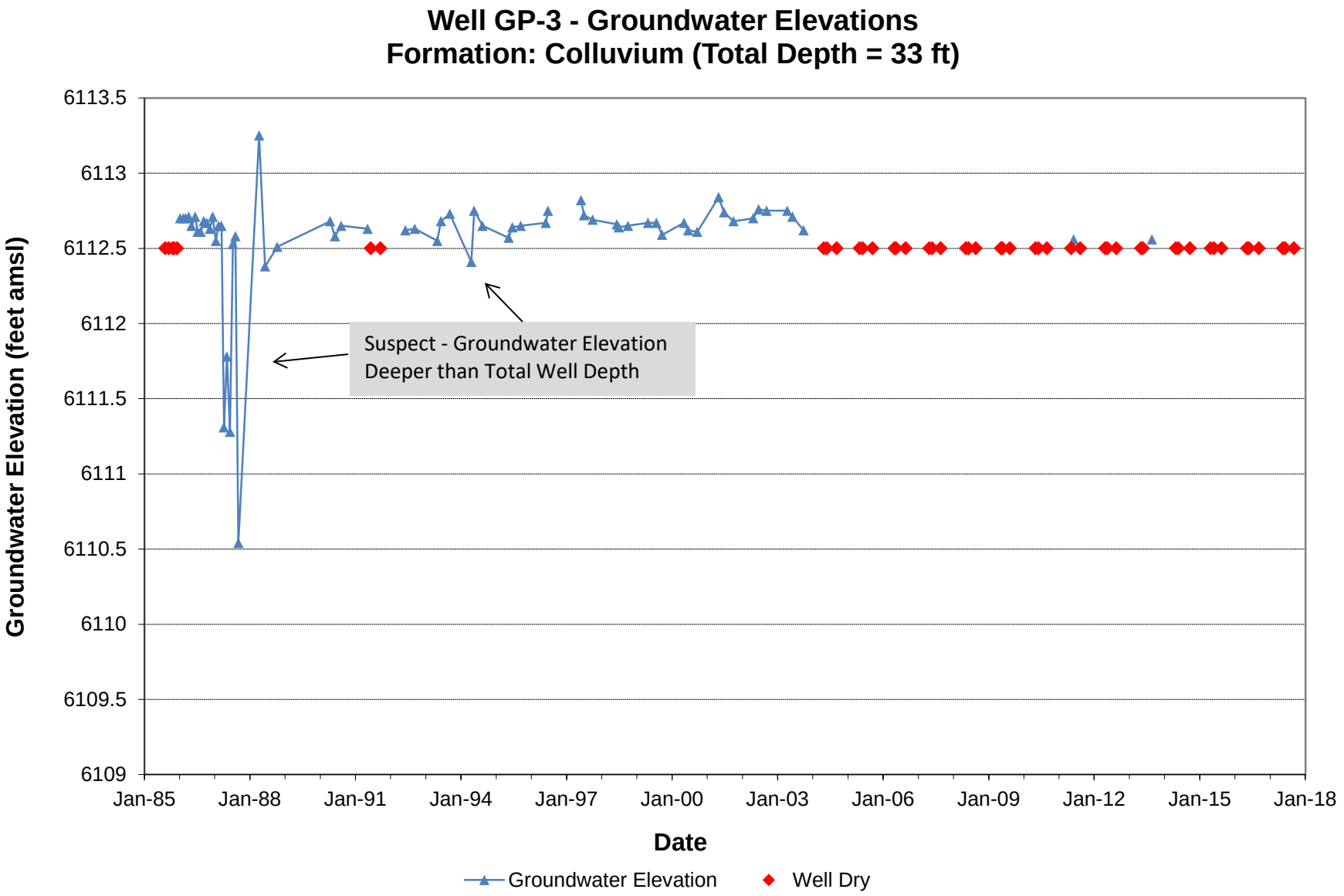
[4] ACZ Lab Qualifiers: U - Analyte was analyzed for but not detected at the indicated MDL.
H - Holding time exceeded; pH is a field test with an immediate hold time.
B - Analyte concentration detected at a value between method detection limit (MDL) and practical quantitation limit (PQL). The associated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

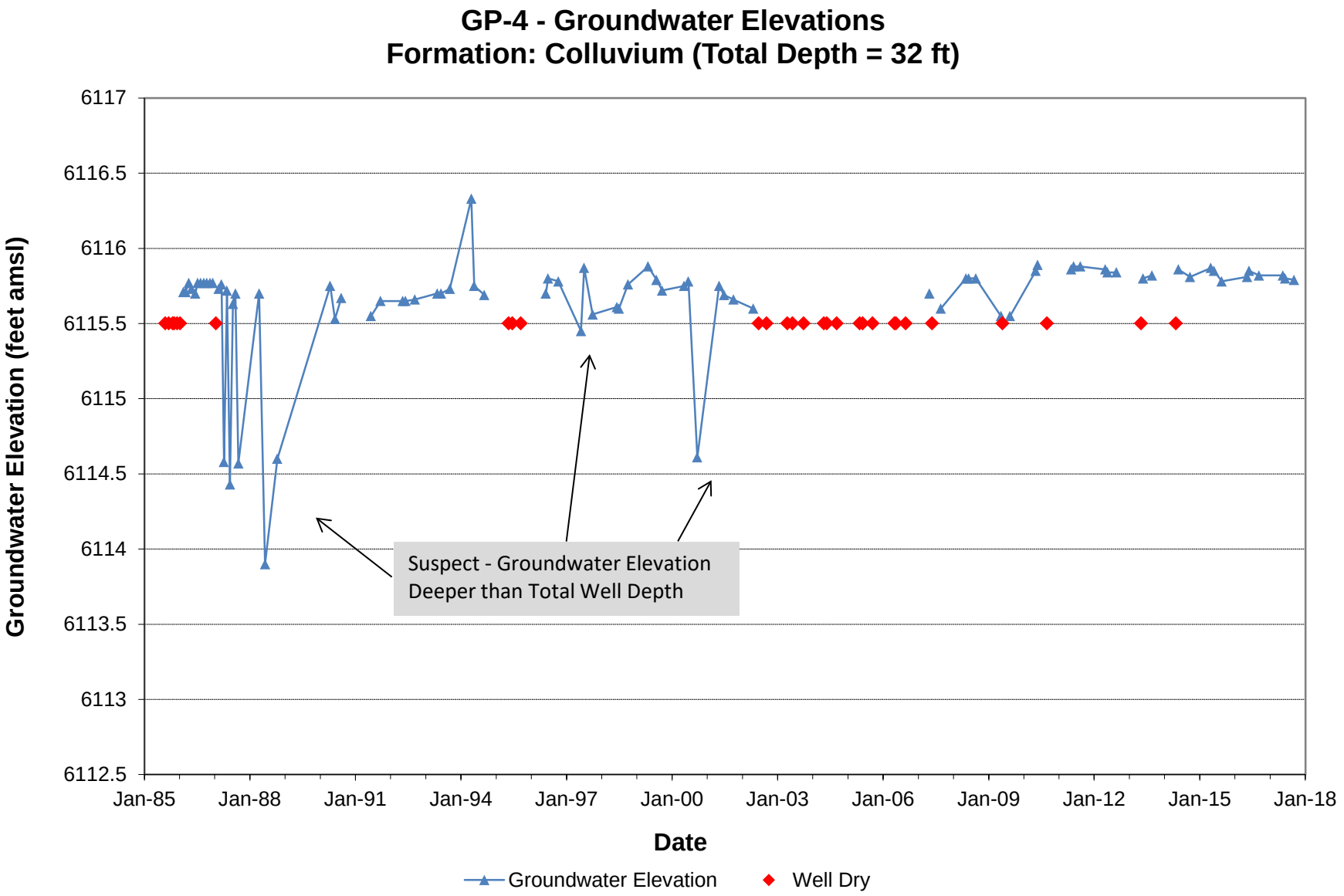
[5] Average (mean) value calc using 1/2 of detection limit for readings below lab detection limits unless all readings are below lab detection limit.

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

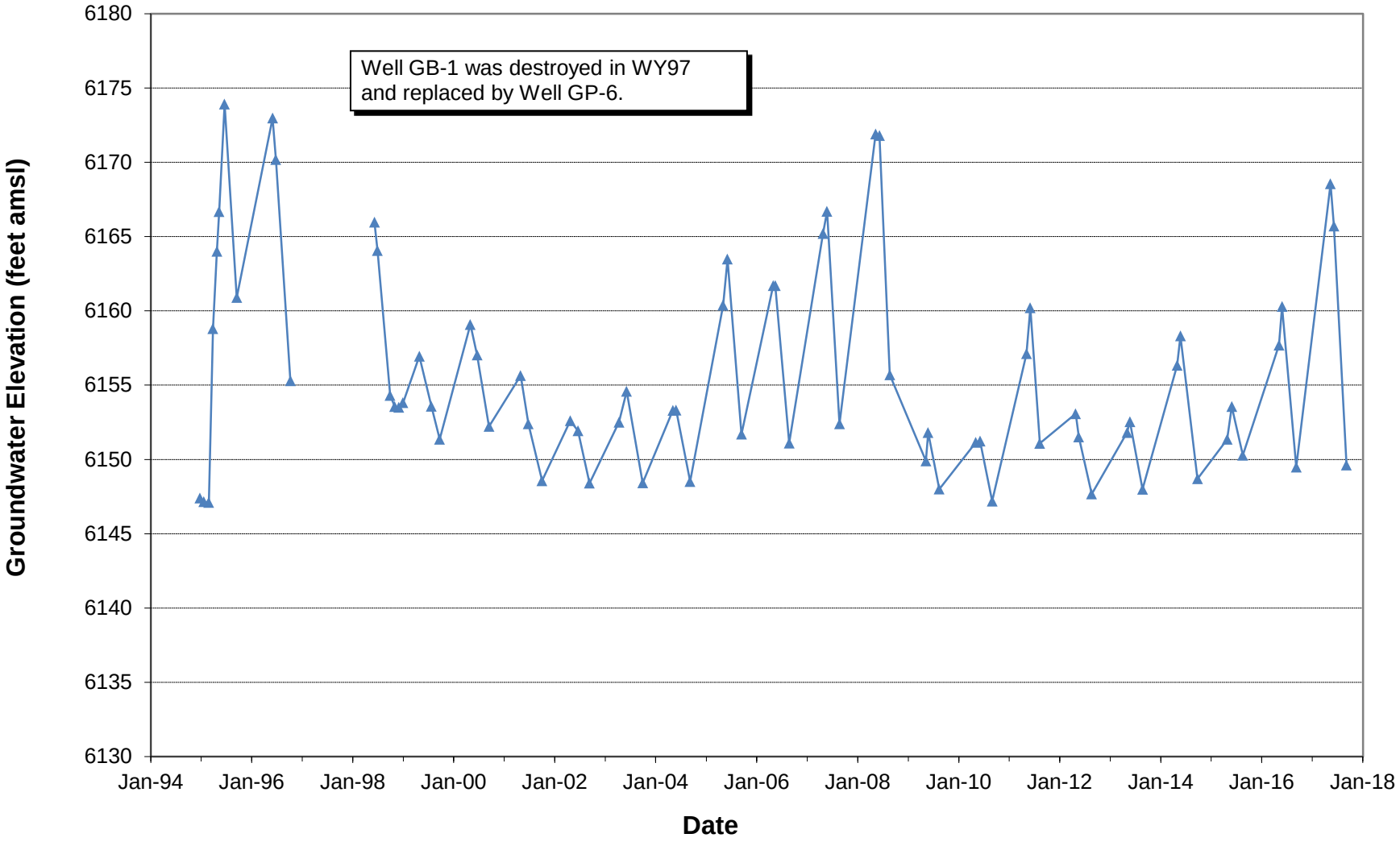
# APPENDIX F

## WELLS - WATER LEVEL ELEVATION GRAPHS

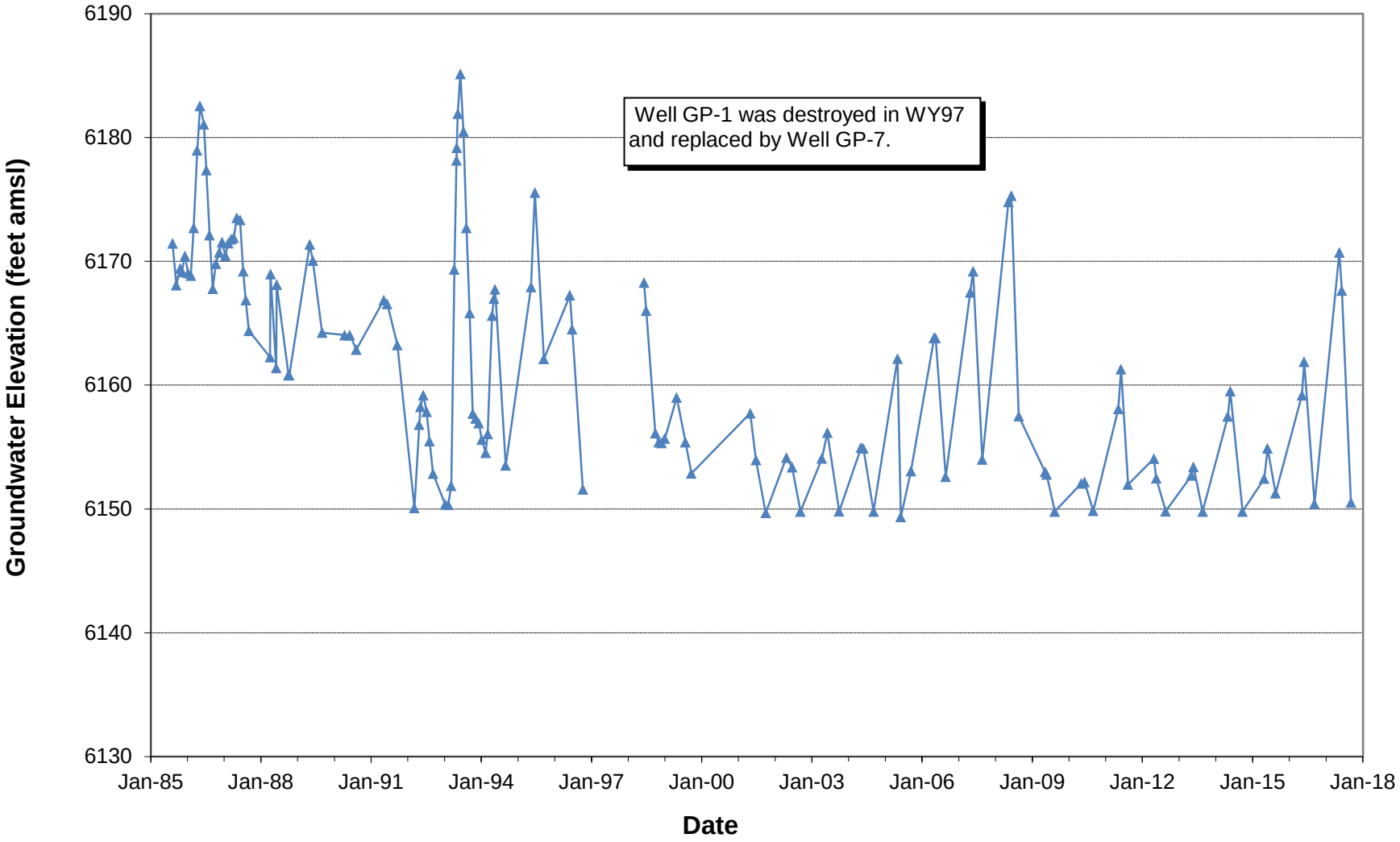

Well GP-3 - Groundwater Elevations
Formation: Colluvium (Total Depth = 33 ft)
Groundwater Elevation (feet amsl)
6113.5
6113
6112.5
6112
6111.5
6111
6110.5
6110
6109.5
6109
Jan-85
Jan-88
Jan-91
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09
Jan-12
Jan-15
Jan-18
Date
Suspect - Groundwater Elevation
Deeper than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


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
Date
Suspect - Groundwater Elevation
Deeper than Total Well Depth
Groundwater Elevation
Well Dry

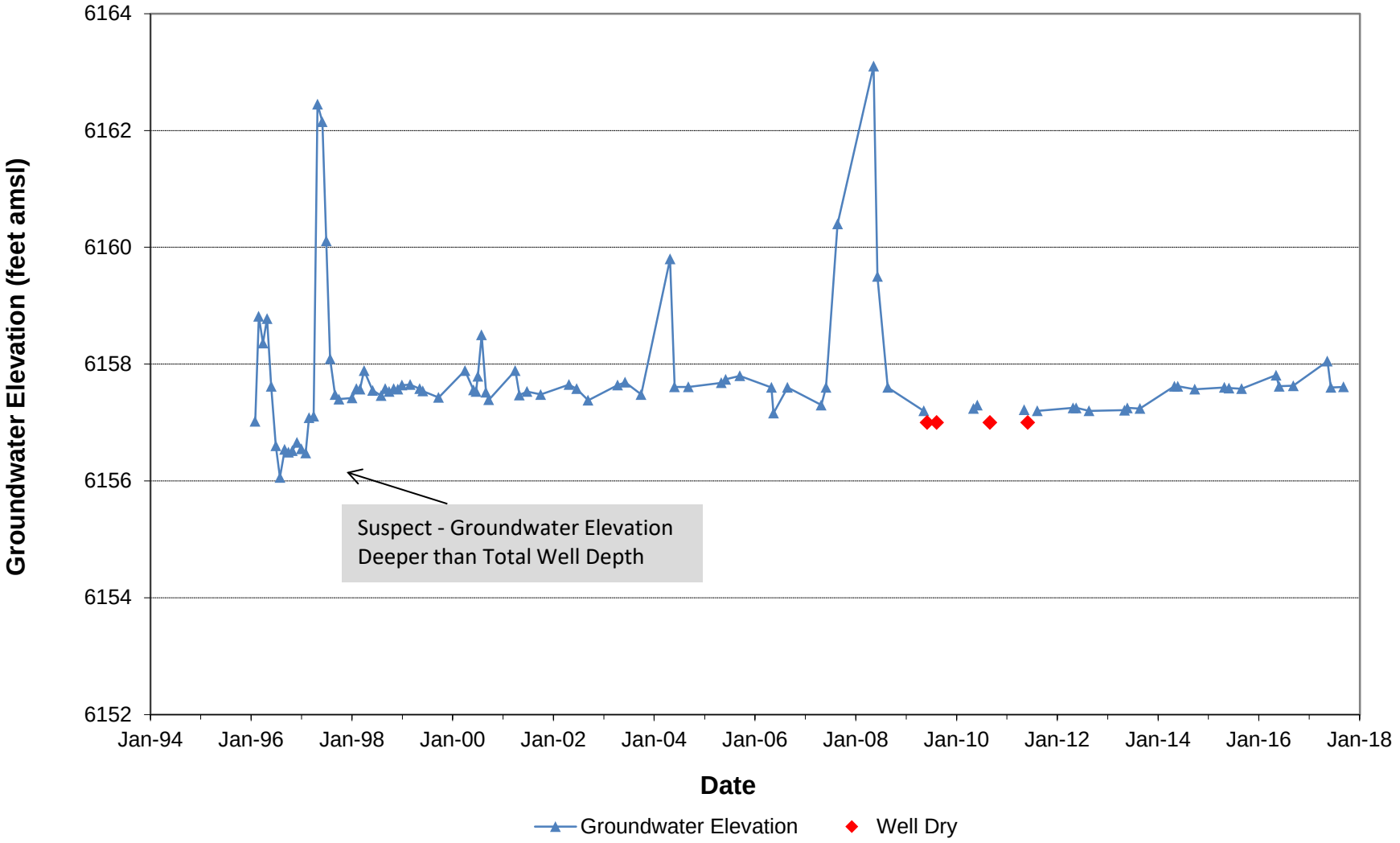
## Well GP-6 - Groundwater Elevations
## Formation: Sylvester Gulch Alluvium (Total Depth = 83 ft)



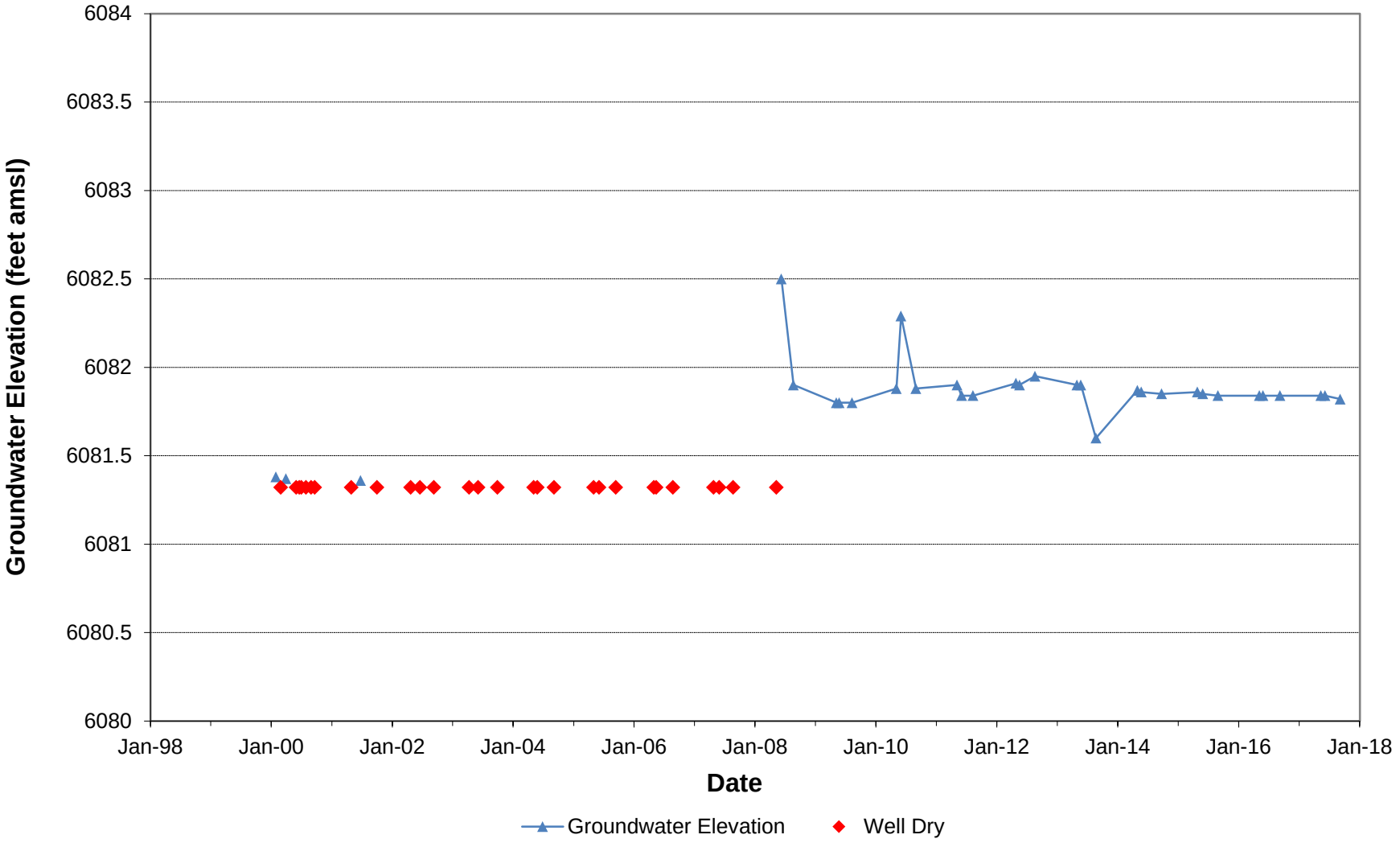
## Well GP-7 - Groundwater Elevations
## Formation: Sylvester Gulch Alluvium (Total Depth = 55 ft)

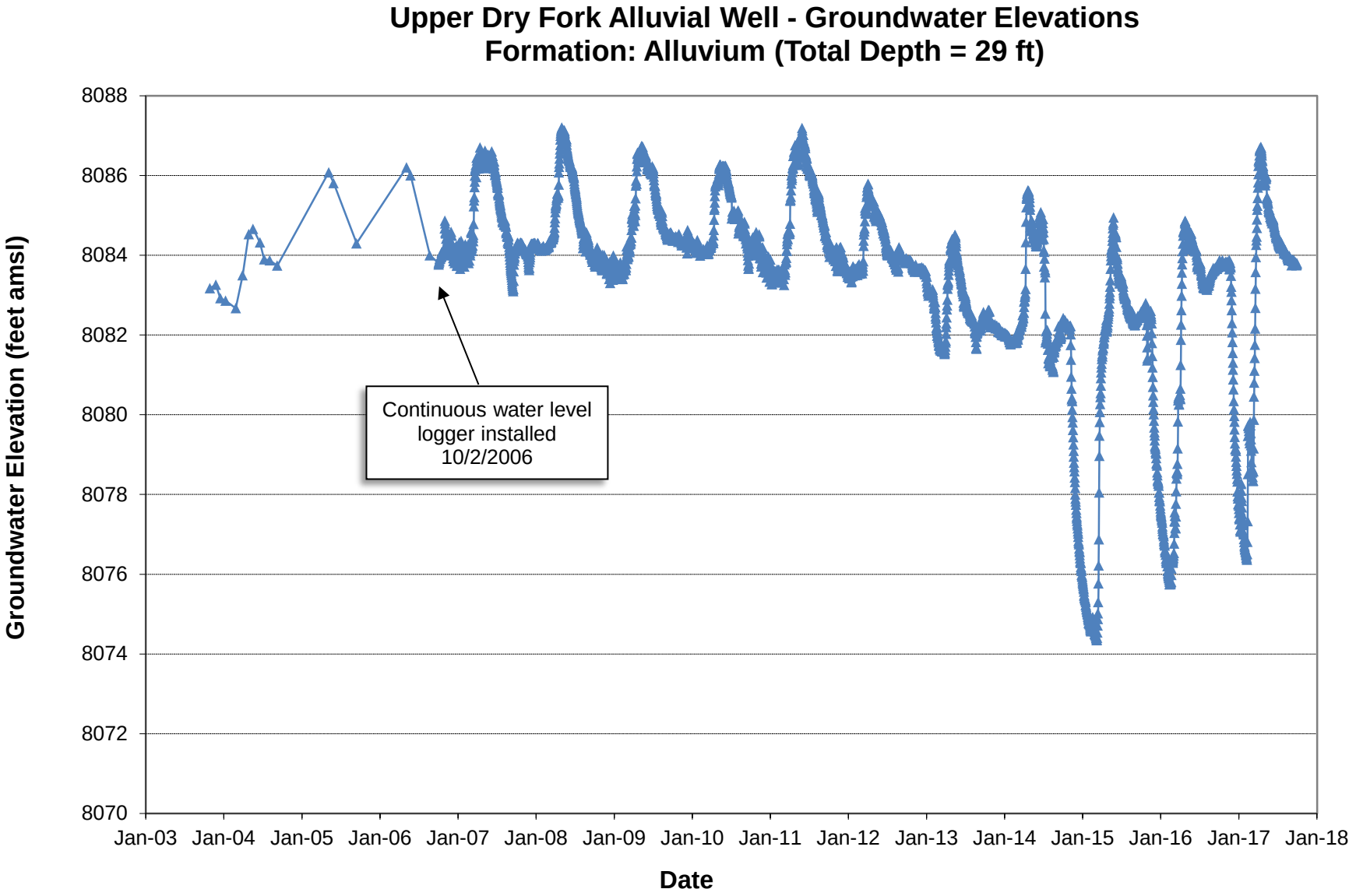


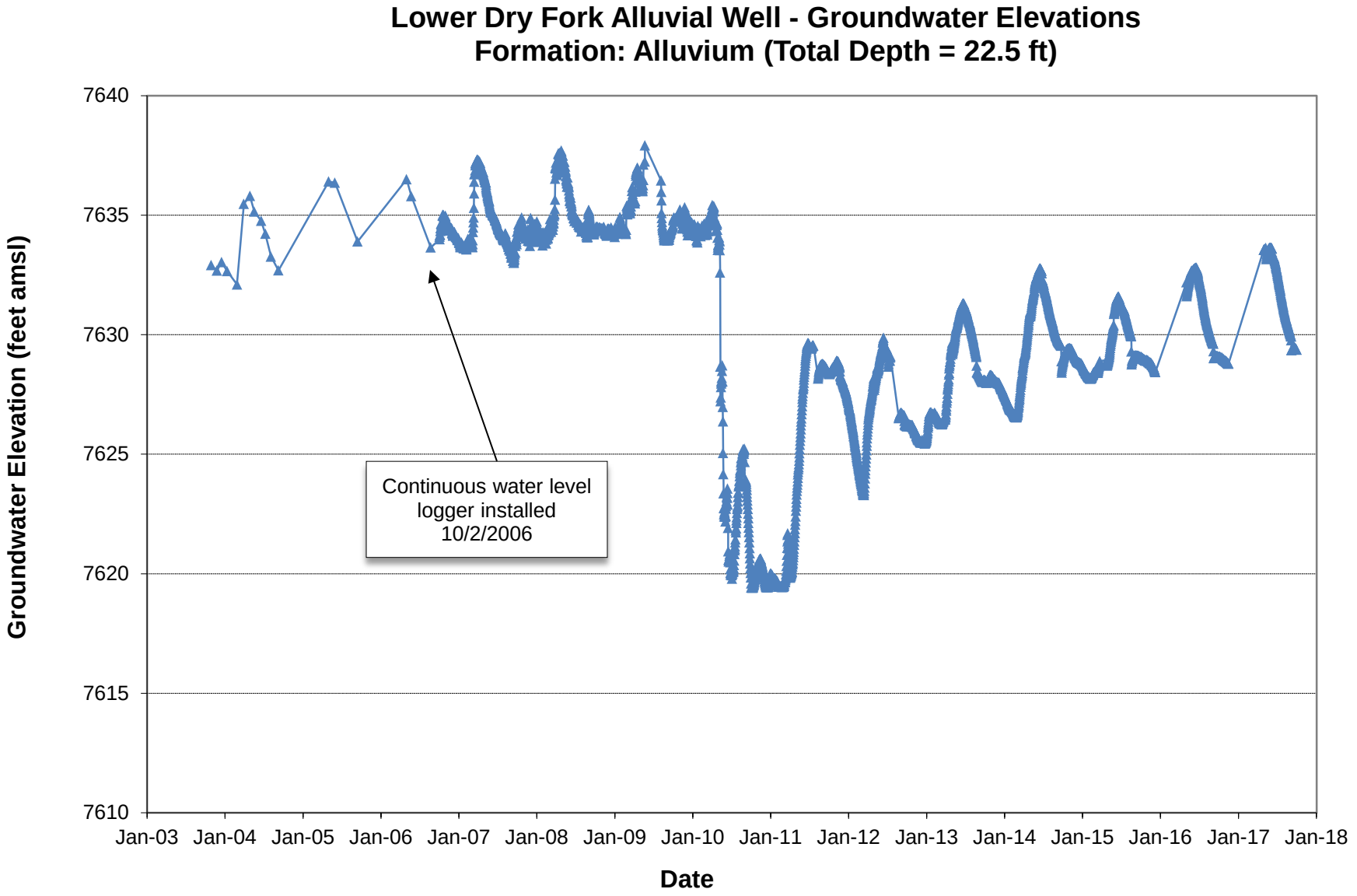
## Well RPE-1 - Groundwater Elevations
## Formation: Colluvium (Total Depth = 30 ft)

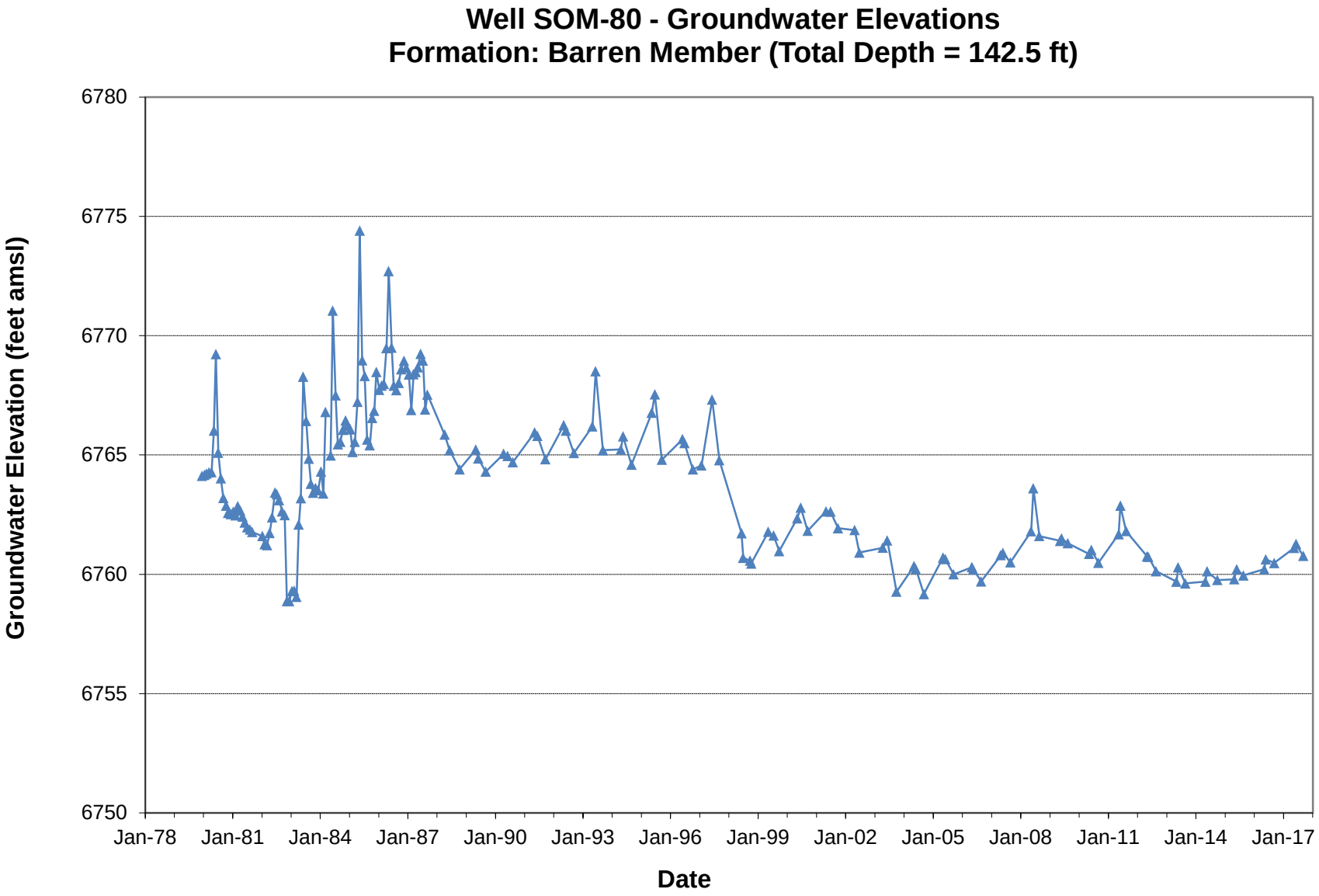


## Well RPE-7 - Groundwater Elevations
## Formation: Colluvium (Total Depth = 32 ft)

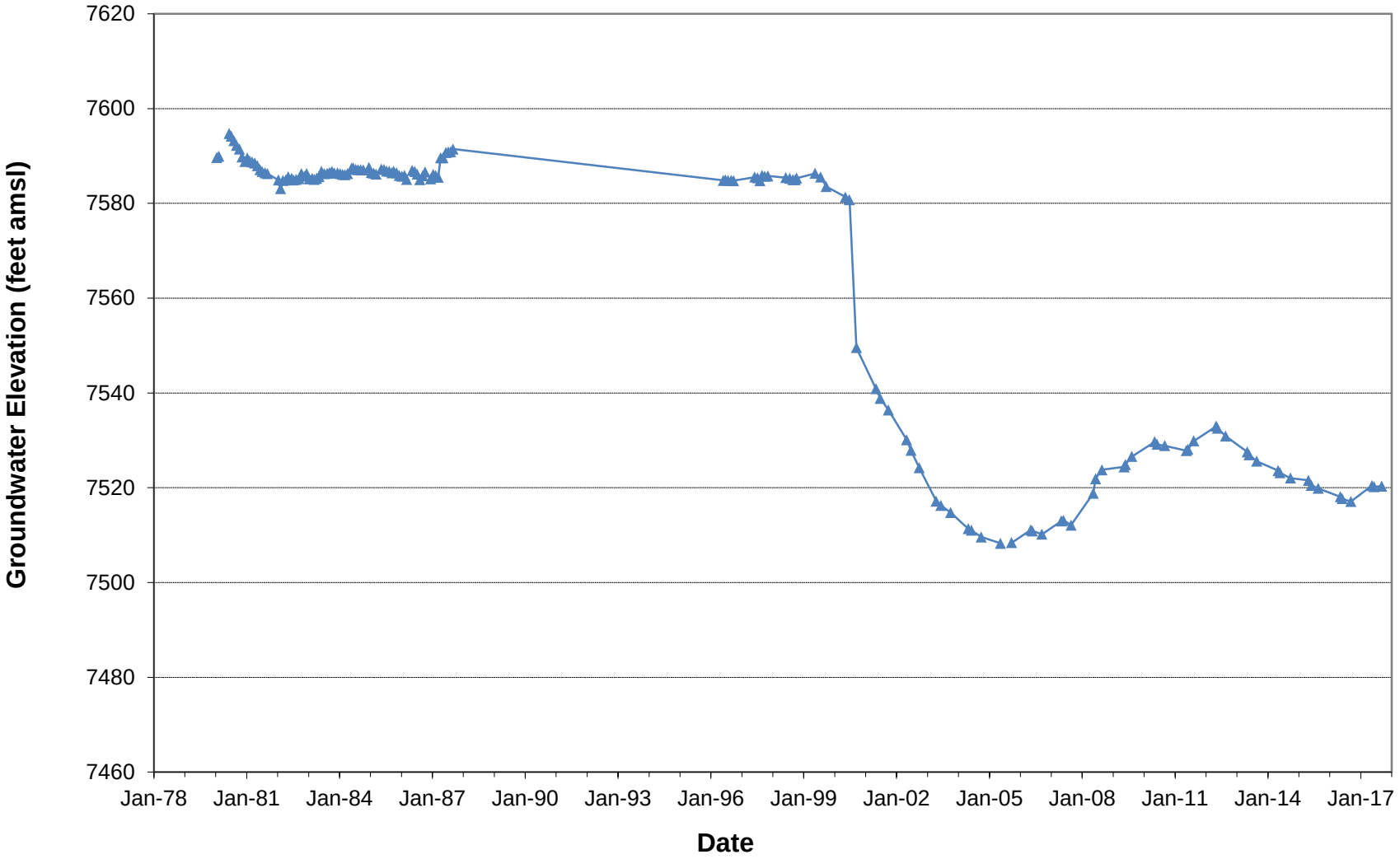


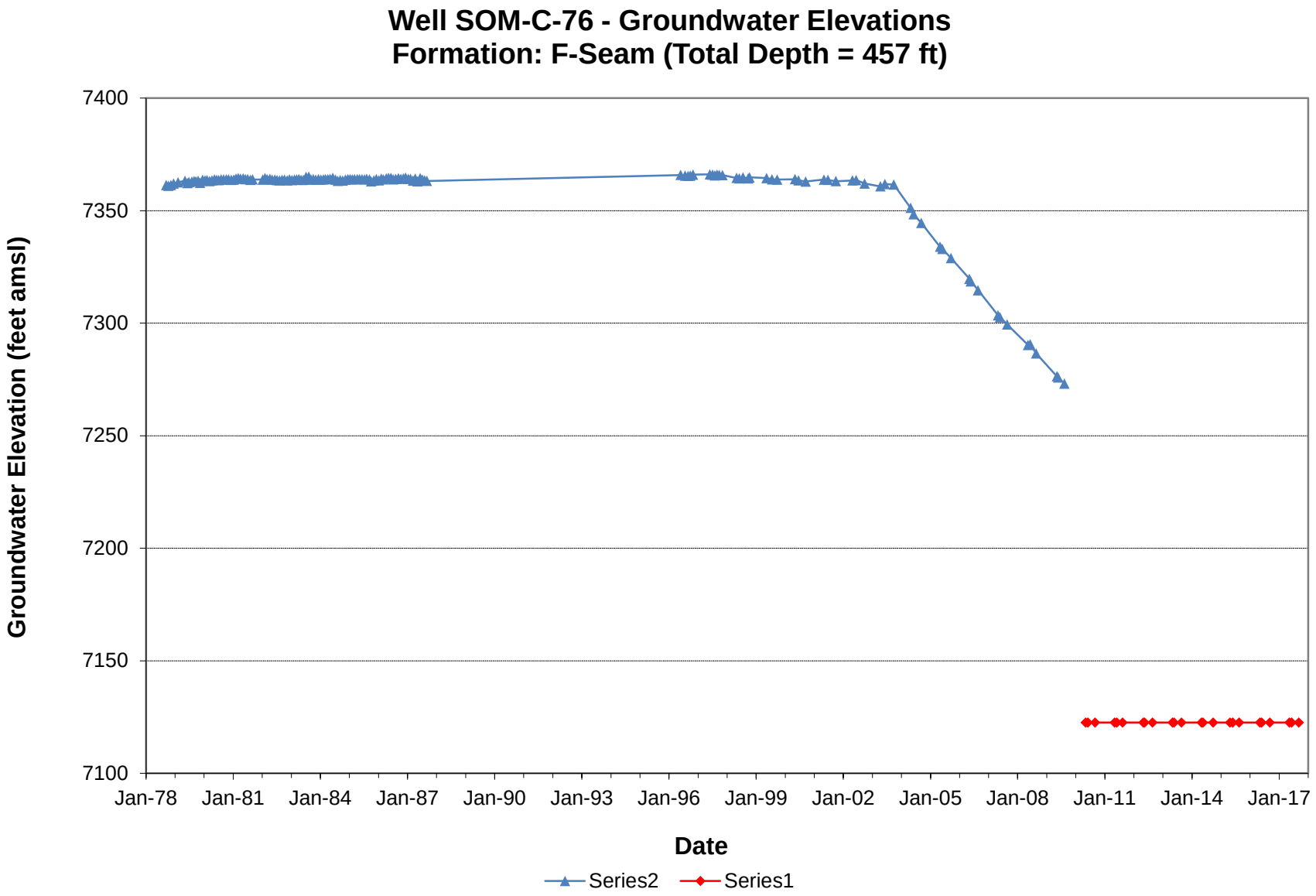

Upper Dry Fork Alluvial Well - Groundwater Elevations
Formation: Alluvium (Total Depth = 29 ft)
Groundwater Elevation (feet amsl)
8088
8086
8084
8082
8080
8078
8076
8074
8072
8070
Continuous water level logger installed 10/2/2006
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13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

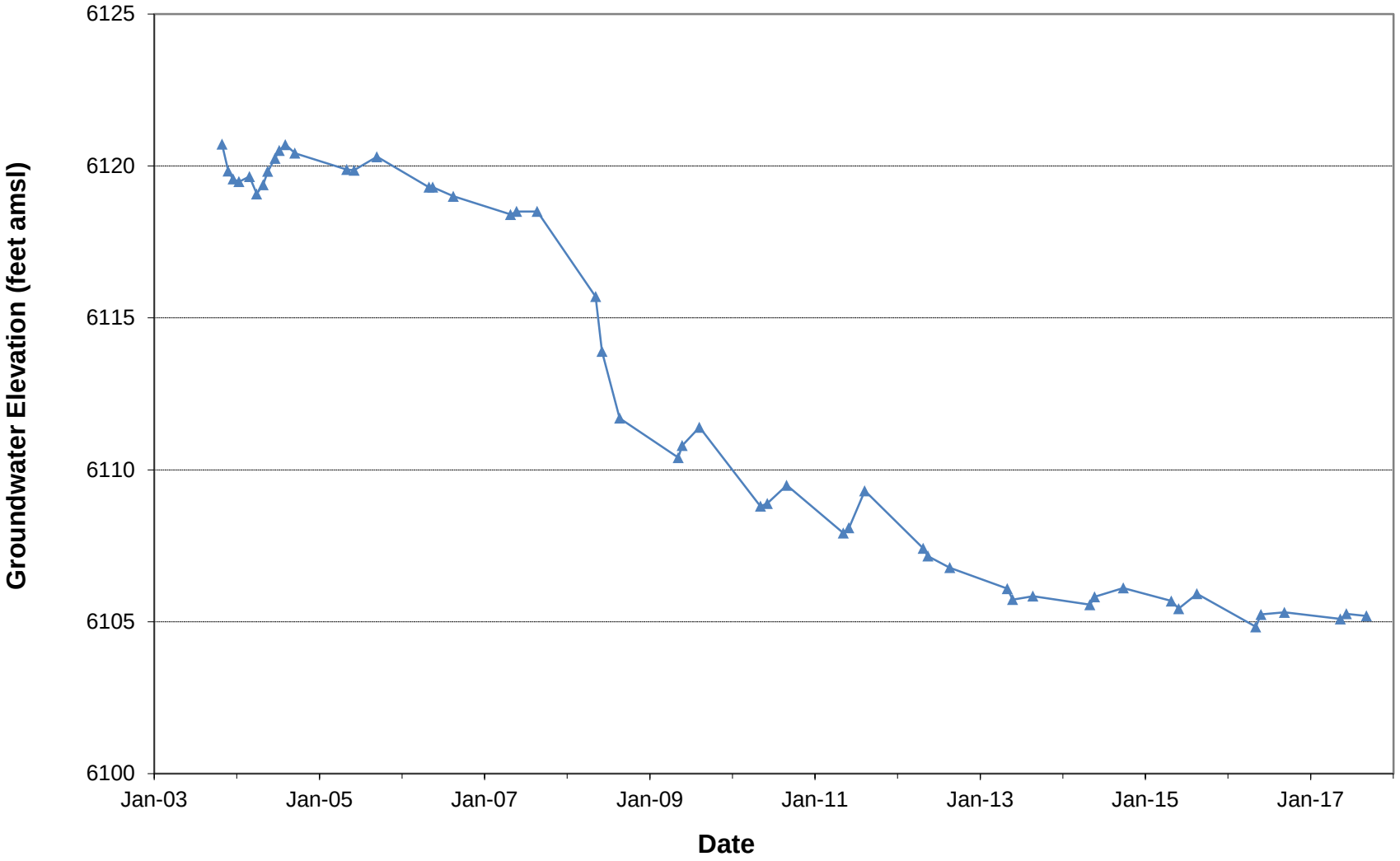

Well SOM-80 - Groundwater Elevations
Formation: Barren Member (Total Depth = 142.5 ft)
Groundwater Elevation (feet amsl)
6780
6775
6770
6765
6760
6755
6750
Jan-78
Jan-81
Jan-84
Jan-87
Jan-90
Jan-93
Jan-96
Jan-99
Jan-02
Jan-05
Jan-08
Jan-11
Jan-14
Jan-17
Date

## Well SOM-45-H-1 - Groundwater Elevations
## Formation: Barren Member (Total Depth = 260 ft)

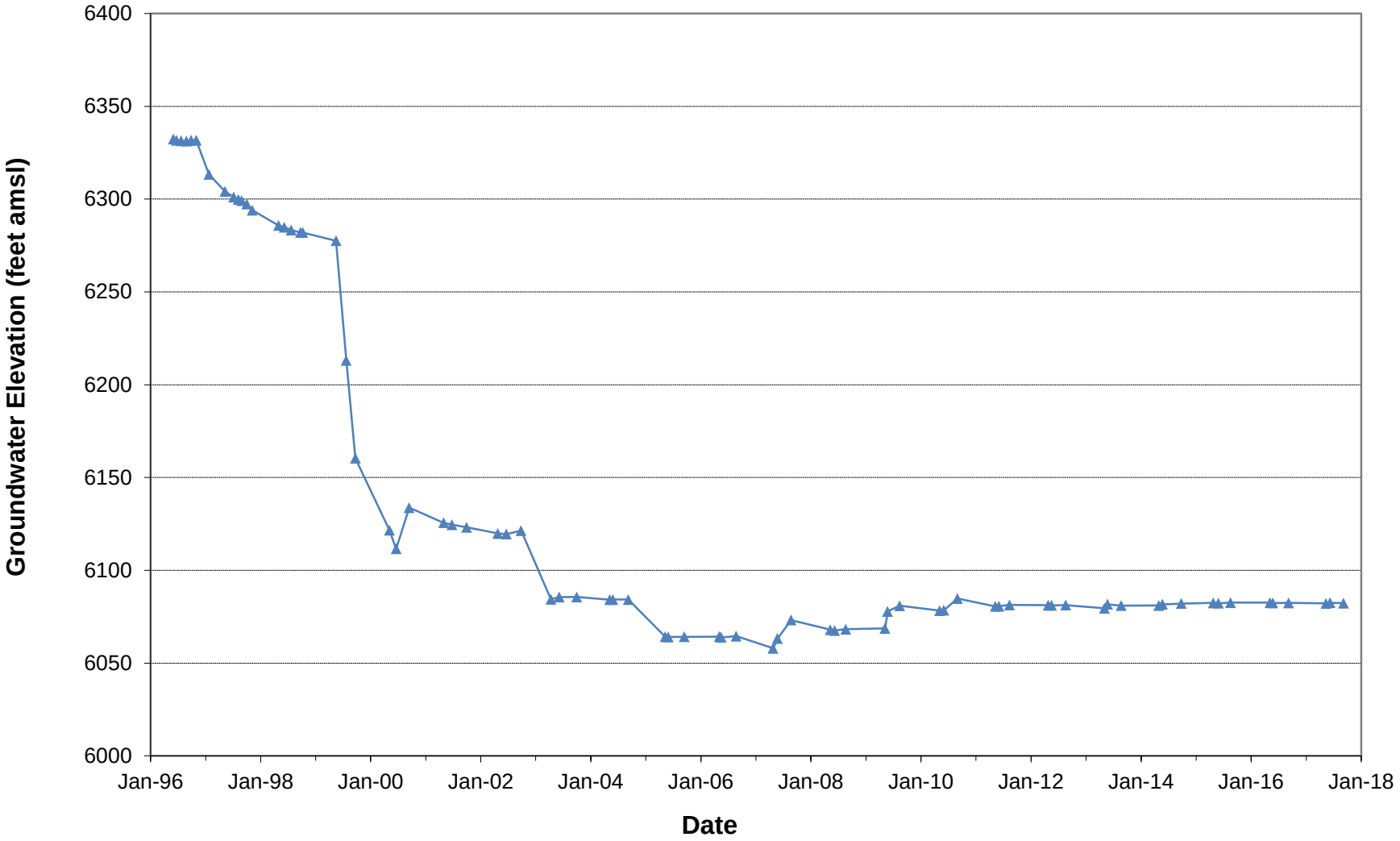



Well SOM-C-76 - Groundwater Elevations
Formation: F-Seam (Total Depth = 457 ft)
Groundwater Elevation (feet amsl)
7400
7350
7300
7250
7200
7150
7100
Jan-78
Jan-81
Jan-84
Jan-87
Jan-90
Jan-93
Jan-96
Jan-99
Jan-02
Jan-05
Jan-08
Jan-11
Jan-14
Jan-17
Date
Series2
Series1

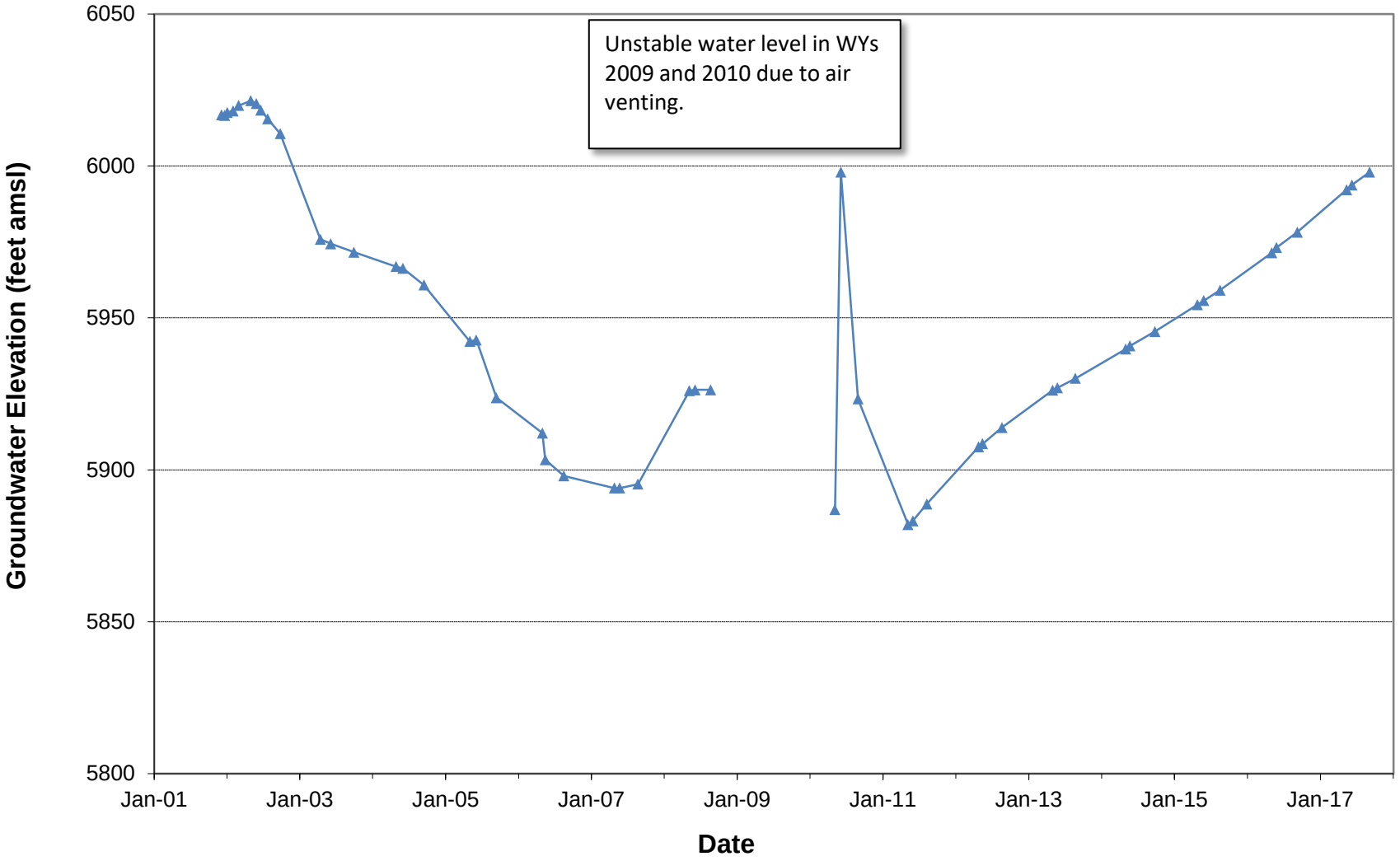
## Well 03-11-1- Groundwater Elevations
## Formation: E-Seam (Total Depth = 250 ft)



## Well Rav-4b - Groundwater Elevations
## Formation: B-Seam (Total Depth = 630 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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well GP-3** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 |
| **Field Parameters** | | | | | | | |
| Water Level Depth | feet | | | | dry | dry | dry |
| Conductivity (Field) | µmhos/cm | | | | | | |
| pH (Field) | SU | | | | | | |
| Temperature (Field- F) | °F | | | | | | |
| Temperature (Field) | °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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well GP-4** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 |
| **Field Parameters** | | | | | | | |
| Water Level Depth | feet | | | | 31.68 | 31.70 | 31.71 |
| Conductivity (Field) | µmhos/cm | | | | | | |
| pH (Field) | SU | | | | | | |
| Temperature (Field- F) | °F | | | | | | |
| Temperature (Field) | °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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location Well GP-6** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 36.25 | 39.09 | 55.19 | |
| Conductivity (Field) | µmhos/cm | | | | 1,115 | 1,134 | 1,138 | |
| pH (Field) | SU | | | | 7.50 | 7.45 | 7.49 | |
| Temperature (Field) | °C | | | | 12.2 | 11.8 | 12.4 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-07 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Conductivity @25C | µmhos/cm | | | | | | 1,100 | |
| Iron, dissolved | mg/L | | | | | | 0.78 | |
| Iron, total | mg/L | | | | | | 1.75 | |
| pH | SU | | | | | | 8.2 | H |
| Residue, Filterable (TDS) @180C | mg/L | | | | | | 662 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | 15.0 | B |

[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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well GP-7** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 34.98 | 38.06 | 55.17 | |
| Conductivity (Field) | µmhos/cm | | | | 1,771 | 1,693 | 1,536 | |
| pH (Field) | SU | | | | 7.00 | 7.11 | 7.32 | |
| Temperature (Field) | °C | | | | 11.3 | 11.6 | 15.4 | |
| Comment | | | | | | | not enough water for lab sample | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | | |
| 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.

[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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well RPE-1** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/6/2017 |
| **Field Parameters** | | | | | | | |
| Water Level Depth | feet | | | | 28.95 | 29.40 | 29.39 |
| Conductivity (Field) | µmhos/cm | | | | | | |
| pH (Field) | SU | | | | | | |
| Temperature (Field) | °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 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well RPE-7** | | **Baseline [1]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/6/2017 |
| **Field Parameters** | | | | | | | |
| Water Level Depth | feet | | | | 34.46 | 34.46 | 34.48 |
| Conductivity (Field) | µmhos/cm | | | | | | |
| pH (Field) | SU | | | | | | |
| Temperature (Field) | °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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Upper Dry Fk Alluvial Well** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/11/2017 | 6/7/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 14.56 | 15.03 | 16.10 | |
| Conductivity (Field) | µmhos/cm | | | | 903 | 885 | 867 | |
| pH (Field) | SU | | | | 7.51 | 7.46 | 7.54 | |
| Temperature (Field) | °C | | | | 9.2 | 10.1 | 11.1 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-04 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 227 | 266 | 248 | | | | |
| Sum of Anions | meq/L | 5.6 | 6.2 | 5.8 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 5.7 | 6.7 | 6.0 | | | | |
| Chloride | mg/L | -1 | 6 | 4 | | | | |
| Conductivity @25C | µmhos/cm | 493 | 509 | 503 | | | 836 | |
| 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 | | | 0.08 | |
| Iron, total | mg/L | 1.3 | 25.9 | 13.6 | | | 0.16 | |
| 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 | | | 8.3 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | mg/L | 1 | 1 | 1 | | | | |
| TDS (calculated) | calc. | 313 | 313 | 313 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 290 | 390 | 326 | | | 528 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | -5 | U |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Lower Dry Fk Alluvial Well** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/10/2017 | 6/8/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | 4.19 | 7.90 | 6.27 | 6.35 | 6.43 | 10.15 | |
| Conductivity (Field) | µmhos/cm | 575 | 693 | 626 | 523 | 521 | 517 | |
| pH (Field) | SU | 6.60 | 7.10 | 6.87 | 7.82 | 7.76 | 7.55 | |
| Temperature (Field) | °C | 6.4 | 16.4 | 10.3 | 8.7 | 12.4 | 12.8 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-05 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 260 | 300 | 272 | | | | |
| Sum of Anions | meq/L | 5.8 | 5.8 | 5.8 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 5.9 | 6.2 | 6.0 | | | | |
| Chloride | mg/L | -1 | 3 | 2 | | | | |
| Conductivity @25C | µmhos/cm | 459 | 497 | 482 | | | 492 | |
| 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 | | | -0.02 | U |
| Iron, total | mg/L | 0.08 | 0.51 | 0.26 | | | 0.06 | |
| 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 | | | 8.3 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 250 | 310 | 297 | | | 272 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | -5 | U |
| 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 2017 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well SOM-80** | | **Baseline [1]** | | | **2017 Water Year** | | | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 | Q[4] | 9/5/2017 (Duplicate) | Q[4] |
| **Field Parameters** | | | | | | | | | | |
| Water Level Depth | feet | | | | 93.30 | 93.13 | 93.63 | | -- | |
| Conductivity (Field) | µmhos/cm | | | | 1,076 | 1,079 | 1,063 | | -- | |
| pH (Field) | SU | | | | 7.27 | 7.34 | 7.37 | | -- | |
| Temperature (Field) | °C | | | | 12.9 | 11.7 | 11.4 | | -- | |
| Comment | | | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | . | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | | ACZ | |
| Lab Reference # | | | | | | | L39748-03 | | L39748-01 | |
| Sample Date | | | | | | | 9/5/2017 | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | | 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 | | | 1,040 | | 1,070 | |
| Hardness as CaCO3 | mg/L | 45 | 754 | 389 | | | | | | |
| Iron, dissolved | mg/L | 0 | 0.82 | 0.15 | | | 0.03 | B | 0.03 | B |
| Iron, total | mg/L | 0 | 6.8 | 0.71 | | | 0.19 | | 0.19 | |
| 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 | | | 8.1 | H | 8.1 | H |
| Phosphorus, ortho dissolved | mg/L | 0 | 0.3 | 0.049 | | | | | | |
| 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 | | | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 26.8 | 1,888 | 868 | | | 646 | | 630 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | -5 | U | 6.0 | B |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well SOM-45-H-1** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/8/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 183.36 | 183.59 | 183.46 | |
| Conductivity (Field) | µmhos/cm | 1,073 | 1,626 | 1,285 | 1,937 | 1,922 | 1,944 | |
| pH (Field) | SU | 6.4 | 8.6 | 7.7 | 7.87 | 7.81 | 7.93 | |
| Temperature (Field) | °C | | | | 10.6 | 11.0 | 10.9 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-02 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 286 | 955 | 635 | | | | |
| Ammonia | mg/L | 0.03 | 2.35 | 0.69 | | | | |
| Sum of Anions | meq/L | 15 | 15.5 | 15.3 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 13.9 | 16.4 | 15.3 | | | | |
| 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 | | | 2.65 | |
| Iron, total | mg/L | 0.35 | 6.15 | 1.96 | | | 2.58 | |
| 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | | | | | | 1,210 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | 60.0 | |
| 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]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean [2] | 5/11/2017 | 6/8/2017 | 9/5/2017 |
| **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 | | | |
| Sum of Anions | meq/L | 29.6 | 30.88 | 32.71 | | | |
| 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 | | | |
| Sum of Cations | meq/L | 29.30 | 30.53 | 31.50 | | | |
| 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 | | | |
| 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 | | | |
| Residue, Filterable (TDS) @180C | mg/L | 1,530 | 1,642 | 2,590 | | | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 7 | 37 | 226 | | | |
| 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 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well 03-11-1** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/12/2017 | 6/8/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 175.91 | 175.74 | 175.81 | |
| Conductivity (Field) | µmhos/cm | | | | 3,260 | 3,220 | 3,250 | |
| pH (Field) | SU | | | | 7.56 | 7.51 | 7.73 | |
| Temperature (Field) | °C | | | | 14.2 | 13.8 | 15.0 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-06 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 1620 | 1950 | 1802 | | | | |
| Sum of Anions | meq/L | 35 | 36 | 35 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 33.0 | 33.4 | 33.2 | | | | |
| Chloride | mg/L | 66 | 177 | 89 | | | | |
| Conductivity @25C | µmhos/cm | 2,660 | 2,730 | 2,695 | | | 3,020 | |
| 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 | | | 0.35 | |
| Iron, total | mg/L | 0.30 | 0.49 | 0.40 | | | 0.23 | |
| 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 | | | 8.4 | 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 | | | | |
| 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 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 1,850 | 2,130 | 2,044 | | | 1,930 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | -5 | U |
| 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 RAV-4b
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well RAV-4b** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/8/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | | | | 604.85 | 604.48 | 604.65 | |
| Conductivity (Field) | µmhos/cm | 1,480 | 3,000 | 2,362 | 2,720 | 2,660 | 2,620 | |
| pH (Field) | SU | 8.4 | 9.1 | 8.8 | 7.73 | 7.69 | 7.93 | |
| Temperature (Field) | °C | 9.9 | 21.3 | 19.2 | 22.7 | 22.6 | 23.5 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-08 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 684 | 1,510 | 1,115 | | | | |
| Ammonia | mg/L | 0.21 | 1.83 | 1.02 | | | | |
| Arsenic, dissolved | mg/L | 0 | 0.31 | 0.03 | | | | |
| Arsenic, total recoverable | mg/L | 0.002 | 0.002 | 0.002 | | | | |
| Bicarbonate as CaCO3 | mg/L | 649 | 1,510 | 1,076 | | | | |
| Cadmium, dissolved | mg/L | 0 | 0 | 0 | | | | |
| Calcium, dissolved | mg/L | 0.9 | 8.5 | 2.3 | | | | |
| Carbonate as CaCO3 | mg/L | 0 | 80 | 38.8 | | | | |
| Cation - Anion Balance | % | -3.2 | 4 | 1.5 | | | | |
| Sum of Cations | meq/L | 28.3 | 32.3 | 30.8 | | | | |
| Chloride | mg/L | 21 | 59 | 41.2 | | | | |
| Conductivity @25C | µmhos/cm | 2,500 | 2,700 | 2,582.5 | | | 2,430 | |
| Hardness as CaCO3 | mg/L | 5 | 32 | 13.1 | | | | |
| Hydroxide as CaCO3 | mg/L | 0 | 0 | 0 | | | | |
| Iron, dissolved | mg/L | 0 | 2.64 | 0.305 | | | 0.52 | |
| Iron, total | mg/L | 6.34 | 22.5 | 13.21 | | | 2.27 | |
| Lead, dissolved | mg/L | 0 | 0 | 0 | | | | |
| Magnesium, dissolved | mg/L | 0.7 | 2.7 | 1.68 | | | | |
| Manganese, dissolved | mg/L | 0 | 0.435 | 0.05 | | | | |
| Manganese, total | mg/L | 0.094 | 0.384 | 0.21 | | | | |
| Mercury, dissolved | mg/L | 0 | 0 | 0 | | | | |
| Nitrogen, ammonia | mg/L | 0.67 | 1.89 | 1.14 | | | | |
| pH | SU | 7.3 | 8.9 | 8.28 | | | 8.4 | H |
| Phosphate | mg/L | 0 | 0 | 0 | | | | |
| Phosphorus, ortho dissolved | mg/L | 0 | 0.051 | 0.008 | | | | |
| Potassium, dissolved | mg/L | 3.1 | 3.6 | 3.4 | | | | |
| Selenium, dissolved | mg/L | 0 | 0 | 0 | | | | |
| Sodium Absorption Ratio (SAR) | calc. | 29.9 | 128 | 79.6 | | | | |
| Sodium, dissolved | mg/L | 339 | 727 | 573.5 | | | | |
| Sulfate | mg/L | 0 | 20 | 2.5 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 770 | 1,710 | 1,193 | | | 1,570 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | 38 | 192 | 72.7 | | | 10.0 | B |
| Zinc, dissolved | mg/L | 0 | 0.08 | 0.007 | | | | |

[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 maximum baseline value.

## Well 01-11-1
## Water Quality and Field Parameters

| Mountain Coal West Elk Mine - Water Year 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Monitoring Location: Well 01-11-1** | | **Baseline [1]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean [5] | 5/12/2017 | 6/8/2017 | 9/5/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Water Level Depth | feet | 259.9 | 295.4 | 268.4 | 289.13 | 287.56 | 283.33 | |
| Conductivity (Field) | µmhos/cm | 5,010 | 6,820 | 5,880 | 4,410 | 4,350 | 4,360 | |
| pH (Field) | SU | 9.1 | 9.7 | 9.4 | 7.75 | 7.72 | 7.90 | |
| Temperature (Field) | °C | 9.8 | 20.2 | 15.6 | 17.8 | 17.9 | 19.1 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [2]** | | | | | | | | |
| Name of Certified Lab [3] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-09 | |
| Sample Date | | | | | | | 9/5/2017 | |
| Lab Test Date | | | | | | | 9/9-9/22 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/L | 629 | 1,880 | 1,602 | | | | |
| Ammonia | mg/L | 0.79 | 1.56 | 1.08 | | | | |
| Sum of Anions | meq/L | 51.1 | 56.6 | 53.7 | | | | |
| 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 | | | | |
| Sum of Cations | meq/L | 43.4 | 54.0 | 47.7 | | | | |
| Chloride | mg/L | 527 | 640 | 603 | | | | |
| Conductivity @25C | µmhos/cm | 4,060 | 5,740 | 5,115 | | | 4,220 | |
| 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 | | | 0.16 | |
| Iron, total | mg/L | 0.16 | 0.99 | 0.57 | | | 0.35 | |
| 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 | | | 8.4 | 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 | | | | |
| 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 | | | | |
| TDS (ratio - measured/calculated) | mg/L | 1 | 1 | 1 | | | | |
| TDS (calculated) | calc. | 2,900 | 3,430 | 3,165 | | | | |
| Residue, Filterable (TDS) @180C | mg/L | 2,910 | 3,300 | 3,180 | | | 2,770 | |
| Residue, Non-Filterable (TSS) @105C | mg/L | | | | | | 6.0 | B |
| 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]** | | | **2017 Water Year** | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/5/2017 |
| **Field Parameters** | | | | | | | |
| Flow | gpm | | | | dry | dry | dry |
| Electrical Conductivity | mmhos/cm | | | | | | |
| pH | SU | | | | | | |
| Temperature (°C) | °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 | | | | | | |
| Sum of Anions | meq/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 | % | | | | | | |
| Sum of Cations | meq/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 | | | | | | |
| Selenium, total | mg/l | | | | | | |
| Sodium Absorption Ratio (SAR) | calc. | | | | | | |
| Sodium, dissolved | mg/l | | | | | | |
| Sulfate | mg/l | | | | | | |
| TDS (ratio - measured/calculated) | mg/l | | | | | | |
| TDS (calculated) | calc. | | | | | | |
| Residue, Filterable (TDS) @180C | 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]** | | | **2017 Water Year** | | | |
| Description | Units | Minimum | Maximum | Mean | 5/12/2017 | 6/6/2017 | 9/6/2017 | Q[4] |
| **Field Parameters** | | | | | | | | |
| Flow [5] | gpm | | | | 0.75 | 0.5 | 0.5 | |
| Conductivity (Field) | µmhos/cm | | | | 4,930 | 4,790 | 5,240 | |
| pH (Field) | SU | | | | 8.26 | 8.26 | 8.22 | |
| Temperature (Field) | °C | | | | 12.5 | 14.5 | 15.6 | |
| Comment | | | | | | | | |
| **Laboratory Parameters [3]** | | | | | | | | |
| Name of Certified Lab [2] | | | | | | | ACZ | |
| Lab Reference # | | | | | | | L39748-13 | |
| Sample Date | | | | | | | 9/6/2017 | |
| Lab Test Date | | | | | | | 9/8-9/29 | |
| Sampled By | | | | | | | PH | |
| Alkalinity (Total CaCO3) | mg/l | | | | | | 545 | |
| Aluminum, dissolved | mg/l | | | | | | -0.06 | U |
| Sum of Anions | meq/l | | | | | | 52 | |
| Arsenic, total | mg/l | | | | | | 0.0015 | B |
| Bicarbonate as CaCO3 | mg/l | | | | | | 528 | |
| Boron, dissolved | mg/l | | | | | | 0.9 | |
| Cadmium, dissolved | mg/l | | | | | | -0.01 | U |
| Calcium, dissolved | mg/l | | | | | | 112 | |
| Carbonate as CaCO3 | mg/l | | | | | | 16.8 | B |
| Cation - Anion Balance | % | | | | | | -1.0 | |
| Sum of Cations | meq/l | | | | | | 51 | |
| Chloride | mg/l | | | | | | 845 | |
| Conductivity @25C | µmhos/cm | | | | | | 5,020 | |
| Copper, dissolved | mg/l | | | | | | -0.02 | U |
| Hardness as CaCO3 | mg/l | | | | | | 394 | |
| Hydroxide as CaCO3 | mg/l | | | | | | -2 | U |
| Iron, dissolved | mg/l | | | | | | 0.08 | B |
| Iron, total | mg/l | | | | | | 0.16 | |
| Lead, dissolved | mg/l | | | | | | -0.06 | U |
| Magnesium, dissolved | mg/l | | | | | | 27.7 | |
| Manganese, dissolved | mg/l | | | | | | -0.01 | U |
| Manganese, total | mg/l | | | | | | 0.01 | B |
| Mercury, total | mg/l | | | | | | -0.0002 | U |
| Molybdenum, dissolved | mg/l | | | | | | 0.07 | B |
| Nitrate/Nitrite (as N) | mg/l | | | | | | 2.31 | |
| pH | SU | | | | | | 8.3 | H |
| Phosphate | mg/l | | | | | | -0.06 | U |
| Phosphorus, ortho dissolved | mg/l | | | | | | -0.02 | UH |
| Potassium, dissolved | mg/l | | | | | | 15.2 | |
| Selenium, total | mg/l | | | | | | 0.0045 | |
| Sodium Absorption Ratio (SAR) | calc. | | | | | | 21 | |
| Sodium, dissolved | mg/l | | | | | | 964 | |
| Sulfate | mg/l | | | | | | 840 | |
| TDS (ratio - measured/calculated) | mg/l | | | | | | 1.03 | |
| TDS (calculated) | calc. | | | | | | 3,140 | |
| Residue, Filterable (TDS) @180C | mg/l | | | | | | 3,230 | |
| Zinc, dissolved | mg/l | | | | | | 0.06 | B |

[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-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.14 | 8.40 | 0.03 | 0.02 | 0.02 | 0.73 | 6.03 | 6.23 | 8.09 | 12.22 | 16.46 | 17.81 |
| 2 | 11.36 | 8.35 | 0.03 | 0.02 | 0.02 | 1.00 | 5.62 | 7.76 | 8.38 | 12.98 | 15.04 | 17.69 |
| 3 | 10.02 | 5.72 | 0.02 | 0.02 | 0.03 | 1.43 | 4.85 | 8.03 | 8.75 | 14.15 | 14.46 | 17.73 |
| 4 | 7.66 | 5.41 | 0.03 | 0.02 | 0.04 | 0.97 | 4.62 | 8.36 | 8.71 | 14.74 | 14.78 | 17.57 |
| 5 | 6.77 | 6.99 | 0.03 | 0.02 | 0.05 | 0.84 | 5.59 | 7.17 | 9.07 | 14.59 | 14.92 | 17.69 |
| 6 | 7.52 | 8.17 | 0.03 | 0.02 | 0.10 | 0.96 | 5.85 | 7.35 | 9.76 | 14.41 | 14.76 | 17.05 |
| 7 | 6.05 | 6.12 | 0.03 | 0.02 | 0.35 | 2.61 | 5.69 | 6.70 | 10.07 | 15.36 | 14.50 | 17.09 |
| 8 | 6.07 | 4.80 | 0.03 | 0.02 | 1.22 | 3.07 | 5.81 | 6.11 | 9.72 | 15.86 | 13.72 | 17.57 |
| 9 | 7.58 | 4.18 | 0.03 | 0.02 | 1.70 | 3.26 | 5.37 | 6.96 | 10.12 | 16.28 | 14.01 | 17.66 |
| 10 | 8.93 | 3.84 | 0.03 | 0.02 | 1.39 | 4.18 | 5.49 | 7.48 | 10.17 | 16.23 | 14.31 | 17.55 |
| 11 | 10.09 | 3.55 | 0.03 | 0.02 | 0.76 | 3.35 | 6.60 | 7.87 | 9.86 | 15.82 | 13.16 | 17.76 |
| 12 | 10.20 | 3.24 | 0.03 | 0.02 | 1.57 | 3.58 | 6.30 | 7.95 | 9.04 | 15.65 | 13.80 | 17.31 |
| 13 | 9.37 | 3.08 | 0.03 | 0.02 | 2.77 | 4.32 | 6.49 | 7.73 | 9.89 | 16.28 | 13.01 | 17.25 |
| 14 | 8.60 | 2.48 | 0.03 | 0.03 | 2.06 | 4.28 | 6.47 | 8.10 | 10.44 | 16.26 | 13.84 | 17.05 |
| 15 | 9.06 | 2.28 | 0.03 | 0.06 | 1.56 | 4.20 | 6.39 | 7.30 | 10.79 | 16.73 | 12.71 | 16.01 |
| 16 | 9.09 | 1.80 | 0.02 | 0.33 | 1.53 | 4.59 | 6.25 | 5.92 | 11.04 | 17.69 | 13.17 | 14.76 |
| 17 | 9.25 | 1.71 | 0.02 | 0.80 | 1.98 | 4.61 | 6.77 | 5.21 | 11.47 | ND | 12.30 | 12.15 |
| 18 | 8.18 | 0.05 | 0.02 | 0.49 | 2.31 | 4.57 | 6.98 | 6.27 | 11.69 | ND | 13.19 | 13.20 |
| 19 | 8.66 | 0.04 | 0.02 | 0.03 | 3.38 | 4.63 | 5.97 | 6.97 | 12.02 | 17.66 | 13.35 | 12.31 |
| 20 | 5.55 | 0.18 | 0.02 | 0.03 | 3.72 | 4.69 | 5.81 | 7.73 | 12.04 | 16.08 | 13.51 | 13.13 |
| 21 | 4.58 | 3.13 | 0.02 | 0.15 | 3.35 | 4.52 | 6.10 | 8.23 | 11.95 | 15.54 | 13.72 | 12.55 |
| 22 | 5.21 | 4.03 | 0.02 | 0.35 | 2.21 | 4.56 | 6.70 | 8.52 | 12.08 | 15.63 | 13.56 | 12.11 |
| 23 | 6.08 | 1.65 | 0.02 | 0.16 | 1.02 | 4.93 | 6.43 | 8.98 | 11.95 | 16.23 | 14.59 | 10.43 |
| 24 | 6.71 | 1.05 | 0.03 | 0.13 | 0.42 | 4.65 | 5.80 | 8.50 | 12.23 | 16.38 | 14.57 | 9.41 |
| 25 | 8.92 | 0.08 | 0.02 | 0.05 | 0.93 | 5.08 | 5.67 | 8.51 | 12.35 | 15.62 | 15.15 | 8.11 |
| 26 | 8.13 | 0.04 | 0.02 | 0.03 | 1.11 | 4.94 | 5.28 | 7.57 | 12.78 | 16.27 | 15.62 | 8.27 |
| 27 | 7.27 | 0.03 | 0.02 | 0.02 | 0.56 | 4.82 | 5.37 | 7.80 | 12.26 | 17.17 | 15.90 | 8.77 |
| 28 | 8.13 | 0.03 | 0.02 | 0.02 | 0.53 | 5.65 | 5.52 | 8.21 | 12.43 | 15.92 | 16.20 | 10.70 |
| 29 | 10.46 | 0.02 | 0.02 | 0.02 | -- | 5.83 | 6.33 | 8.25 | 12.92 | 15.12 | 16.81 | 10.71 |
| 30 | 9.18 | 0.03 | 0.02 | 0.02 | -- | 5.67 | 6.67 | 7.96 | 12.78 | 15.54 | 17.20 | 10.61 |
| 31 | 8.76 | -- | 0.02 | 0.02 | -- | 6.01 | -- | 8.23 | -- | 16.37 | 17.54 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 8.24 | 3.02 | 0.03 | 0.10 | 1.31 | 3.82 | 5.96 | 7.55 | 10.83 | 15.68 | 14.51 | 14.27 |
| Min | 4.58 | 0.02 | 0.02 | 0.02 | 0.02 | 0.73 | 4.62 | 5.21 | 8.09 | 12.22 | 12.30 | 8.11 |
| Max | 12.14 | 8.40 | 0.03 | 0.80 | 3.72 | 6.01 | 6.98 | 8.98 | 12.92 | 17.69 | 17.54 | 17.81 |

ND No Data. Data Logger Washed to Warm, Shallow Water.

# NFG-2
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.24 | 8.52 | 0.03 | 0.03 | 0.05 | 0.64 | 6.04 | 6.69 | 8.24 | 12.59 | 16.27 | 17.68 |
| 2 | 11.41 | 8.53 | 0.03 | 0.03 | 0.04 | 0.84 | 6.06 | 6.25 | 8.10 | 12.13 | 14.88 | 17.55 |
| 3 | 10.06 | 5.89 | 0.03 | 0.03 | 0.05 | 1.08 | 5.64 | 7.78 | 8.38 | 12.76 | 14.28 | 17.59 |
| 4 | 7.75 | 5.52 | 0.03 | 0.03 | 0.09 | 1.50 | 4.87 | 8.05 | 8.75 | 13.95 | 14.62 | 17.44 |
| 5 | 6.80 | 7.01 | 0.03 | 0.02 | 0.18 | 0.99 | 4.65 | 8.39 | 8.73 | 14.54 | 14.76 | 17.56 |
| 6 | 7.60 | 8.25 | 0.03 | 0.03 | 0.28 | 0.85 | 5.62 | 7.20 | 9.20 | 14.41 | 14.63 | 16.92 |
| 7 | 6.16 | 6.30 | 0.03 | 0.02 | 0.44 | 1.04 | 5.88 | 7.38 | 9.63 | 14.26 | 14.35 | 16.96 |
| 8 | 6.15 | 4.98 | 0.03 | 0.02 | 1.36 | 2.67 | 5.71 | 6.73 | 9.96 | 15.15 | 13.58 | 17.44 |
| 9 | 7.63 | 4.37 | 0.03 | 0.03 | 1.85 | 3.13 | 5.84 | 6.13 | 9.57 | 15.68 | 13.86 | 17.54 |
| 10 | 9.02 | 4.02 | 0.03 | 0.02 | 1.49 | 3.30 | 5.39 | 6.98 | 10.00 | 16.10 | 14.15 | 17.43 |
| 11 | 10.14 | 3.73 | 0.04 | 0.03 | 0.81 | 4.22 | 5.51 | 7.49 | 10.01 | 16.10 | 13.01 | 17.64 |
| 12 | 10.29 | 3.41 | 0.03 | 0.03 | 1.66 | 3.37 | 6.64 | 7.90 | 9.78 | 15.67 | 13.65 | 17.19 |
| 13 | 9.50 | 3.25 | 0.04 | 0.04 | 2.80 | 3.62 | 6.33 | 7.97 | 8.88 | 15.52 | 12.88 | 17.13 |
| 14 | 8.69 | 2.68 | 0.05 | 0.05 | 2.09 | 4.37 | 6.52 | 7.76 | 9.71 | 16.12 | 13.68 | 16.94 |
| 15 | 9.17 | 2.49 | 0.06 | 0.20 | 1.61 | 4.33 | 6.50 | 8.12 | 10.28 | 16.05 | 12.56 | 15.90 |
| 16 | 9.19 | 1.82 | 0.05 | 0.62 | 1.58 | 4.24 | 6.42 | 7.32 | 10.63 | 16.59 | 13.01 | 14.69 |
| 17 | 9.30 | 1.76 | 0.03 | 0.87 | 2.04 | 4.63 | 6.27 | 5.94 | 10.89 | 17.47 | 12.16 | 12.05 |
| 18 | 8.26 | 0.16 | 0.03 | 0.55 | 3.27 | 4.65 | 6.79 | 5.22 | 11.32 | 18.46 | 13.03 | 13.14 |
| 19 | 8.79 | 0.08 | 0.03 | 0.03 | 2.33 | 4.61 | 7.00 | 6.27 | 11.52 | 17.49 | 13.20 | 12.24 |
| 20 | 5.70 | 0.37 | 0.02 | 0.03 | 3.41 | 4.65 | 6.00 | 6.97 | 11.86 | 15.94 | 13.36 | 13.08 |
| 21 | 4.70 | 3.14 | 0.02 | 0.20 | 3.74 | 4.71 | 5.83 | 7.73 | 11.92 | 15.39 | 13.58 | 12.50 |
| 22 | 5.32 | 4.05 | 0.03 | 0.39 | 3.37 | 4.55 | 6.13 | 8.20 | 11.80 | 15.47 | 13.42 | 12.01 |
| 23 | 6.17 | 1.83 | 0.03 | 0.17 | 2.23 | 4.58 | 6.72 | 8.50 | 11.95 | 16.05 | 14.44 | 10.31 |
| 24 | 6.80 | 1.23 | 0.04 | 0.16 | 1.03 | 4.95 | 6.46 | 8.97 | 11.80 | 16.21 | 14.42 | 9.35 |
| 25 | 8.94 | 0.11 | 0.03 | 0.08 | 0.44 | 4.72 | 5.82 | 8.51 | 12.06 | 15.49 | 15.00 | 8.09 |
| 26 | 8.24 | 0.07 | 0.03 | 0.03 | 0.99 | 5.11 | 5.69 | 8.50 | 12.21 | 16.11 | 15.48 | 8.22 |
| 27 | 7.37 | 0.06 | 0.02 | 0.03 | 1.12 | 4.97 | 5.30 | 7.57 | 12.64 | 16.98 | 15.75 | 8.68 |
| 28 | 8.16 | 0.05 | 0.02 | 0.04 | 0.57 | 4.84 | 5.39 | 7.80 | 12.10 | 15.77 | 16.06 | 10.64 |
| 29 | 10.56 | 0.03 | 0.02 | 0.03 | -- | 5.68 | 5.54 | 8.21 | 12.26 | 14.97 | 16.65 | 10.62 |
| 30 | 9.22 | 0.04 | 0.02 | 0.04 | -- | 5.87 | 6.35 | 8.25 | 12.77 | 15.41 | 17.04 | 10.51 |
| 31 | 8.85 | -- | 0.02 | 0.04 | -- | 5.69 | -- | 7.97 | -- | 16.18 | 17.39 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 8.33 | 3.12 | 0.03 | 0.13 | 1.46 | 3.69 | 5.96 | 7.51 | 10.56 | 15.52 | 14.36 | 14.17 |
| Min | 4.70 | 0.03 | 0.02 | 0.02 | 0.04 | 0.64 | 4.65 | 5.22 | 8.10 | 12.13 | 12.16 | 8.09 |
| Max | 12.24 | 8.53 | 0.06 | 0.87 | 3.74 | 5.87 | 7.00 | 8.97 | 12.77 | 18.46 | 17.39 | 17.68 |

# NFG-3
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.31 | 8.48 | -0.01 | -0.03 | -0.03 | 0.58 | ND | 6.66 | 8.24 | 12.75 | ND | ND |
| 2 | 11.44 | 8.56 | -0.02 | -0.03 | -0.04 | 0.83 | ND | 6.23 | 8.10 | 12.30 | ND | ND |
| 3 | 10.04 | 5.96 | -0.02 | -0.03 | -0.02 | 1.13 | ND | 7.72 | 8.35 | 12.86 | ND | ND |
| 4 | 7.77 | 5.53 | -0.01 | -0.03 | 0.01 | 1.54 | ND | 8.00 | 8.74 | 14.14 | ND | ND |
| 5 | 6.74 | 7.00 | -0.01 | -0.03 | 0.06 | 0.92 | ND | 8.48 | 8.71 | 14.74 | ND | ND |
| 6 | 7.58 | 8.24 | -0.03 | -0.03 | 0.10 | 0.82 | ND | 7.16 | 9.02 | 14.61 | ND | 15.96 |
| 7 | 6.15 | 6.34 | -0.03 | -0.03 | 0.28 | 1.05 | ND | 7.48 | 9.73 | 14.43 | ND | 17.04 |
| 8 | 6.10 | 5.03 | -0.04 | -0.03 | 1.32 | 2.71 | ND | 6.68 | 10.08 | 15.34 | ND | 17.57 |
| 9 | 7.56 | 4.40 | -0.03 | -0.03 | 1.88 | 3.19 | ND | 6.14 | 9.67 | 15.86 | ND | 17.68 |
| 10 | 9.00 | 4.04 | -0.03 | -0.03 | 1.48 | 3.36 | ND | 6.93 | 10.12 | 16.32 | ND | 17.58 |
| 11 | 10.09 | 3.78 | -0.02 | -0.03 | 0.84 | 4.30 | ND | 7.39 | 10.12 | 16.32 | ND | 17.76 |
| 12 | 10.29 | 3.42 | -0.03 | -0.03 | 1.62 | 3.39 | ND | 7.86 | 9.90 | 15.90 | ND | 17.27 |
| 13 | 9.52 | 3.27 | -0.04 | -0.03 | 2.82 | 3.63 | ND | 7.93 | 8.98 | 15.74 | ND | 17.18 |
| 14 | 8.71 | 2.68 | -0.03 | -0.03 | 2.12 | 4.40 | ND | 7.71 | 9.83 | 16.33 | ND | 17.01 |
| 15 | 9.19 | 2.52 | -0.01 | -0.03 | 1.59 | 4.36 | ND | 8.06 | 10.41 | 16.26 | ND | 15.93 |
| 16 | 9.22 | 1.80 | -0.03 | -0.03 | 1.57 | 4.26 | ND | 7.34 | 10.76 | 16.81 | ND | 14.91 |
| 17 | 9.25 | 1.74 | -0.03 | -0.03 | 2.02 | 4.65 | ND | 6.06 | 11.03 | 17.68 | ND | 12.25 |
| 18 | 8.27 | 0.10 | -0.02 | 0.00 | 3.35 | 4.66 | ND | 5.09 | 11.45 | 18.72 | ND | 13.32 |
| 19 | 8.81 | 0.02 | -0.02 | -0.04 | 2.30 | 4.60 | ND | 6.16 | 11.65 | 17.79 | ND | 12.42 |
| 20 | 5.72 | 0.29 | -0.01 | -0.03 | 3.43 | 4.63 | ND | 6.90 | 11.99 | 16.24 | ND | 13.25 |
| 21 | 4.70 | 3.01 | -0.03 | -0.02 | 3.81 | 4.68 | ND | 7.58 | 12.05 | 15.61 | ND | 12.70 |
| 22 | 5.33 | 4.08 | -0.03 | 0.08 | 3.39 | 4.50 | ND | 8.20 | 11.94 | 15.70 | ND | 12.19 |
| 23 | 6.19 | 1.85 | -0.03 | 0.01 | 2.18 | 4.56 | ND | 8.51 | 12.09 | ND | ND | 10.49 |
| 24 | 6.79 | 1.25 | -0.03 | 0.02 | 0.92 | 4.39 | ND | 8.88 | 11.93 | ND | ND | 9.42 |
| 25 | 8.92 | 0.09 | -0.03 | -0.02 | 0.32 | ND | ND | 8.59 | 12.20 | ND | ND | 8.21 |
| 26 | 8.26 | 0.01 | -0.03 | -0.03 | 0.92 | ND | ND | 8.49 | 12.35 | ND | ND | 8.37 |
| 27 | 7.37 | -0.01 | -0.03 | -0.03 | 1.03 | ND | ND | 7.61 | 12.80 | ND | ND | 8.81 |
| 28 | 8.14 | 0.02 | -0.03 | -0.02 | 0.51 | ND | ND | 7.74 | 12.25 | ND | ND | 10.80 |
| 29 | 10.56 | 0.01 | -0.03 | -0.04 | -- | ND | 5.51 | 8.20 | 12.42 | ND | ND | 10.83 |
| 30 | 9.24 | 0.01 | -0.03 | -0.04 | -- | ND | 6.21 | 8.23 | 12.94 | ND | ND | 10.63 |
| 31 | 8.87 | -- | -0.03 | -0.04 | -- | ND | -- | 7.96 | -- | ND | ND | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 8.33 | 3.12 | -0.03 | -0.02 | 1.42 | 3.21 | 5.86 | 7.48 | 10.66 | 15.57 | ND | 13.58 |
| Min | 4.70 | -0.01 | -0.04 | -0.04 | -0.04 | 0.58 | 5.51 | 5.09 | 8.10 | 12.30 | ND | 8.21 |
| Max | 12.31 | 8.56 | -0.01 | 0.08 | 3.81 | 4.68 | 6.21 | 8.88 | 12.94 | 18.72 | ND | 17.76 |

ND No Data. Data Logger Malfunction.

# MCSG-1
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.55 | 6.54 | -0.33 | -0.36 | 0.47 | 0.23 | 5.58 | 7.75 | 12.30 | 13.74 | 16.80 | 14.78 |
| 2 | 9.25 | 6.15 | -0.31 | -0.29 | 0.54 | 0.11 | 5.65 | 6.80 | 12.00 | 13.56 | 15.97 | 14.28 |
| 3 | 8.66 | 4.24 | -0.24 | -0.24 | 0.58 | 0.17 | 5.05 | 8.07 | 12.27 | 13.82 | 15.57 | 14.21 |
| 4 | 5.63 | 4.12 | -0.44 | -0.22 | 0.64 | 0.36 | 3.75 | 9.07 | 13.20 | 14.78 | 15.60 | 13.95 |
| 5 | 5.24 | 5.85 | -0.33 | -0.20 | 0.65 | 0.59 | 3.46 | 10.23 | 13.89 | 15.22 | 15.99 | 14.02 |
| 6 | 5.62 | 6.46 | -0.43 | -0.25 | 0.70 | 0.63 | 5.14 | 10.05 | 14.30 | 15.57 | 15.81 | 13.12 |
| 7 | 4.12 | 4.47 | -0.36 | -0.45 | 0.73 | 0.20 | 6.17 | 10.91 | 13.88 | 15.27 | 16.05 | 12.92 |
| 8 | 4.16 | 3.54 | -0.54 | -0.39 | 0.78 | 0.64 | 5.91 | 10.03 | 14.30 | 15.27 | 15.67 | 13.29 |
| 9 | 5.56 | 2.98 | -0.34 | -0.25 | 0.85 | 1.05 | 5.75 | 8.30 | 13.32 | 15.59 | 15.39 | 13.76 |
| 10 | 6.25 | 2.59 | -0.30 | -0.14 | 0.83 | 1.35 | 4.44 | 9.46 | 13.98 | 16.16 | 15.74 | 14.09 |
| 11 | 7.73 | 2.34 | -0.17 | -0.12 | 0.54 | 1.71 | 5.21 | 10.41 | 13.87 | 16.77 | 15.10 | 14.24 |
| 12 | 7.78 | 2.03 | -0.14 | -0.10 | 0.75 | 1.63 | 7.36 | 11.06 | 13.32 | 16.63 | 15.57 | 13.90 |
| 13 | 6.99 | 1.69 | -0.26 | 0.01 | 0.93 | 1.59 | 7.35 | 11.35 | 11.62 | 16.17 | 15.06 | 13.33 |
| 14 | 6.57 | 1.27 | -0.23 | 0.29 | 0.87 | 1.86 | 7.54 | 10.41 | 12.05 | 16.18 | 15.66 | 13.77 |
| 15 | 6.90 | 1.10 | -0.18 | 0.43 | 0.70 | 2.01 | 7.14 | 10.61 | 12.99 | 16.39 | 14.74 | 12.04 |
| 16 | 7.07 | 1.62 | -0.10 | 0.48 | 0.65 | 2.20 | 7.32 | 9.64 | 13.67 | 16.76 | 14.48 | 11.62 |
| 17 | 7.37 | 1.62 | -0.09 | 0.52 | 0.78 | 2.47 | 7.23 | 6.67 | 14.54 | 16.89 | 13.57 | 10.58 |
| 18 | 6.50 | 0.00 | -0.10 | 0.53 | 1.07 | 2.64 | 8.48 | 5.13 | 15.28 | 17.91 | 13.62 | 10.96 |
| 19 | 6.38 | -0.09 | -0.34 | 0.45 | 0.97 | 2.90 | 9.39 | 7.14 | 15.28 | 18.19 | 13.83 | 10.20 |
| 20 | 3.35 | 0.07 | -0.58 | 0.54 | 1.29 | 3.16 | 6.73 | 8.07 | 15.60 | 18.21 | 13.95 | 10.55 |
| 21 | 2.74 | 1.21 | -0.57 | 0.59 | 1.40 | 3.48 | 6.46 | 9.23 | 15.67 | 17.47 | 14.31 | 10.26 |
| 22 | 3.39 | 2.36 | -0.35 | 0.63 | 1.39 | 3.56 | 6.88 | 10.12 | 15.34 | 17.35 | 13.94 | 10.73 |
| 23 | 4.35 | 0.81 | -0.15 | 0.66 | 1.06 | 3.85 | 8.27 | 9.89 | 14.95 | 16.97 | 14.17 | 9.94 |
| 24 | 4.99 | 0.16 | -0.13 | 0.66 | 0.50 | 4.37 | 7.95 | 10.87 | 14.36 | 17.20 | 14.28 | 8.02 |
| 25 | 7.30 | -0.09 | -0.12 | 0.62 | 0.25 | 4.12 | 6.45 | 11.30 | 14.31 | 17.65 | 13.87 | 6.24 |
| 26 | 5.95 | -0.53 | -0.12 | 0.55 | 0.21 | 4.93 | 6.62 | 11.45 | 14.49 | 17.72 | 13.85 | 6.13 |
| 27 | 5.16 | -0.16 | -0.25 | 0.40 | 0.42 | 4.62 | 6.16 | 11.18 | 14.93 | 17.87 | 13.82 | 7.03 |
| 28 | 6.23 | -0.10 | -0.36 | 0.31 | 0.61 | 4.63 | 6.09 | 10.40 | 14.39 | 17.52 | 13.82 | 8.26 |
| 29 | 7.96 | -0.10 | -0.40 | 0.30 | -- | 4.84 | 5.74 | 10.99 | 14.04 | 16.95 | 13.94 | 8.63 |
| 30 | 7.43 | -0.21 | -0.50 | 0.34 | -- | 5.46 | 6.84 | 11.49 | 14.31 | 16.67 | 14.31 | 9.09 |
| 31 | 7.46 | -- | -0.41 | 0.37 | -- | 5.42 | -- | 11.97 | -- | 16.83 | 14.93 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 6.24 | 2.07 | -0.30 | 0.18 | 0.76 | 2.48 | 6.40 | 9.68 | 13.95 | 16.43 | 14.82 | 11.46 |
| Min | 2.74 | -0.53 | -0.58 | -0.45 | 0.21 | 0.11 | 3.46 | 5.13 | 11.62 | 13.56 | 13.57 | 6.13 |
| Max | 9.55 | 6.54 | -0.09 | 0.66 | 1.40 | 5.46 | 9.39 | 11.97 | 15.67 | 18.21 | 16.80 | 14.78 |

# MCSG-2
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.57 | 6.59 | 0.15 | 0.34 | 0.64 | 0.29 | 5.25 | 7.36 | 12.19 | 13.52 | 15.96 | 14.43 |
| 2 | 9.30 | 6.14 | 0.16 | 0.44 | 0.81 | 0.28 | 5.43 | 6.74 | 12.02 | 13.34 | 15.31 | 14.06 |
| 3 | 8.78 | 4.56 | 0.15 | 0.50 | 0.86 | 0.45 | 5.06 | 7.58 | 12.04 | 13.77 | 15.17 | 13.95 |
| 4 | 5.93 | 4.63 | 0.12 | 0.53 | 0.89 | 0.71 | 4.20 | 8.48 | 12.88 | 14.44 | 15.17 | 13.73 |
| 5 | 5.80 | 5.98 | 0.14 | 0.57 | 0.87 | 1.00 | 3.50 | 9.66 | 13.61 | 14.90 | 15.74 | 13.71 |
| 6 | 6.19 | 6.52 | 0.13 | 0.46 | 1.01 | 0.87 | 4.48 | 9.83 | 13.87 | 15.15 | 15.71 | 12.71 |
| 7 | 4.68 | 4.84 | 0.14 | 0.41 | 1.09 | 0.43 | 5.64 | 10.70 | 13.66 | 14.99 | 15.71 | 12.50 |
| 8 | 4.76 | 4.01 | 0.17 | 0.43 | 1.04 | 1.19 | 5.82 | 10.04 | 13.92 | 15.12 | 15.43 | 13.00 |
| 9 | 5.93 | 3.53 | 0.18 | 0.33 | 1.29 | 1.58 | 5.61 | 8.78 | 13.13 | 15.37 | 15.13 | 13.19 |
| 10 | 6.51 | 3.14 | 0.17 | 0.46 | 1.27 | 1.82 | 4.32 | 9.39 | 13.61 | 16.26 | 15.54 | 13.49 |
| 11 | 7.72 | 2.81 | 0.10 | 0.81 | 0.90 | 2.08 | 4.79 | 10.02 | 13.56 | 16.72 | 14.75 | 13.65 |
| 12 | 7.77 | 2.56 | 0.16 | 0.88 | 1.37 | 2.05 | 6.47 | 10.66 | 13.08 | 16.63 | 15.18 | 13.13 |
| 13 | 7.00 | 2.30 | 0.15 | 0.90 | 1.62 | 1.92 | 6.81 | 11.19 | 11.56 | 16.35 | 14.67 | 12.88 |
| 14 | 6.62 | 1.93 | 0.26 | 0.97 | 1.66 | 2.02 | 7.05 | 10.53 | 11.96 | 15.91 | 15.46 | 13.32 |
| 15 | 6.77 | 1.75 | 0.25 | 1.03 | 1.43 | 2.13 | 6.79 | 10.51 | 12.76 | 15.88 | 14.31 | 11.71 |
| 16 | 6.84 | 2.34 | 0.15 | 0.98 | 1.44 | 2.32 | 6.92 | 9.80 | 13.43 | 16.10 | 14.13 | 11.19 |
| 17 | 7.15 | 2.02 | 0.11 | 0.92 | 1.62 | 2.58 | 6.92 | 7.65 | 14.35 | 16.23 | 13.41 | 10.38 |
| 18 | 6.45 | 0.12 | 0.15 | 0.84 | 2.21 | 2.69 | 7.74 | 5.83 | 15.01 | 17.21 | 13.53 | 10.52 |
| 19 | 6.17 | -0.09 | 0.40 | 0.74 | 1.76 | 2.85 | 8.79 | 6.91 | 15.09 | 17.46 | 13.57 | 9.85 |
| 20 | 3.65 | 0.71 | 0.49 | 1.06 | 2.28 | 3.05 | 7.09 | 7.72 | 15.39 | 17.30 | 13.70 | 10.09 |
| 21 | 3.17 | 2.34 | 0.48 | 1.08 | 2.51 | 3.31 | 6.69 | 8.79 | 15.44 | 16.71 | 14.09 | 9.79 |
| 22 | 3.73 | 2.88 | 0.53 | 1.09 | 2.37 | 3.47 | 6.49 | 9.85 | 15.14 | 16.82 | 13.75 | 10.49 |
| 23 | 4.49 | 1.35 | 0.31 | 1.18 | 1.77 | 3.62 | 7.56 | 9.65 | 14.72 | 16.55 | 14.04 | 9.85 |
| 24 | 5.03 | 0.78 | 0.27 | 1.07 | 1.07 | 3.79 | 7.85 | 10.50 | 14.09 | 16.59 | 13.98 | 7.92 |
| 25 | 7.07 | 0.16 | 0.30 | 0.82 | 0.66 | 3.79 | 6.82 | 11.17 | 14.04 | 17.41 | 13.76 | 6.17 |
| 26 | 5.94 | -0.06 | 0.31 | 0.72 | 0.64 | 4.41 | 6.49 | 11.30 | 14.20 | 17.42 | 13.68 | 6.17 |
| 27 | 5.34 | 0.02 | 0.26 | 0.65 | 1.07 | 4.32 | 6.38 | 11.09 | 14.59 | 17.48 | 13.79 | 7.21 |
| 28 | 6.30 | 0.37 | 0.28 | 0.60 | 1.16 | 4.56 | 5.79 | 10.26 | 14.13 | 17.04 | 13.58 | 8.20 |
| 29 | 7.61 | 0.20 | 0.29 | 0.57 | -- | 4.51 | 5.46 | 10.74 | 13.80 | 16.87 | 13.73 | 8.52 |
| 30 | 7.32 | 0.14 | 0.30 | 0.56 | -- | 4.96 | 6.27 | 11.27 | 13.98 | 16.26 | 14.01 | 8.94 |
| 31 | 7.25 | -- | 0.30 | 0.55 | -- | 5.27 | -- | 11.73 | -- | 16.05 | 14.62 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 6.35 | 2.49 | 0.24 | 0.72 | 1.33 | 2.53 | 6.15 | 9.54 | 13.71 | 16.06 | 14.54 | 11.16 |
| Min | 3.17 | -0.09 | 0.10 | 0.33 | 0.64 | 0.28 | 3.50 | 5.83 | 11.56 | 13.34 | 13.41 | 6.17 |
| Max | 9.57 | 6.59 | 0.53 | 1.18 | 2.51 | 5.27 | 8.79 | 11.73 | 15.44 | 17.48 | 15.96 | 14.43 |

# MCSG-3
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.52 | 7.00 | 0.18 | 1.51 | 1.47 | 0.64 | 5.98 | 7.57 | 10.31 | 11.52 | 14.12 | 13.32 |
| 2 | 9.23 | 6.57 | 0.75 | 1.83 | 1.58 | 0.66 | 6.06 | 6.86 | 9.99 | 11.32 | 13.37 | 12.87 |
| 3 | 8.44 | 4.78 | 0.86 | 1.86 | 1.68 | 0.98 | 5.71 | 7.70 | 10.29 | 11.80 | 13.36 | 12.77 |
| 4 | 5.82 | 5.03 | 0.26 | 1.75 | 1.94 | 1.38 | 4.79 | 8.33 | 10.88 | 12.45 | 13.57 | 12.58 |
| 5 | 5.93 | 6.70 | 0.82 | 1.63 | 1.67 | 1.99 | 4.83 | 9.01 | 11.43 | 12.91 | 14.08 | 12.68 |
| 6 | 6.50 | 7.03 | 0.46 | 0.72 | 1.96 | 1.42 | 5.94 | 8.88 | 11.36 | 13.09 | 13.95 | 11.74 |
| 7 | 4.94 | 4.98 | 0.54 | 0.46 | 2.05 | 0.73 | 6.52 | 9.50 | 11.22 | 12.75 | 14.10 | 11.73 |
| 8 | 5.25 | 4.22 | 0.28 | 1.31 | 1.81 | 2.03 | 6.32 | 8.84 | 11.56 | 12.99 | 13.62 | 12.52 |
| 9 | 6.44 | 3.81 | 0.98 | 0.86 | 2.05 | 2.19 | 6.34 | 7.76 | 10.90 | 13.17 | 13.60 | 12.77 |
| 10 | 7.00 | 3.51 | 1.05 | 1.30 | 2.11 | 2.51 | 5.51 | 8.55 | 11.36 | 13.91 | 13.94 | 13.09 |
| 11 | 8.46 | 3.26 | 1.16 | 1.79 | 1.87 | 2.71 | 5.90 | 9.18 | 11.26 | 14.15 | 13.14 | 13.30 |
| 12 | 8.25 | 3.06 | 1.33 | 1.99 | 2.37 | 2.76 | 7.21 | 9.53 | 10.86 | 13.79 | 13.66 | 12.48 |
| 13 | 7.40 | 2.74 | 1.05 | 2.31 | 2.69 | 2.70 | 7.22 | 9.78 | 9.54 | 13.54 | 13.00 | 12.60 |
| 14 | 7.09 | 2.39 | 1.72 | 2.45 | 2.46 | 2.92 | 7.39 | 9.06 | 10.11 | 13.56 | 13.98 | 12.59 |
| 15 | 7.32 | 2.13 | 1.70 | 2.48 | 2.00 | 3.05 | 7.13 | 9.38 | 10.75 | 13.53 | 12.82 | 11.13 |
| 16 | 7.39 | 2.95 | 0.59 | 2.43 | 1.86 | 3.39 | 7.20 | 8.64 | 11.25 | 13.71 | 12.75 | 10.95 |
| 17 | 7.53 | 2.30 | 0.53 | 2.35 | 2.18 | 3.79 | 7.12 | 6.66 | 11.97 | 14.03 | 11.76 | 10.16 |
| 18 | 6.82 | 0.19 | 0.20 | 2.07 | 2.60 | 3.99 | 8.02 | 5.73 | 12.38 | 14.76 | 12.15 | 10.37 |
| 19 | 6.63 | 0.47 | 0.14 | 1.48 | 2.33 | 4.18 | 8.57 | 7.29 | 12.36 | 15.21 | 12.17 | 9.72 |
| 20 | 3.76 | 1.55 | 0.00 | 2.02 | 2.84 | 4.41 | 6.72 | 7.57 | 12.65 | 14.87 | 12.39 | 10.01 |
| 21 | 3.48 | 3.19 | 0.37 | 2.09 | 2.88 | 4.58 | 6.65 | 8.39 | 12.45 | 14.09 | 12.65 | 9.74 |
| 22 | 4.20 | 3.88 | 1.31 | 2.10 | 2.85 | 4.60 | 6.97 | 8.81 | 12.53 | 14.31 | 12.37 | 10.40 |
| 23 | 5.08 | 1.89 | 1.23 | 2.18 | 2.20 | 4.74 | 7.80 | 8.61 | 12.19 | 14.32 | 12.85 | 9.16 |
| 24 | 5.70 | 1.34 | 1.22 | 1.86 | 1.41 | 5.02 | 7.54 | 9.45 | 11.75 | 14.36 | 12.78 | 7.54 |
| 25 | 7.94 | 0.32 | 1.13 | 1.46 | 0.96 | 4.91 | 6.60 | 9.62 | 11.76 | 14.92 | 12.44 | 6.02 |
| 26 | 6.28 | 0.46 | 1.03 | 0.85 | 1.17 | 5.36 | 6.75 | 9.90 | 11.88 | 15.24 | 12.33 | 6.29 |
| 27 | 5.78 | 1.09 | 0.41 | 0.22 | 1.90 | 5.26 | 6.41 | 9.71 | 12.45 | 15.16 | 12.44 | 7.37 |
| 28 | 7.05 | 1.23 | 1.20 | 0.29 | 1.76 | 5.11 | 6.30 | 9.02 | 11.99 | 14.66 | 12.31 | 8.36 |
| 29 | 8.51 | 0.42 | 0.71 | 0.55 | -- | 5.39 | 6.05 | 9.36 | 11.73 | 14.37 | 12.64 | 8.95 |
| 30 | 7.87 | 0.08 | 0.64 | 0.70 | -- | 5.90 | 6.98 | 9.71 | 11.92 | 14.12 | 12.87 | 9.03 |
| 31 | 7.72 | -- | 1.22 | 0.89 | -- | 5.77 | -- | 10.06 | -- | 14.25 | 13.71 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 6.75 | 2.95 | 0.81 | 1.54 | 2.02 | 3.39 | 6.62 | 8.66 | 11.44 | 13.77 | 13.06 | 10.74 |
| Min | 3.48 | 0.08 | 0.00 | 0.22 | 0.96 | 0.64 | 4.79 | 5.73 | 9.54 | 11.32 | 11.76 | 6.02 |
| Max | 9.52 | 7.03 | 1.72 | 2.48 | 2.88 | 5.90 | 8.57 | 10.06 | 12.65 | 15.24 | 14.12 | 13.32 |

# MCSG-4
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.66 | 6.86 | 0.25 | 0.86 | 0.84 | 0.69 | 5.80 | 7.35 | 10.50 | 12.03 | 14.81 | 14.17 |
| 2 | 9.33 | 6.59 | 0.44 | 1.10 | 0.96 | 0.55 | 5.88 | 6.82 | 10.35 | 11.86 | 14.18 | 13.69 |
| 3 | 8.83 | 4.91 | 0.67 | 1.16 | 1.03 | 0.69 | 5.57 | 7.53 | 10.42 | 12.18 | 14.11 | 13.65 |
| 4 | 6.43 | 4.90 | 0.27 | 1.12 | 1.15 | 0.93 | 4.84 | 8.03 | 11.01 | 12.87 | 14.07 | 13.48 |
| 5 | 6.08 | 6.28 | 0.57 | 1.11 | 0.97 | 1.42 | 4.58 | 8.80 | 11.57 | 13.29 | 14.61 | 13.48 |
| 6 | 6.68 | 6.81 | 0.37 | 0.63 | 1.11 | 1.37 | 5.64 | 8.80 | 11.70 | 13.58 | 14.65 | 12.96 |
| 7 | 5.31 | 5.09 | 0.46 | 0.34 | 1.23 | 0.63 | 6.23 | 9.46 | 11.57 | 13.37 | 14.83 | 12.07 |
| 8 | 5.21 | 4.30 | 0.21 | 0.79 | 1.01 | 1.41 | 6.17 | 9.00 | 11.89 | 13.51 | 14.60 | 12.92 |
| 9 | 6.19 | 3.82 | 0.64 | 0.51 | 1.22 | 1.70 | 6.24 | 8.08 | 11.27 | 13.73 | 14.34 | 13.20 |
| 10 | 6.73 | 3.48 | 0.73 | 0.69 | 1.30 | 2.03 | 5.38 | 8.61 | 11.67 | 14.45 | 14.66 | 13.53 |
| 11 | 7.97 | 3.17 | 0.69 | 1.19 | 1.08 | 2.29 | 5.63 | 9.11 | 11.61 | 14.77 | 14.18 | 13.67 |
| 12 | 8.08 | 2.95 | 0.80 | 1.38 | 1.44 | 2.37 | 6.92 | 9.50 | 11.28 | 14.51 | 14.36 | 13.05 |
| 13 | 7.41 | 2.66 | 0.65 | 1.50 | 1.84 | 2.33 | 7.01 | 9.84 | 10.08 | 14.26 | 14.07 | 12.95 |
| 14 | 7.02 | 2.29 | 1.13 | 1.59 | 1.83 | 2.51 | 7.24 | 9.30 | 10.39 | 14.09 | 14.43 | 13.13 |
| 15 | 7.19 | 2.05 | 1.12 | 1.66 | 1.54 | 2.64 | 6.97 | 9.41 | 11.00 | 14.03 | 14.04 | 11.59 |
| 16 | 7.22 | 2.66 | 0.41 | 1.61 | 1.47 | 2.91 | 7.06 | 8.87 | 11.53 | 14.19 | 13.70 | 11.35 |
| 17 | 7.41 | 2.37 | 0.34 | 1.54 | 1.66 | 3.30 | 7.01 | 7.16 | 12.21 | 14.42 | 12.99 | 10.37 |
| 18 | 6.84 | 0.53 | 0.20 | 1.37 | 2.18 | 3.49 | 7.80 | 5.93 | 12.75 | 15.03 | 12.86 | 10.69 |
| 19 | 6.70 | 0.43 | 0.18 | 1.00 | 1.95 | 3.66 | 8.51 | 7.03 | 12.81 | 15.66 | 13.00 | 9.96 |
| 20 | 4.09 | 1.29 | 0.14 | 1.40 | 2.34 | 3.88 | 6.87 | 7.46 | 13.04 | 15.45 | 13.05 | 10.28 |
| 21 | 3.59 | 2.58 | 0.11 | 1.47 | 2.49 | 4.08 | 6.75 | 8.08 | 13.01 | 14.76 | 13.28 | 9.93 |
| 22 | 4.07 | 3.32 | 0.58 | 1.50 | 2.49 | 4.20 | 6.83 | 8.80 | 13.01 | 14.93 | 13.13 | 10.51 |
| 23 | 4.82 | 2.02 | 0.79 | 1.54 | 2.10 | 4.31 | 7.49 | 8.74 | 12.74 | 14.87 | 13.33 | 9.56 |
| 24 | 5.35 | 1.39 | 0.74 | 1.36 | 1.35 | 4.59 | 7.55 | 9.22 | 12.28 | 14.91 | 13.46 | 7.88 |
| 25 | 7.39 | 0.54 | 0.75 | 1.05 | 0.91 | 4.45 | 6.77 | 9.78 | 12.22 | 15.71 | 13.22 | 6.31 |
| 26 | 6.22 | 0.46 | 0.75 | 0.65 | 1.00 | 4.96 | 6.66 | 9.95 | 12.35 | 15.79 | 13.20 | 6.36 |
| 27 | 5.64 | 0.90 | 0.33 | 0.21 | 1.46 | 4.84 | 6.47 | 9.91 | 12.87 | 15.70 | 13.16 | 7.22 |
| 28 | 6.60 | 1.03 | 0.70 | 0.21 | 1.54 | 4.91 | 6.28 | 9.20 | 12.50 | 15.46 | 13.16 | 8.36 |
| 29 | 8.04 | 0.57 | 0.51 | 0.34 | -- | 5.14 | 6.05 | 9.46 | 12.25 | 15.25 | 13.24 | 8.77 |
| 30 | 7.60 | 0.31 | 0.41 | 0.42 | -- | 5.48 | 6.64 | 9.80 | 12.46 | 14.83 | 13.57 | 9.02 |
| 31 | 7.56 | -- | 0.70 | 0.50 | -- | 5.63 | -- | 10.13 | -- | 14.89 | 14.08 | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 6.69 | 2.89 | 0.54 | 1.03 | 1.48 | 3.01 | 6.50 | 8.68 | 11.81 | 14.34 | 13.82 | 11.14 |
| Min | 3.59 | 0.31 | 0.11 | 0.21 | 0.84 | 0.55 | 4.58 | 5.93 | 10.08 | 11.86 | 12.86 | 6.31 |
| Max | 9.66 | 6.86 | 1.13 | 1.66 | 2.49 | 5.63 | 8.51 | 10.13 | 13.04 | 15.79 | 14.83 | 14.17 |

# MCSG-5
## Daily Mean Temperature Values
## (Degrees Celsius)

| Day | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.47 | 7.88 | -0.78 | -0.09 | -0.12 | 0.06 | 5.61 | 7.64 | 12.00 | 13.35 | 17.46 | 15.02 |
| 2 | 10.28 | 7.04 | -0.66 | -0.03 | -0.07 | -0.05 | 5.71 | 6.51 | 11.80 | 13.03 | 16.27 | 14.77 |
| 3 | 9.05 | 5.41 | -0.54 | 0.40 | 0.06 | -0.06 | 5.15 | 7.89 | 11.72 | 13.62 | 15.94 | 14.77 |
| 4 | 5.51 | 5.64 | -1.34 | 0.50 | 0.21 | -0.03 | 4.05 | 8.59 | 12.53 | 14.83 | 16.24 | 14.59 |
| 5 | 5.97 | 6.87 | -0.57 | 0.50 | 0.12 | 0.15 | 3.43 | 9.90 | 13.21 | 15.45 | 16.43 | 15.08 |
| 6 | 6.04 | 7.40 | -1.11 | 0.47 | 0.35 | 0.46 | 5.03 | 9.63 | 13.71 | 15.75 | 16.08 | 14.68 |
| 7 | 4.68 | 5.52 | -1.32 | 0.27 | 0.35 | 0.03 | 6.10 | 11.00 | 13.32 | 15.39 | 16.22 | 14.65 |
| 8 | 5.01 | 4.74 | -2.19 | 0.35 | 0.05 | 0.23 | 6.02 | 10.00 | 13.81 | 15.68 | 15.55 | 15.44 |
| 9 | 6.54 | 4.28 | -0.66 | 0.07 | 0.29 | 0.80 | 6.26 | 8.27 | 12.61 | 15.98 | 15.64 | 15.83 |
| 10 | 7.50 | 3.96 | -0.44 | 0.03 | 0.39 | 1.29 | 4.34 | 9.49 | 13.08 | 16.64 | 15.69 | 16.04 |
| 11 | 8.96 | 3.75 | -0.15 | 0.00 | 0.22 | 1.75 | 4.84 | 10.03 | 12.89 | 17.30 | 15.19 | 16.20 |
| 12 | 8.99 | 3.43 | -0.12 | 0.03 | 0.53 | 1.97 | 7.29 | 10.62 | 12.36 | 17.02 | 15.71 | 15.56 |
| 13 | 7.98 | 3.19 | -0.19 | 0.07 | 1.11 | 1.87 | 7.11 | 11.14 | 10.59 | 16.48 | 15.27 | 15.33 |
| 14 | 7.61 | 2.84 | -0.17 | 0.09 | 0.90 | 2.21 | 7.39 | 10.25 | 11.15 | 16.65 | 15.76 | 15.15 |
| 15 | 7.85 | 2.87 | -0.10 | 0.14 | 0.59 | 2.43 | 6.91 | 10.28 | 12.06 | 16.75 | 14.84 | 12.21 |
| 16 | 7.87 | 2.82 | 0.00 | 0.24 | 0.53 | 2.80 | 7.14 | 9.39 | 12.80 | 16.65 | 14.57 | 11.76 |
| 17 | 8.46 | 2.28 | -0.01 | 0.34 | 0.84 | 3.35 | 6.98 | 6.74 | 13.81 | 17.32 | 13.77 | 10.92 |
| 18 | 7.43 | 0.38 | -0.04 | 0.33 | 1.52 | 3.53 | 8.17 | 4.87 | 14.71 | 18.37 | 14.01 | 11.47 |
| 19 | 7.23 | -0.06 | -0.63 | 0.16 | 1.28 | 3.67 | 9.72 | 6.86 | 14.70 | 18.64 | 14.15 | 10.18 |
| 20 | 4.46 | 1.50 | -1.28 | 0.56 | 1.80 | 3.84 | 6.53 | 7.52 | 15.05 | 18.76 | 14.58 | 10.65 |
| 21 | 3.96 | 2.05 | -0.94 | 0.62 | 1.97 | 3.97 | 6.73 | 8.25 | 15.17 | 17.69 | 14.84 | 10.13 |
| 22 | 4.75 | 2.75 | -0.34 | 0.64 | 2.06 | 4.03 | 6.58 | 9.68 | 15.11 | 17.88 | 14.54 | 10.74 |
| 23 | 5.82 | 1.17 | -0.17 | 0.65 | 1.28 | 4.17 | 7.73 | 9.49 | 14.55 | 17.63 | 14.88 | 9.92 |
| 24 | 6.46 | 0.70 | -0.14 | 0.55 | 0.18 | 4.56 | 8.06 | 10.16 | 13.75 | 17.66 | 14.63 | 8.00 |
| 25 | 8.67 | 0.37 | -0.14 | 0.32 | 0.08 | 4.06 | 6.58 | 11.10 | 13.76 | 18.11 | 14.52 | 6.21 |
| 26 | 7.14 | 0.02 | -0.15 | 0.05 | 0.03 | 4.98 | 6.23 | 11.27 | 13.94 | 18.25 | 14.55 | 6.49 |
| 27 | 6.63 | 0.79 | -0.45 | -0.32 | 0.16 | 4.45 | 6.18 | 10.95 | 14.46 | 18.75 | 14.67 | 7.80 |
| 28 | 7.86 | 1.06 | -0.24 | -0.57 | 0.32 | 4.52 | 5.77 | 9.85 | 13.88 | 18.04 | 14.26 | 8.98 |
| 29 | 9.58 | 0.38 | -0.21 | -0.43 | -- | 5.19 | 5.40 | 10.24 | 13.45 | 17.27 | 14.51 | 9.29 |
| 30 | 8.78 | -0.64 | -0.19 | -0.19 | -- | 5.24 | 6.36 | 10.82 | 13.90 | 17.30 | 14.87 | 9.74 |
| 31 | 8.78 | -- | -0.12 | -0.14 | -- | 5.69 | -- | 11.36 | -- | 17.36 | 15.15 | -- |

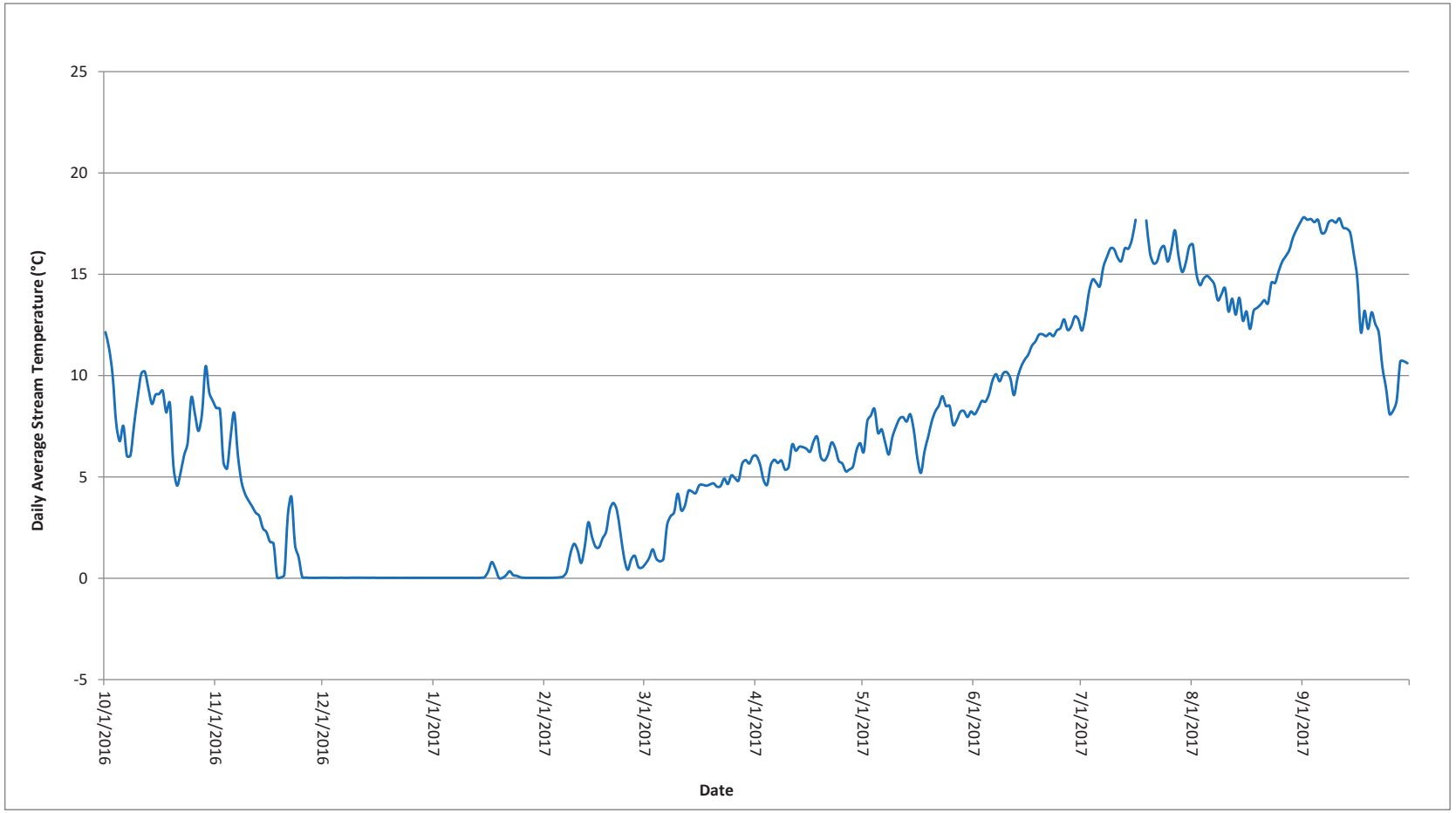
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 7.30 | 3.01 | -0.50 | 0.18 | 0.61 | 2.62 | 6.31 | 9.35 | 13.33 | 16.76 | 15.19 | 12.25 |
| Min | 3.96 | -0.64 | -2.19 | -0.57 | -0.12 | -0.06 | 3.43 | 4.87 | 10.59 | 13.03 | 13.77 | 6.21 |
| Max | 10.47 | 7.88 | 0.00 | 0.65 | 2.06 | 5.69 | 9.72 | 11.36 | 15.17 | 18.76 | 17.46 | 16.20 |

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

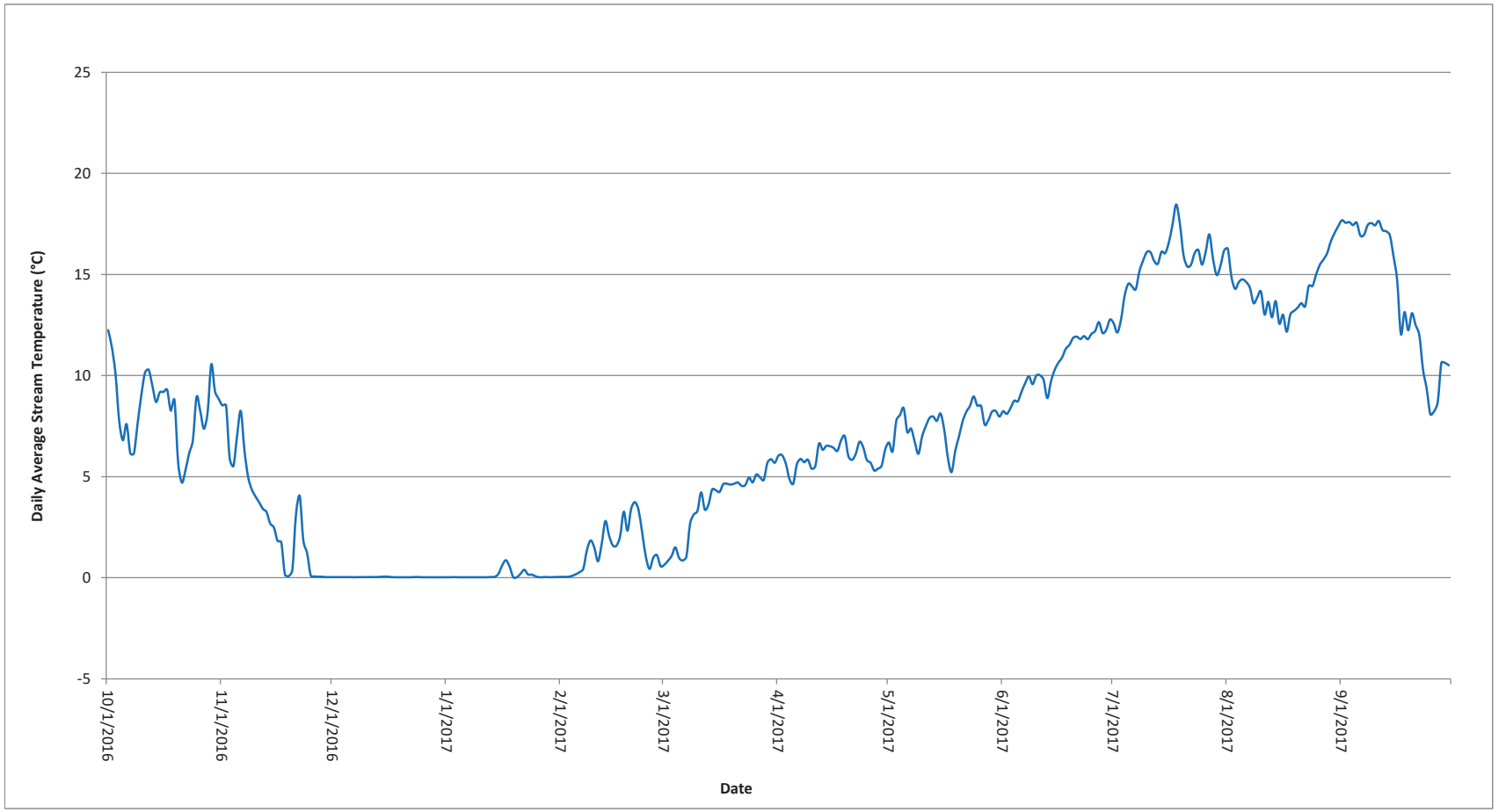
# APPENDIX J

## SURFACE WATER - TEMPERATURE GRAPHS

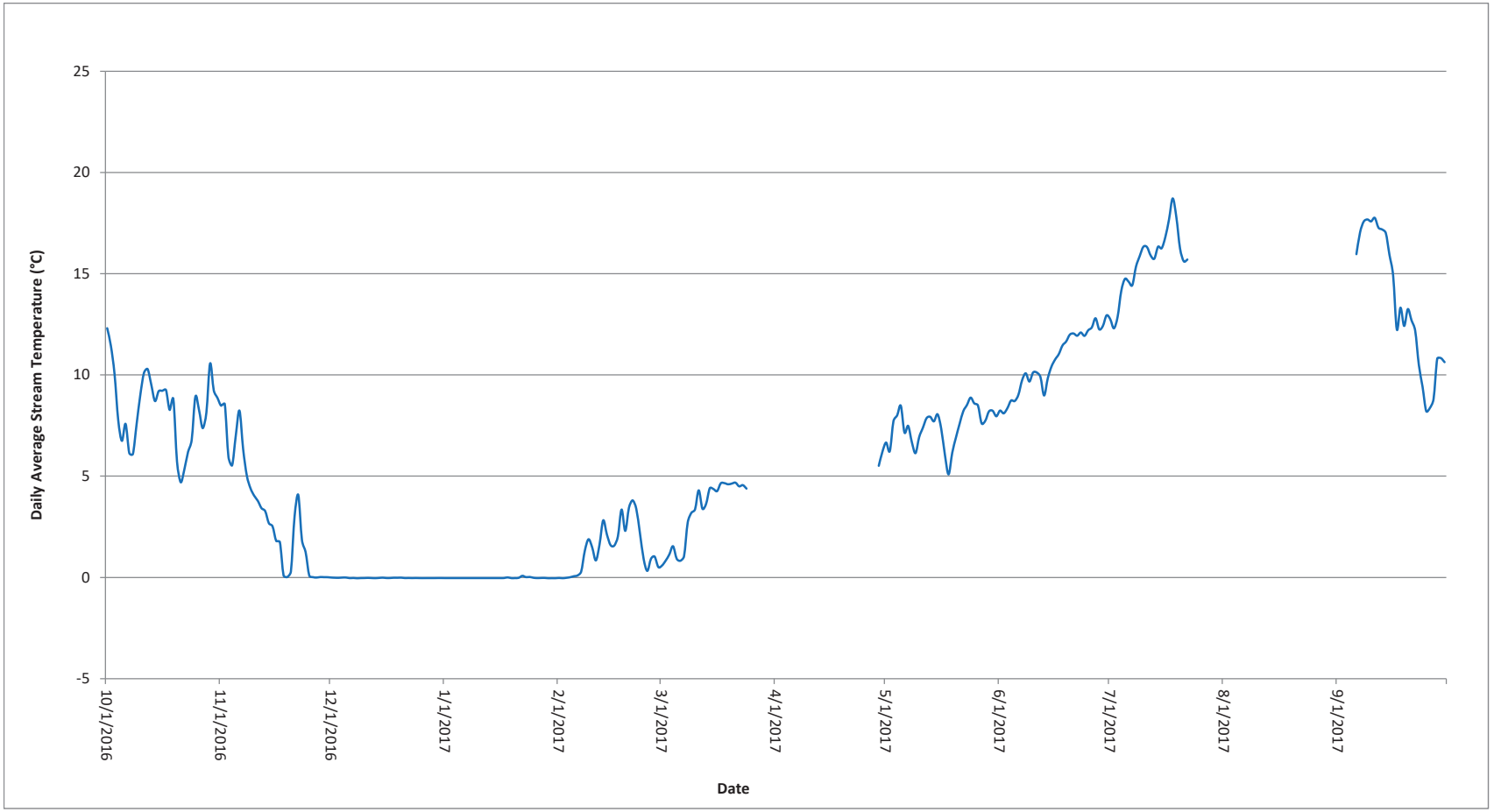
## NFG-1
## Daily Mean Temperature Graph



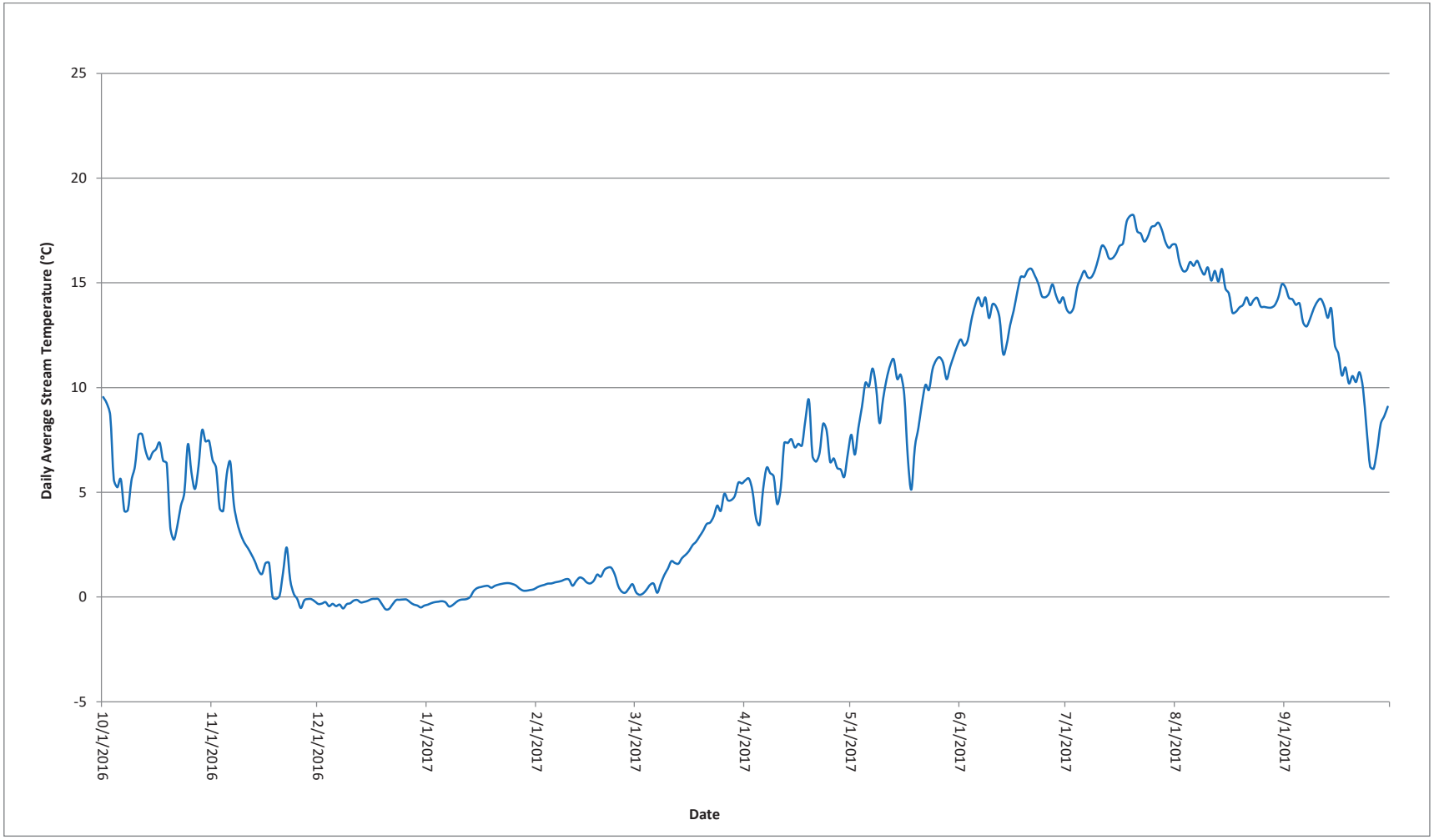
## NFG-2
## Daily Mean Temperature Graph



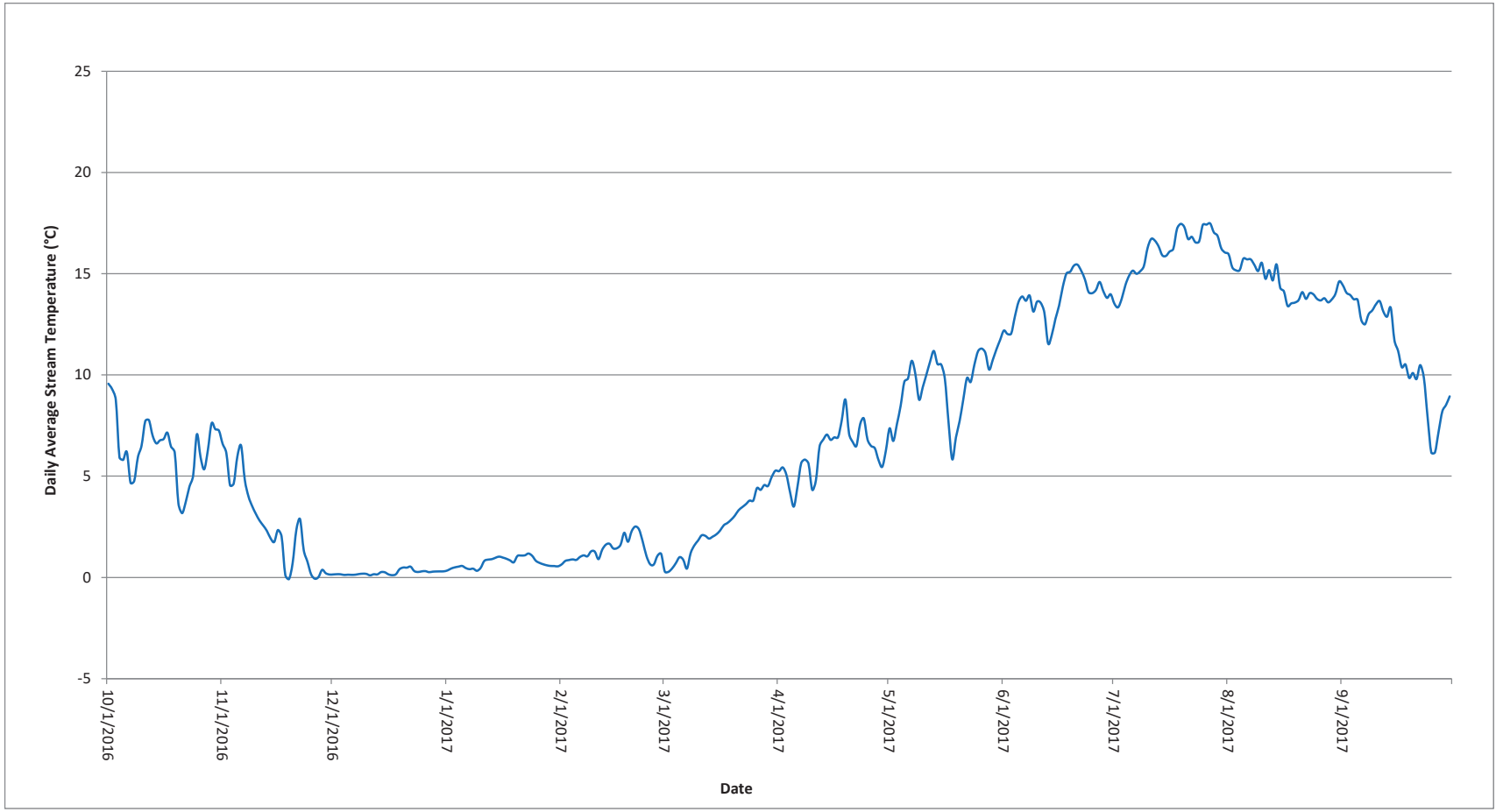
## NFG-3
## Daily Mean Temperature Graph



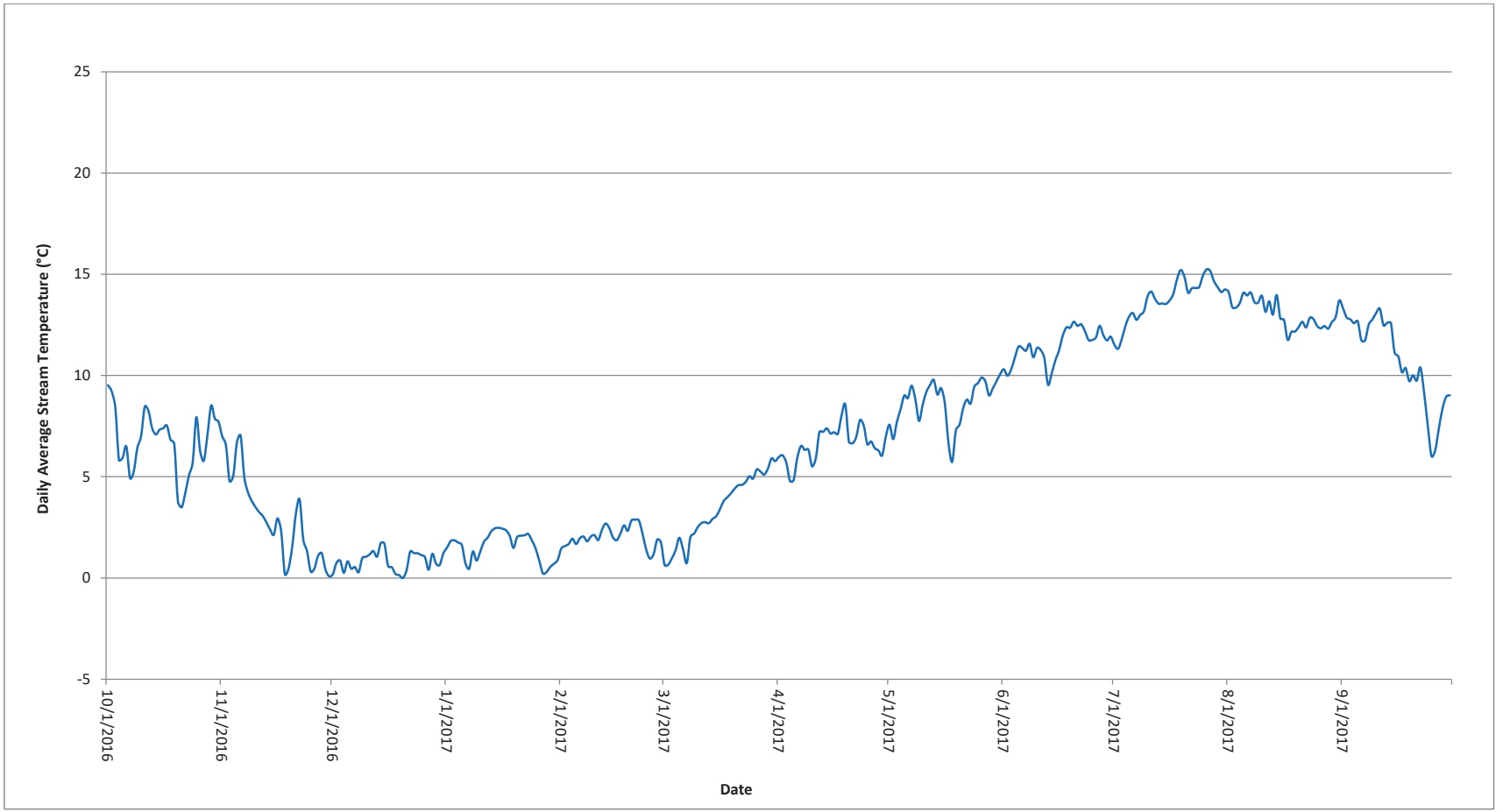
## MCSG-1
## Daily Mean Temperature Graph



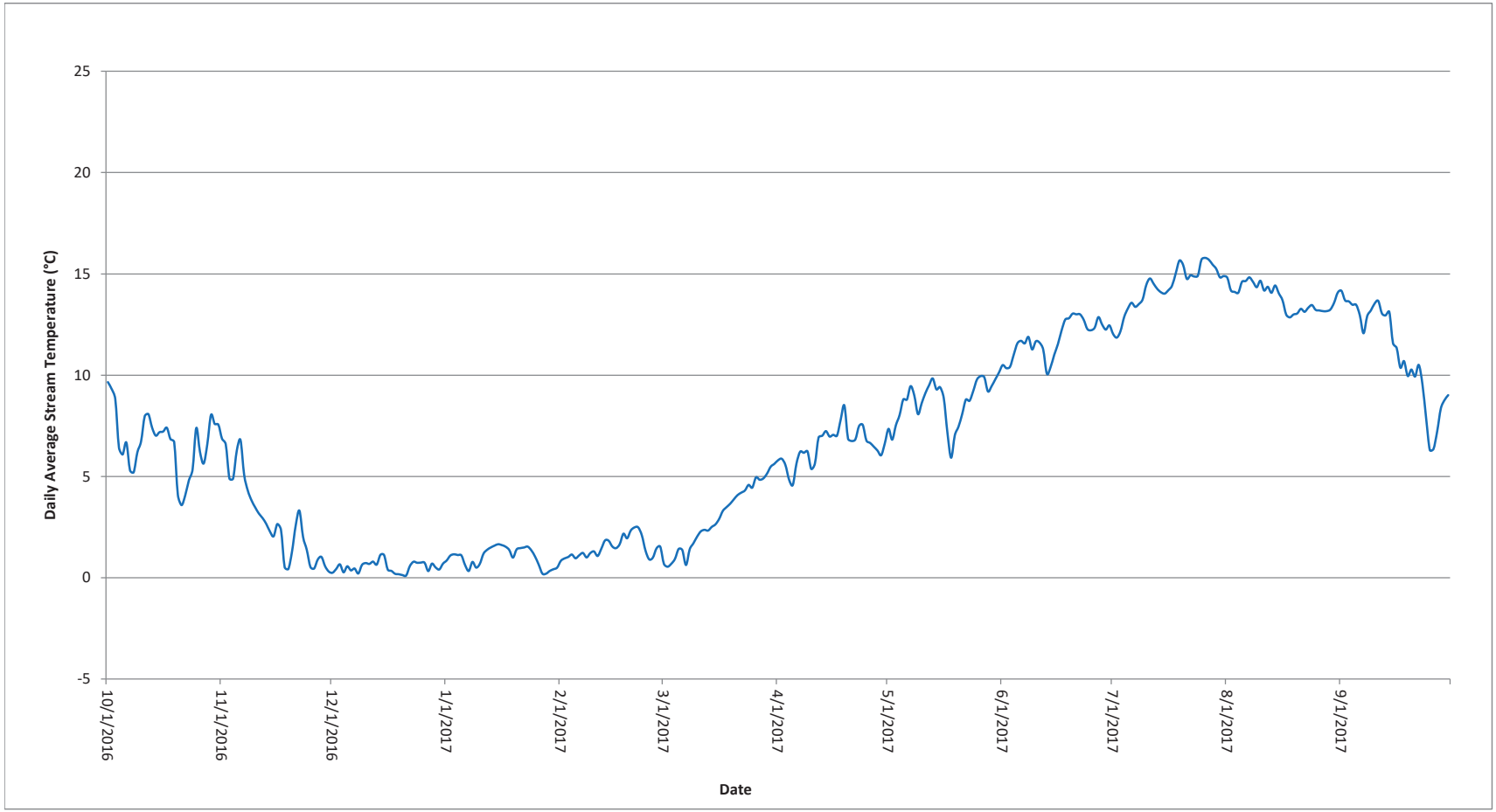
# MCSG-2
## Daily Mean Temperature Graph



## MCSG-3
## Daily Mean Temperature Graph



## MCSG-4
## Daily Mean Temperature Graph



## MCSG-5
## Daily Mean Temperature Graph