2018 SAN JUAN RIVER WATER QUALITY REPORT

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INTRODUCTION

This report documents water quality conditions on the San Juan River and select tributaries for the 2018 calendar year. The San Juan River monitoring program is managed by the Bureau of Indian Affairs (BIA) in accordance with commitments outlined in the Navajo Indian Irrigation Project (NIIP) Biological Assessment[1]. The Biological Assessment was prepared in preparation for consultation under Section 7 of the Endangered Species act for Blocks 1-11 of NIIP.

San Juan River water samples were collected by Navajo Agricultural Products Industry (NAPI) staff with BIA oversight. The samples were sent to ACZ Laboratories in Steamboat Springs, Colorado for analyses. Keller-Bliesner Engineering (KB) manages and coordinates the data collection, maintains a water quality database and interprets and reports the results to BIA. This report presents the water quality data collected in 2018, compares to historical data, and reports anomalies and any potential trends that need to be monitored. In conjunction with the San Juan River water quality data, this monitoring program also collects water quality data from NIIP wells and return flows as stipulated in the NIIP Biological Assessment. These data are included in the annual NIIP Irrigation and Drainage report.

In 2018, the San Juan River basin experienced one of the driest years on record. Consequently, the tributary flows in the San Juan Basin were significantly lower throughout the year. The Animas River was reduced to a trickle in July and the Mancos and LaPlata Rivers were dry during portions of the late summer months. The San Juan River baseflows are managed to maintain approximately 500 cfs below Farmington for critical fish habitat by making releases from Navajo Reservoir. The dry conditions also led to several large fires. The 416 Fire in the Animas River basin near Durango burned over 54,000 acres in June and July. This burn could potentially impact water quality in the Animas River and below, particularly following storm events.

WATER QUALITY

METHODS

Water Chemistry

Ten water quality monitoring sites were identified as necessary to characterize water quality in the San Juan River and key tributaries (Figure 1, Table 1). Sampling intervals are quarterly (February, May, August, and November). This schedule was adopted to ensure water sampling occurs during winter base flows, during spring runoff, and during the summer low flow period when irrigation return flow has a more significant impact on the river.

The water quality parameters included in the monitoring program and their associated detection limits are shown in Table 2 and Table 3. Parameters in Table 2 are measured quarterly. In addition, field measurements of water temperature, pH, redox potential, specific conductance, and dissolved oxygen are recorded. Annually, during low-flow periods, water samples are analyzed for all parameters listed in Table 2 and Table 3. This typically occurs in February.

[1] Keller-Bliesner Engineering, June 11, 1999. Navajo Indian Irrigation Project Blocks 1-11 Biological Assessment. Prepared for Bureau of Indian Affairs, Farmington, New Mexico.

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An evaluation of the Bureau of Indian Affair's (BIA) surface water monitoring plan occurred in 2011 resulting in several annually measured parameters being dropped from the monitoring plan. These dropped parameters include ***potassium, silica, barium, manganese and strontium***. The discontinued parameters had a high percentage of non-detectable concentrations, no water quality standards, and/or no exceedances to established water quality criteria.

Table 1. San Juan River Water Quality Monitoring Sites

Station Name	USGS ID	USGS Record	BIA Record
San Juan River at Archuleta Bridge	9355500	1958 -1984	1991-2018
Animas River at Farmington (Miller Bridge)	9364500	1958 -1992	1991-2018
San Juan River at Highway 371 Bridge	9365000	1974 -1991	1991-2018
La Plata River near Farmington	9367500	1977-1991	1994-2018
San Juan River at Shiprock Bridge	9368000	1958 -1992	1991-2018
Mancos River near Four Corners	9371005		1991-2018
San Juan River at Four Corners Bridge	9371010	1977-1990	1991-2018
San Juan River at Montezuma Creek Bridge	9378610		1991-2018
San Juan River at Bluff Bridge	9379495		1991-2018
San Juan River at Mexican Hat Bridge	9379500	1974 -1993	1991-2018

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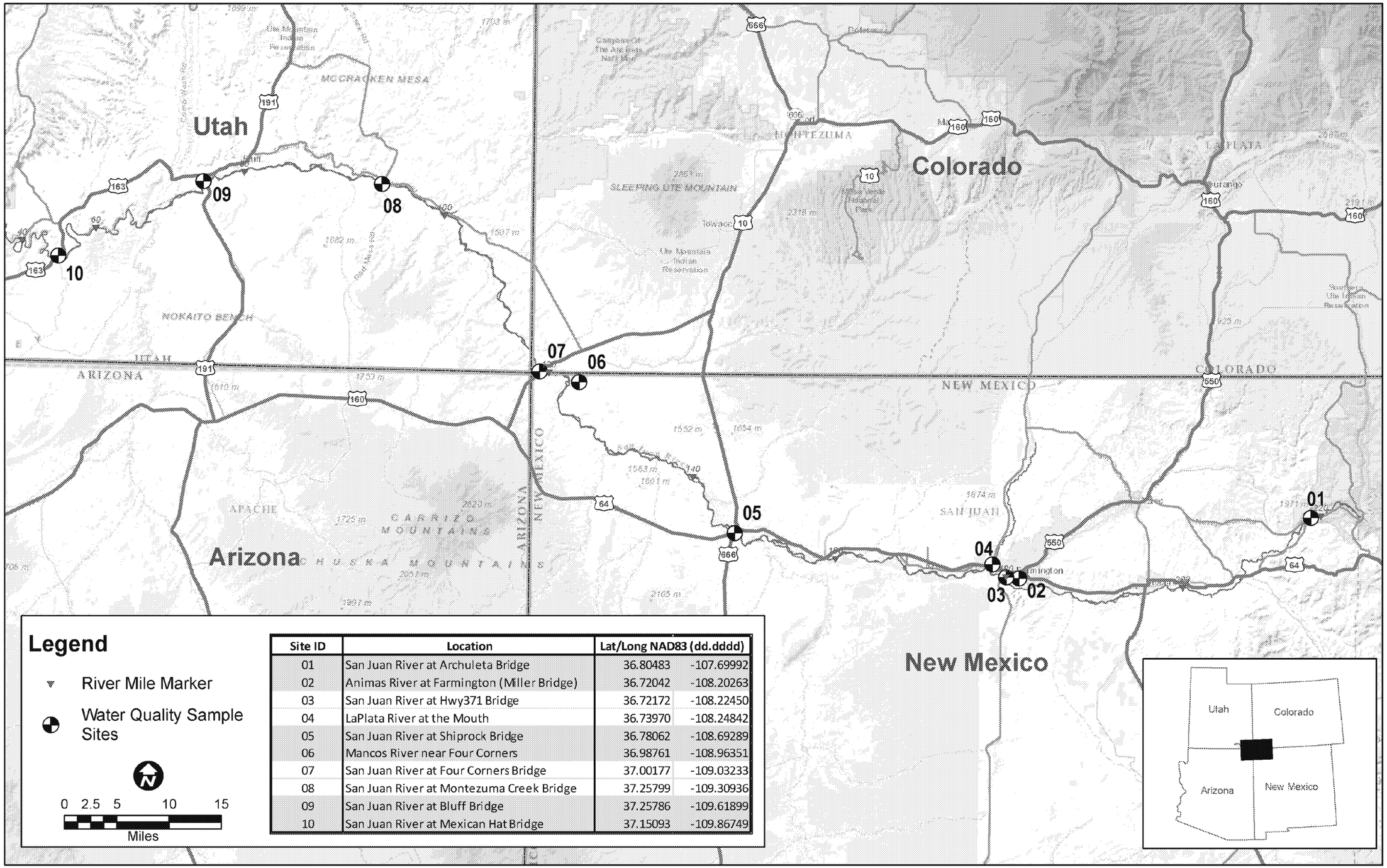

Site ID	Location	Lat/Long NAD83 (dd.dddd)	
01	San Juan River at Archuleta Bridge	36.80483	-107.69992
02	Animas River at Farmington (Miller Bridge)	36.72042	-108.20263
03	San Juan River at Hwy371 Bridge	36.72172	-108.22450
04	LaPlata River at the Mouth	36.73970	-108.24842
05	San Juan River at Shiprock Bridge	36.78062	-108.69289
06	Mancos River near Four Corners	36.98761	-108.96351
07	San Juan River at Four Corners Bridge	37.00177	-109.03233
08	San Juan River at Montezuma Creek Bridge	37.25799	-109.30936
09	San Juan River at Bluff Bridge	37.25786	-109.61899
10	San Juan River at Mexican Hat Bridge	37.15093	-109.86749

Figure 1. San Juan River and Tributary Water Quality Sample Site Locations

Table 2. San Juan River Monitoring Program Quarterly Water Quality Parameters

Quarterly Parameter	Method Detection Limit (MDL)	Practical Quantitation Limit (PQL)
Alkalinity (HCO_3)	*2 mg/L*	*20 mg/L*
Arsenic (total & dissolved)	*0.2 µg/L*	*1 µg/L*
Calcium (dissolved)	*0.1 mg/L*	*0.5 mg/L*
Copper (total & dissolved)	*0.8 µg/L*	*2 µg/L*
Hardness as $CaCO_3$ (dissolved)	*0.2 mg/L*	*5 mg/L*
Lead (total & dissolved)	*0.1 µg/L*	*0.5 µg/L*
Magnesium (dissolved)	*0.2 mg/L*	*1 mg/L*
Mercury (total & dissolved)	*0.2 µg/L*	*1 µg/L*
Sodium (dissolved)	*0.2 mg/L*	*1 mg/L*
Selenium (total, dissolved, & total recoverable)		
Pre-2010	*1 µg/L*	*3 µg/L*
2010-Present	*0.1 µg/L*	*0.3 µg/L*
Total Dissolved Solids (TDS) @ 180°C	*10 mg/L*	*20 mg/L*
Total Suspended Solids (TSS) @ 105°C	*5 mg/L*	*20 mg/L*
Turbidity	*0.1 NTU*	*0.5 NTU*
Zinc (total & dissolved)	*10 µg/L*	*50 µg/L*

Table 3. San Juan River Monitoring Program Annual Water Quality Parameters

Annual Parameter	Method Detection Limit (MDL)	Practical Quantitation Limit (PQL)
Aluminum (total & dissolved)	*0.03 mg/L*	*0.2 mg/L*
Chloride	*0.5 mg/L*	*2 mg/L*
Nickel (total & dissolved)		
Pre-2014	*10 µg/L*	*50 µg/L*
2014-Present	*8 µg/L*	*40 µg/L*
Nitrogen as NH_3 (dissolved)	*0.05 mg/L*	*0.5 mg/L*
Nitrogen as NO_3 (dissolved)	*0.02 mg/L*	*100 µg/L*
Nitrogen as NO_2 (dissolved)	*10 µg/L*	*50 µg/L*
Sulfate (dissolved)	*1 mg/L*	*5 mg/L*

RESULTS

Water Chemistry

Tables 4 through 6 show general water quality trends for some of the key parameters monitored on the San Juan River and its tributaries. These tables show the average annual value for each parameter, the average difference in comparison to the previous year, and the overall trend. The trend columns show whether the trend is upward, downward or no significant change for periods 2014-2018 (short-term trend) and 1997-2018 (long-term trend). These tables use color coding and indicators to aid in visually showing changes from year to year and in overall trends.

The Mancos River average annual dissolved selenium concentration in 2018 is the higher than the previous 20 years of record (Table 6). This is likely due to drought induced low flow conditions through a watershed that is naturally high in selenium bearing shales. During 2018 the Mancos River was dry during the August and November sampling events and hence no sample could be taken. In the context of the Navajo Indian Irrigation Project, it is important to note that the Mancos River drains the southwestern corner of Colorado and is not affected in any way by return flows or selenium loads from NIIP.

Tables 7 through 16 summarize the water quality data for the 10 permanent stations, comparing the 2018 statistics to those from 1995-2017. In each case the minimum, maximum, mean and standard deviation are given for each parameter in Table 2. The results for the annual parameters shown in Table 3 are presented in Tables 17 through 26. When values fall below detection, they are shown at ½ method detection limit (MDL) and included in the summary statistics in ***bold italics***.

Parameter MDL's are shown in Table 2 and Table 3. Prior to 2010, the lab used EPA Method SM 3114 B, AA-Hydride for all selenium measurements, which has a 1.0 µg/L MDL and a 5.0 µg/L practical quantitation limit (PQL). Due to low selenium concentrations within the San Juan River, a large portion of the samples collected have resulted in non-detectable selenium concentrations both in the San Juan River and its tributaries. Since 2010, a more sensitive selenium analysis method (EPA Method M200.8 ICP-MS) has been used. This method lowers the MDL to 0.1 µg/L and the PQL to 0.5 µg/L for dissolved, total, and total recoverable selenium. Since the selenium MDL change there have been no selenium non-detects in the monitoring program. In Tables 7 through 16, the 1995-2017 statistics lists the original (pre-2010) selenium ½ detection limit (0.5 µg/L) when values fall below the 1 µg/L MDL. The selenium statistical data lists the pre-2010 one-half detection limit because the majority of the data in this timeframe have the higher detection limit.

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Table 4. Upper San Juan River Trend Summary for Key Water Quality Parameters

Analysis	Units	2016 Avg	2017 Avg	2018 Avg	2017-2016 Difference	2018-2017 Difference	2014-2018 Trend	1997-2018 Trend
San Juan River at Highway 371 Bridge								
Al, diss.	µg/L	40	***15***	***15***	-25	0	≈	≈
Cu, diss.	µg/L	1.12	1.40	0.75	0.27	-0.65	≈	≈
Pb, diss.	µg/L	0.06	0.54	0.24	0.48	-0.30	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	***4***	0	0	≈	≈
NO_3 - N	mg/L	0.67	0.52	0.52	-0.15	0.00	≈	≈
Se, diss.	µg/L	0.40	0.47	0.33	0.07	-0.15	≈	≈
Zn, diss.	µg/L	***5***	8.75	***5***	3.75	-3.75	≈	≈
San Juan River at Shiprock Bridge								
Al, diss.	µg/L	***15***	***15***	***15***	0.0	0.0	≈	≈
Cu, diss.	µg/L	1.01	1.02	0.68	0.01	-0.35	≈	≈
Pb, diss.	µg/L	0.09	0.10	0.10	0.01	0.00	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	11	0	7	≈	≈
NO_3 - N	mg/L	0.67	0.93	0.35	0.25	-0.57	≈	≈
Se, diss.	µg/L	0.51	0.61	0.43	0.10	-0.19	≈	≈
Zn, diss.	µg/L	***5***	***5***	***5***	0	0	≈	≈
San Juan River at Four Corners Bridge								
Al, diss.	µg/L	***15***	***15***	30	0	15	≈	≈
Cu, diss.	µg/L	1.10	0.89	0.58	-0.21	-0.31	≈	≈
Pb, diss.	µg/L	***0.05***	0.09	0.06	0.04	-0.02	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	10	0	6	≈	≈
NO_3 - N	mg/L	0.70	0.95	0.16	0.25	-0.79	≈	≈
Se, diss.	µg/L	0.70	0.95	0.58	0.25	-0.37	≈	≈
Zn, diss.	µg/L	***5***	***5***	***5***	0	0	≈	≈

Note: ↑ Increasing ≈ No Significant Change
↓ Decreasing

Bold Italics indicate values are "below method detection limit" and shown at 1/2 the method detection level.

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Table 5. Lower San Juan River Trend Summary for Key Water Quality Parameters

Analysis	Units	2016 Avg	2017 Avg	2018 Avg	2017-2016 Difference	2018-2017 Difference	2014-2018 Trend	1997-2018 Trend
San Juan River at Montezuma Creek Bridge								
Al, diss.	µg/L	90	40	***15***	-50	-25	≈	≈
Cu, diss.	µg/L	1.13	1.20	0.95	0.07	-0.25	≈	≈
Pb, diss.	µg/L	0.06	0.09	***0.05***	0.02	-0.04	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0.00	0.00	≈	≈
Ni, diss.	µg/L	***4***	***4***	***4***	0	0	≈	≈
NO_3 - N	mg/L	1.07	1.20	0.34	0.13	-0.86	≈	≈
Se, diss.	µg/L	0.73	1.10	0.63	0.37	-0.47	≈	≈
Zn, diss.	µg/L	***5***	***5***	***5***	0.0	0.0	≈	≈
San Juan River at Bluff Bridge								
Al, diss.	µg/L	***15***	***15***	***15***	0	0	≈	≈
Cu, diss.	µg/L	1.29	1.08	0.80	-0.21	-0.28	≈	≈
Pb, diss.	µg/L	0.06	0.10	***0.05***	0.04	-0.05	≈	≈
Hg, diss.	µg/L	**0.1**	**0.1**	**0.1**	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	8	0	4	≈	≈
NO_3 - N	mg/L	0.75	1.14	0.31	0.40	-0.83	≈	≈
Se, diss.	µg/L	0.79	0.84	0.60	0.05	-0.24	≈	≈
Zn, diss.	µg/L	***5***	***5***	***5***	0.0	0.0	≈	≈
San Juan River at Mexican Hat Bridge								
Al, diss.	µg/L	420	***15***	40	-405	25	≈	≈
Cu, diss.	µg/L	1.70	1.30	1.00	-0.40	-0.30	≈	≈
Pb, diss.	µg/L	0.31	0.11	***0.05***	-0.20	-0.06	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	9	0	5	≈	≈
NO_3 - N	mg/L	0.89	1.02	0.22	0.13	-0.80	≈	≈
Se, diss.	µg/L	0.75	0.88	0.60	0.13	-0.27	≈	≈
Zn, diss.	µg/L	***5***	***5***	***5***	0.0	0.0	≈	≈

Note: ↑ Increasing; ≈ No Significant Change; ↓ Decreasing

Bold Italics indicate values are "below method detection limit" and shown at 1/2 the method detection level.

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Table 6. Tributary Trend Summary for Key Water Quality Parameters

Analysis	Units	2016 Avg	2017 Avg	2018 Avg	2017-2016 Difference	2018-2017 Difference	2014-2018 Trend	1997-2018 Trend
Animas River at Farmington-Miller Bridge								
Al, diss.	µg/L	30	***15***	***15***	-15	0	≈	≈
Cu, diss.	µg/L	1.20	1.25	0.67	0.05	-0.58	≈	≈
Pb, diss.	µg/L	0.09	0.16	0.15	0.08	-0.01	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	***4***	0	0	≈	≈
NO_3 - N	mg/L	0.34	1.25	0.19	0.91	-1.06	≈	≈
Se, diss.	µg/L	0.60	0.50	0.40	-0.10	-0.10	≈	≈
Zn, diss.	µg/L	40	58	21	18	-36	≈	≈
LaPlata River at Mouth								
Al, diss.	µg/L	40	50	80	10	30	≈	≈
Cu, diss.	µg/L	1.18	1.00	0.97	-0.17	-0.03	≈	≈
Pb, diss.	µg/L	0.06	0.11	0.13	0.05	0.02	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	***4***	9	0	5	≈	≈
NO_3 - N	mg/L	0.25	0.54	0.07	0.29	-0.47	≈	≈
Se, diss.	µg/L	0.73	1.24	0.22	0.51	-1.02	≈	≈
Zn, diss.	µg/L	88	46	20	-42	-26	≈	≈
Mancos River near Four Corners								
Al, diss.	µg/L	***15***	30	40	15	10	≈	≈
Cu, diss.	µg/L	1.55	1.90	2.05	0.35	0.15	≈	≈
Pb, diss.	µg/L	0.05	0.11	0.18	0.06	0.06	≈	≈
Hg, diss.	µg/L	***0.1***	***0.1***	***0.1***	0	0	≈	≈
Ni, diss.	µg/L	***4***	10	9	6	-1	≈	≈
NO_3 - N	mg/L	0.72	3.02	0.32	2.30	-2.70	≈	≈
Se, diss.	µg/L	6.75	10.55	14.80	3.80	4.25	≈	≈
Zn, diss.	µg/L	***5***	7.5	***5***	2.5	-2.5	≈	≈

Note: ↑ Increasing ≈ No Significant Change
↓ Decreasing

Bold Italics indicate values are "below method detection limit" and shown at 1/2 the method detection level.

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Table 7. 2018 Water Chemistry Data for San Juan River at Archuleta Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	104	43.0	124	79.7	9.8	4	76.0	92.5	80.9	7.8
Arsenic dissolved (µg/L)	124	0.25	2.5	1.3	0.8	4	0.30	0.6	0.5	0.1
Arsenic total (µg/L)	124	0.25	5.0	1.6	1.1	4	0.6	0.8	0.7	0.1
Calcium dissolved (mg/L)	104	25.1	39.8	30.0	2.9	4	26.2	28.2	27.4	0.9
Copper dissolved (µg/L)	104	***0.25***	21.0	2.0	2.4	4	0.70	0.8	0.8	0.1
Copper total (µg/L)	104	***0.3***	41.0	3.7	6.0	4	0.8	1.3	1.0	0.2
Oxygen dissolved (mg/L)	121	4.6	14.3	10.3	1.7	4	8.5	13.1	10.7	2.0
Conductance (µmhos/cm)	124	158	444	246	43.0	4	206	226	215	9.6
Hardness (mg/L)	104	83.0	128	97.9	9.4	4	85.0	91.0	88.8	2.9
Bicarbonate (mg/L)	104	43.0	124	79.0	9.8	4	70.7	92.5	79.2	9.3
Mercury dissolved (µg/L)	124	***0.1***	0.5	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	124	***0.1***	0.2	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	104	4.6	7.1	5.6	0.6	4	4.7	5.1	5.0	0.2
Sodium dissolved (mg/L)	81	10.7	19.9	13.9	2.1	4	11.3	13.1	12.3	0.8
Lead dissolved (µg/L)	124	***0.05***	5.7	0.4	0.7	4	***0.05***	***0.05***	***0.05***	0.0
Lead total (µg/L)	124	***0.05***	19.2	0.8	2.0	4	***0.1***	0.2	***0.1***	0.1
pH	124	6.1	9.1	8.0	0.5	4	6.7	8.7	7.8	0.9
Redox Potential (mv)	120	25	591	339	110	4	139	414	266	132
Selenium dissolved (µg/L)	124	***0.5***	1.0	***0.5***	0.1	4	0.2	0.4	0.3	0.1
Selenium total (µg/L)	124	***0.5***	3.0	***0.5***	0.2	4	0.3	0.4	0.3	0.1
Selenium total recoverable (µg/L)	83	***0.5***	2.0	***0.5***	0.2	4	0.2	0.3	0.3	0.1
Total dissolved solids (mg/L)	103	90.0	280	158	27.6	4	142	162	152	8.8
Temperature (°C)	124	3.1	14.3	7.1	2.2	4	5.7	10.0	7.7	1.8
Total suspended solids (mg/L)	124	***2.5***	378	10.3	34.4	4	***2.5***	5.0	***2.5***	1.3
Turbidity (NTU)	121	0.9	33.0	5.6	4.7	4	1.4	7.3	3.7	2.6
Zinc dissolved (µg/L)	124	***5.0***	70.0	***5.0***	7.6	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	124	***5.0***	50.0	11.9	10.6	4	***5.0***	***5.0***	***5.0***	0.0

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00012

Table 8. 2018 Water Chemistry Data for Animas River at Farmington

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	103	43.0	246	128	35.9	4	73.8	172	143	46.8
Arsenic dissolved (µg/L)	124	***0.10***	2.5	1.2	1.0	4	***0.10***	0.70	0.32	0.3
Arsenic total (µg/L)	124	0.25	25.8	2.2	3.0	4	0.50	1.2	0.8	0.3
Calcium dissolved (mg/L)	103	27.1	117	76.6	23.8	4	47.4	110	88.8	28.3
Copper dissolved (µg/L)	103	***0.25***	9.0	2.3	1.9	4	***0.25***	0.8	0.7	0.2
Copper total (µg/L)	103	***0.25***	90.7	10.2	14.4	4	1.1	5.6	2.5	2.1
Oxygen dissolved (mg/L)	119	0.0	14.9	9.3	2.2	4	8.3	10.2	9.1	1.0
Conductance (µmhos/cm)	124	175	3685	583	335	4	342	890	654	228
Hardness (mg/L)	103	81.0	376	240	75.9	4	143	345	276	90.9
Bicarbonate (mg/L)	103	43.0	246	126	34.8	4	73.8	172	139	44.7
Mercury dissolved (µg/L)	124	***0.1***	0.2	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	124	***0.1***	0.9	***0.1***	0.1	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	103	3.3	20.2	11.8	4.1	4	6.1	17.2	13.2	4.9
Sodium dissolved (mg/L)	80	3.5	63.3	28.0	13.2	4	11.8	50.0	32.3	15.8
Lead dissolved (µg/L)	124	***0.05***	11.9	0.5	1.2	4	***0.05***	0.3	0.2	0.1
Lead total (µg/L)	124	0.3	80.0	11.5	17.2	4	0.7	8.3	2.9	3.6
pH	124	6.9	8.9	8.1	0.4	4	6.8	8.4	7.9	0.8
Redox Potential (mv)	119	4.1	568	340	110	4	124	442	269	157
Selenium dissolved (µg/L)	124	***0.5***	3.0	***0.5***	0.4	4	0.2	0.7	0.4	0.2
Selenium total (µg/L)	124	***0.5***	6.0	***0.5***	0.6	4	0.3	0.6	0.4	0.2
Selenium total recoverable (µg/L)	83	***0.5***	2.0	***0.5***	0.3	4	0.3	0.5	0.4	0.1
Total dissolved solids (mg/L)	103	110	590	360	127	4	216	594	447	162
Temperature (°C)	124	0.1	27.3	11.3	7.1	4	7.7	28.1	15.5	9.0
Total suspended solids (mg/L)	124	***2.5***	3920	165	487	4	***2.5***	103	40.1	43.8
Turbidity (NTU)	122	0.9	3720	122	462	4	3.5	56.1	21.7	24.3
Zinc dissolved (µg/L)	124	***5.0***	90.0	***5.0***	9.9	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	124	***5.0***	430	74.8	80.7	4	***5.0***	70.0	21.3	32.5

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00013

Table 9. 2018 Water Chemistry Data for San Juan River at Farmington Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	104	49.0	165	107	22.9	4	78.1	131	103	25.8
Arsenic dissolved (µg/L)	125	***0.10***	5.0	1.3	1.0	4	0.30	0.5	0.4	0.1
Arsenic total (µg/L)	125	0.25	43.0	2.7	5.1	4	0.9	1.3	1.1	0.2
Calcium dissolved (mg/L)	104	28.8	97.8	57.1	16.1	4	35.5	70.7	55.8	16.4
Copper dissolved (µg/L)	104	***0.25***	10.0	2.4	1.9	4	***0.25***	1.0	0.8	0.3
Copper total (µg/L)	104	0.9	186	16.9	27.5	4	2.0	7.6	3.9	2.5
Oxygen dissolved (mg/L)	118	0.0	13.8	8.6	2.2	4	8.1	10.3	9.2	1.1
Conductance (µmhos/cm)	125	110	2223	460	206	4	398	690	537	157
Hardness (mg/L)	104	88.0	310	179	50.1	4	113	220	174	50.6
Bicarbonate (mg/L)	104	49.0	165	106	22.8	4	78.1	129	102	24.1
Mercury dissolved (µg/L)	125	***0.1***	0.2	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	125	***0.1***	0.6	***0.1***	0.1	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	104	3.7	15.9	8.8	2.5	4	5.8	10.5	8.4	2.4
Sodium dissolved (mg/L)	81	6.2	52.5	29.1	10.7	4	17.7	37.5	26.7	10.2
Lead dissolved (µg/L)	125	***0.05***	4.0	0.4	0.5	4	***0.05***	0.8	0.2	0.4
Lead total (µg/L)	125	0.3	166	12.9	23.5	4	1.0	9.9	4.0	4.0
pH	125	6.8	9.3	8.0	0.4	4	6.6	8.3	7.8	0.8
Redox Potential (mv)	119	2.6	557	349	107	4	124	463	267	164
Selenium dissolved (µg/L)	125	***0.5***	2.0	***0.5***	0.2	4	0.2	0.5	0.3	0.1
Selenium total (µg/L)	125	***0.5***	2.0	***0.5***	0.3	4	0.3	0.5	0.4	0.1
Selenium total recoverable (µg/L)	84	***0.5***	2.0	***0.5***	0.2	4	0.3	0.5	0.4	0.1
Total dissolved solids (mg/L)	104	90.0	490	299	92.1	4	204	400	305	96.1
Temperature (°C)	125	0.1	24.3	10.9	6.1	4	0.0	20.0	9.9	8.2
Total suspended solids (mg/L)	125	***2.5***	9050	357	1075	4	46.0	124	81.5	32.3
Turbidity (NTU)	123	4.2	7400	271	1083	4	17.8	41.9	33.5	10.8
Zinc dissolved (µg/L)	125	***5.0***	30.0	***5.0***	5.6	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	125	***5.0***	610	67.0	90.2	4	***5.0***	90.0	31.3	39.7

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00014

Table 10. 2018 Water Chemistry Data for La Plata River near Farmington

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	69	111	861	264	94.5	3	330	416	381	45.2
Arsenic dissolved (µg/L)	89	0.20	5.0	1.6	1.0	3	0.20	0.6	0.4	0.2
Arsenic total (µg/L)	89	0.5	170	6.9	21.4	3	0.5	1.0	0.8	0.3
Calcium dissolved (mg/L)	69	65.4	507	212	100	3	365	464	424	52.2
Copper dissolved (µg/L)	69	***0.25***	20.0	4.4	4.9	3	0.9	1.0	1.0	0.1
Copper total (µg/L)	69	***0.25***	1090	41.4	145	3	1.0	5.0	2.7	2.1
Oxygen dissolved (mg/L)	87	4.9	14.1	8.7	2.1	3	6.3	10.3	8.6	2.1
Conductance (µmhos/cm)	89	274	5844	2092	1254	3	4178	6503	5626	1264
Hardness (mg/L)	69	279	2120	918	418	3	1580	2020	1853	239
Bicarbonate (mg/L)	69	111	861	262	95.3	3	330	416	378	43.8
Mercury dissolved (µg/L)	89	***0.1***	***0.1***	***0.1***	0.0	3	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	89	***0.1***	1.5	***0.1***	0.2	3	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	69	18.1	208	94.4	43.5	3	163	222	193	29.5
Sodium dissolved (mg/L)	49	36.6	820	280	215	3	599	915	802	176
Lead dissolved (µg/L)	89	***0.05***	1.0	0.3	0.2	3	***0.05***	0.3	0.1	0.1
Lead total (µg/L)	89	***0.05***	744	25.5	98.0	3	0.25	0.7	0.4	0.3
pH	89	6.8	9.1	8.0	0.3	3	6.6	7.9	7.4	0.7
Redox Potential (mv)	88	178	612	357	91.9	3	157	450	314	148
Selenium dissolved (µg/L)	89	***0.5***	7.5	1.1	1.0	3	0.2	0.3	0.2	0.0
Selenium total (µg/L)	89	***0.5***	15.0	1.6	2.3	3	0.3	0.5	0.3	0.1
Selenium total recoverable (µg/L)	53	***0.5***	11.0	1.4	1.9	3	0.1	0.3	0.2	0.1
Total dissolved solids (mg/L)	69	80	4770	1878	1131	3	3910	5800	5057	1008
Temperature (°C)	89	0.0	32.3	13.1	9.3	3	8.7	30.0	18.5	10.8
Total suspended solids (mg/L)	89	***2.5***	46300	1519	5932	3	9.0	62.0	28.3	29.3
Turbidity (NTU)	89	0.1	34400	1230	4942	3	1.3	48.4	18.9	25.7
Zinc dissolved (µg/L)	89	***5.0***	220	10.9	24.6	3	***5.0***	25.0	11.7	11.5
Zinc total (µg/L)	89	***5.0***	3180	125	441	3	10.0	25.0	20.0	8.7

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00015

Table 11. 2018 Water Chemistry Data for San Juan River at Shiprock Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	198	***1.0***	359	113	31.6	8	88.6	140	112	22.2
Arsenic dissolved (µg/L)	240	0.25	5.0	1.4	0.9	8	0.3	0.7	0.5	0.1
Arsenic total (µg/L)	239	0.25	33.9	3.9	5.4	8	0.9	2.4	1.8	0.6
Calcium dissolved (mg/L)	198	29.5	96.3	60.8	15.0	8	41.1	73.3	58.6	14.0
Copper dissolved (µg/L)	198	***0.25***	18.0	2.6	2.5	8	***0.3***	1.1	0.7	0.3
Copper total (µg/L)	198	***0.25***	298	23.4	36.5	8	1.7	8.5	5.0	2.6
Oxygen dissolved (mg/L)	198	2.9	15.0	9.5	2.2	8	7.8	13.1	10.1	2.1
Conductance (µmhos/cm)	203	216	921	515	143	8	380	619	500	104
Hardness (mg/L)	198	91.0	317	195	50.1	8	132	230	186	44.7
Bicarbonate (mg/L)	198	1.0	359	110	31.1	8	86.4	135	107	21.4
Mercury dissolved (µg/L)	240	***0.1***	0.3	***0.1***	0.0	8	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	240	***0.1***	1.6	***0.1***	0.2	8	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	198	4.0	18.6	10.5	3.3	8	7.2	12.4	9.6	2.5
Sodium dissolved (mg/L)	151	8.5	125	36.9	15.3	8	22.9	46.4	33.4	10.6
Lead dissolved (µg/L)	240	***0.05***	18.0	0.6	1.8	8	***0.05***	0.2	0.1	0.1
Lead total (µg/L)	239	0.3	160	18.4	23.7	8	0.6	12.4	6.4	4.5
pH	203	6.9	9.0	8.2	0.4	8	6.8	8.5	7.9	0.8
Redox Potential (mv)	198	34.0	544	363	105	8	141	442	274	136
Selenium dissolved (µg/L)	240	***0.5***	2.0	***0.5***	0.2	8	0.3	0.5	0.4	0.1
Selenium total (µg/L)	240	***0.5***	7.0	***0.5***	0.5	8	0.3	0.7	0.5	0.1
Selenium total recoverable (µg/L)	162	***0.5***	2.0	***0.5***	0.3	8	0.4	0.6	0.5	0.1
Total dissolved solids (mg/L)	197	130	590	345	101	8	236	490	355	110
Temperature (°C)	203	0.1	26.1	12.0	6.8	8	4.8	22.6	13.9	7.7
Total suspended solids (mg/L)	240	***2.5***	20200	625	1667	8	24.0	237	137	79.7
Turbidity (NTU)	238	3.1	22300	525	1772	8	8.8	145	78.3	52.9
Zinc dissolved (µg/L)	240	***5.0***	50.0	***5.0***	5.3	8	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	240	***5.0***	2000	88.4	157	8	***5.0***	80.0	28.1	32.6

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00016

Table 12. 2018 Water Chemistry Data for Mancos River near Four Corners

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	86	86.7	360	181	49.5	2	196	221	209	17.7
Arsenic dissolved (µg/L)	103	0.20	5.0	1.4	1.0	2	0.20	0.5	0.4	0.2
Arsenic total (µg/L)	103	0.25	146	5.9	15.6	2	0.5	0.5	0.5	0.0
Calcium dissolved (mg/L)	86	42.0	323	157	58.2	2	215	285	250	49.5
Copper dissolved (µg/L)	86	***0.25***	20.0	4.6	4.7	2	1.1	3.0	2.1	1.3
Copper total (µg/L)	86	***0.25***	488	26.9	63.6	2	0.9	2.0	1.5	0.8
Oxygen dissolved (mg/L)	99	2.4	17.9	9.4	2.4	2	11.1	11.6	11.4	0.4
Conductance (µmhos/cm)	102	375	2783	1561	577	2	2184	4833	3509	1873
Hardness (mg/L)	86	160	1360	748	295	2	1150	1930	1540	552
Bicarbonate (mg/L)	86	86.7	360	175	48.3	2	190	211	201	14.8
Mercury dissolved (µg/L)	103	***0.1***	***0.1***	***0.1***	0.0	2	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	103	***0.1***	2.0	***0.1***	0.3	2	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	86	13.3	196	86.5	40.1	2	149	297	223	105
Sodium dissolved (mg/L)	63	14.7	313	119	58.3	2	180	509	345	233
Lead dissolved (µg/L)	103	***0.05***	1.0	0.3	0.2	2	0.10	0.25	0.18	0.1
Lead total (µg/L)	103	***0.05***	526	14.1	54.5	2	0.2	0.8	0.5	0.4
pH	101	6.7	9.1	8.2	0.4	2	7.1	8.3	7.7	0.9
Redox Potential (mv)	98	4.2	548	350	108	2	347	406	377	41.7
Selenium dissolved (µg/L)	103	***0.5***	30.0	7.1	6.0	2	5.1	24.5	14.8	13.7
Selenium total (µg/L)	103	***0.5***	30.0	7.4	6.1	2	4.9	25.8	15.4	14.8
Selenium total recoverable (µg/L)	71	***0.5***	26.0	7.2	5.9	2	4.6	24.7	14.7	14.2
Total dissolved solids (mg/L)	86	230	2720	1331	576	2	2110	4530	3320	1711
Temperature (°C)	102	0.04	32.3	11.8	8.7	2	9.1	23.0	16.0	9.8
Total suspended solids (mg/L)	103	***2.5***	33500	1000	3949	2	8.0	51.0	29.5	30.4
Turbidity (NTU)	103	1.7	31000	819	3674	2	6.8	47.3	27.0	28.6
Zinc dissolved (µg/L)	103	***5.0***	40.0	***5.0***	4.8	2	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	103	***5.0***	2300	90.7	318	2	10.0	25.0	17.5	10.6

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00017

Table 13. 2018 Water Chemistry Data for San Juan River at Four Corners Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	108	64.0	214	119	25.0	4	89.5	139	112	22.6
Arsenic dissolved (µg/L)	129	0.25	17.2	1.5	1.6	4	0.30	0.8	0.6	0.2
Arsenic total (µg/L)	129	0.25	124	5.3	11.6	4	0.8	2.2	1.5	0.6
Calcium dissolved (mg/L)	108	31.7	136	65.3	18.1	4	45.2	77.0	61.1	15.1
Copper dissolved (µg/L)	108	***0.25***	16.2	2.8	2.6	4	***0.3***	1.1	0.6	0.4
Copper total (µg/L)	108	***0.25***	575	28.5	58.8	4	1.2	8.9	4.1	3.3
Oxygen dissolved (mg/L)	124	2.6	17.5	9.1	2.2	4	7.8	11.5	9.4	1.7
Conductance (µmhos/cm)	127	239	1496	572	187	4	408	634	530	116
Hardness (mg/L)	108	102	407	215	61.9	4	148	245	198	50.1
Bicarbonate (mg/L)	108	63.0	214	116	24.8	4	87.9	135	108	23.1
Mercury dissolved (µg/L)	129	***0.1***	0.2	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	129	***0.1***	1.0	***0.1***	0.1	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	108	3.1	23.8	12.7	4.6	4	8.0	14.7	11.0	3.3
Sodium dissolved (mg/L)	85	9.6	90.9	41.9	16.7	4	24.8	54.4	36.7	13.9
Lead dissolved (µg/L)	129	***0.05***	14.4	0.5	1.6	4	***0.05***	0.10	***0.05***	0.0
Lead total (µg/L)	129	0.3	404	21.9	46.0	4	0.3	10.9	3.9	4.8
pH	127	6.8	9.2	8.1	0.4	4	6.9	8.6	8.1	0.8
Redox Potential (mv)	122	30.0	655	354	111	4	121	443	265	156
Selenium dissolved (µg/L)	129	***0.5***	4.0	***0.5***	0.5	4	0.4	0.8	0.6	0.2
Selenium total (µg/L)	129	***0.5***	6.3	1.0	0.8	4	0.5	0.9	0.7	0.2
Selenium total recoverable (µg/L)	88	***0.5***	4.0	***0.5***	0.6	4	0.5	0.9	0.7	0.2
Total dissolved solids (mg/L)	108	110	1120	388	143	4	270	476	366	106
Temperature (°C)	127	0.02	26.5	12.1	7.4	4	4.8	23.5	13.8	8.5
Total suspended solids (mg/L)	129	***2.5***	12400	795	1663	4	8.0	192	100	75.8
Turbidity (NTU)	127	2.0	60500	1182	5811	4	6.7	112	62.7	43.4
Zinc dissolved (µg/L)	129	***5.0***	50.0	***5.0***	6.6	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	129	***5.0***	1700	95.0	174	4	***5.0***	60.0	18.8	27.5

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00018

Table 14. 2018 Water Chemistry Data for San Juan River at Montezuma Creek Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	99	59.0	205	124	26.7	4	83.8	142	115	28.3
Arsenic dissolved (µg/L)	120	0.25	3.2	1.4	0.8	4	0.3	0.8	0.6	0.2
Arsenic total (µg/L)	120	0.25	70.0	5.1	9.2	4	0.5	4.1	1.8	1.7
Calcium dissolved (mg/L)	99	33.9	113	71.5	19.5	4	45.4	80.0	63.5	18.6
Copper dissolved (µg/L)	99	***0.25***	36.2	2.9	4.2	4	0.8	1.2	1.0	0.2
Copper total (µg/L)	99	1.3	310	28.8	46.6	4	0.9	16.9	6.2	7.4
Oxygen dissolved (mg/L)	116	2.5	17.5	9.0	2.1	4	7.5	10.7	9.0	1.6
Conductance (µmhos/cm)	120	257	1160	639	202	4	427	733	563	160
Hardness (mg/L)	99	108	449	251	77.4	4	150	286	212	69.3
Bicarbonate (mg/L)	99	59.0	205	122	26.4	4	83.8	137	112	28.3
Mercury dissolved (µg/L)	120	***0.1***	0.2	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	120	***0.1***	0.8	***0.1***	0.1	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	99	5.6	40.5	17.6	7.4	4	7.7	21.0	12.9	6.1
Sodium dissolved (mg/L)	75	10.3	93.2	45.0	18.6	4	22.8	63.0	39.9	18.2
Lead dissolved (µg/L)	120	***0.05***	63.6	0.8	5.8	4	***0.05***	***0.05***	***0.05***	0.0
Lead total (µg/L)	120	0.3	322	23.0	45.1	4	0.3	20.1	6.8	9.0
pH	120	6.8	9.3	8.1	0.4	4	6.8	8.5	7.9	0.8
Redox Potential (mv)	115	35.0	520	349	103	4	108	421	236	142
Selenium dissolved (µg/L)	120	***0.5***	4.0	***0.5***	0.5	4	0.3	1.0	0.6	0.3
Selenium total (µg/L)	120	***0.5***	6.0	1.1	0.8	4	0.5	1.0	0.7	0.2
Selenium total recoverable (µg/L)	83	***0.5***	3.0	***0.5***	0.5	4	0.5	0.9	0.7	0.2
Total dissolved solids (mg/L)	99	160	800	436	150	4	268	548	396	142
Temperature (°C)	120	0.1	27.8	12.2	7.6	4	7.4	23.1	14.8	7.8
Total suspended solids (mg/L)	120	***2.5***	13000	910	2020	4	10.0	476	189	200
Turbidity (NTU)	120	2.5	17200	713	2164	4	4.9	268	122	111
Zinc dissolved (µg/L)	120	***5.0***	60.0	***5.0***	6.2	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	120	***5.0***	1050	97.1	155	4	***5.0***	130	38.8	60.9

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00019

Table 15. 2018 Water Chemistry Data for San Juan River at Bluff Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	201	47.0	349	126	33.6	8	81.4	144	115	24.7
Arsenic dissolved (µg/L)	242	0.25	2.5	1.4	0.8	8	***0.10***	1.0	0.6	0.4
Arsenic total (µg/L)	241	***0.10***	52.0	5.1	7.6	8	0.7	4.0	2.2	1.1
Calcium dissolved (mg/L)	201	32.3	121	72.7	19.1	8	46.3	80.8	63.9	17.5
Copper dissolved (µg/L)	201	***0.25***	13.0	3.0	2.8	8	***0.3***	1.3	0.8	0.3
Copper total (µg/L)	201	***0.25***	236	28.7	42.3	8	1.1	15.9	6.9	4.8
Oxygen dissolved (mg/L)	200	2.7	16.4	9.1	2.1	8	7.3	10.6	8.9	1.6
Conductance (µmhos/cm)	205	255	1145	661	205	8	409	774	576	161
Hardness (mg/L)	201	106	507	256	76.6	8	145	290	214	65.7
Bicarbonate (mg/L)	201	47.0	349	123	33.3	8	81.4	140	112	23.8
Mercury dissolved (µg/L)	242	***0.1***	0.5	***0.1***	0.0	8	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	242	***0.1***	0.9	***0.1***	0.1	8	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	201	5.6	49.8	18.0	7.5	8	7.2	21.5	13.1	5.8
Sodium dissolved (mg/L)	154	10.5	108	46.4	19.3	8	20.8	64.2	40.2	17.3
Lead dissolved (µg/L)	242	***0.05***	14.2	0.5	1.3	8	***0.05***	***0.1***	***0.1***	0.0
Lead total (µg/L)	241	0.1	167	21.0	31.5	8	0.4	20.3	6.7	6.9
pH	205	6.8	9.6	8.1	0.3	8	6.7	8.4	7.6	0.8
Redox Potential (mv)	201	4.0	535	358	107	8	111	437	248	138
Selenium dissolved (µg/L)	242	***0.5***	3.0	***0.5***	0.5	8	0.3	1.1	0.6	0.3
Selenium total (µg/L)	242	***0.5***	4.0	1.1	0.7	8	0.3	1.0	0.7	0.3
Selenium total recoverable (µg/L)	164	***0.5***	3.0	***0.5***	0.5	8	0.5	0.9	0.7	0.1
Total dissolved solids (mg/L)	200	150	990	453	152	8	264	570	402	133
Temperature (°C)	205	0.1	29.4	11.9	7.6	8	6.3	22.3	13.6	7.4
Total suspended solids (mg/L)	242	***2.5***	9820	883	1727	8	14.0	1020	269	319
Turbidity (NTU)	240	2.3	7900	608	1394	8	5.9	478	172	153
Zinc dissolved (µg/L)	242	***5.0***	70.0	***5.0***	7.5	8	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	242	***5.0***	730	97.7	140	8	***5.0***	120	36.3	41.3

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00020

Table 16. 2018 Water Chemistry Data for San Juan River at Mexican Hat Bridge

Parameter	1995-2017 N of Cases	Minimum	Maximum	Mean	Standard Dev	2018 N of Cases	Minimum	Maximum	Mean	Standard Dev
Alkalinity (mg/L)	103	70.0	1070	136	95.8	4	81.5	145.0	116.4	27.5
Arsenic dissolved (µg/L)	124	0.25	2.5	1.5	0.8	4	***0.1***	0.9	0.6	0.4
Arsenic total (µg/L)	124	0.25	75.7	6.1	10.1	4	0.7	7.6	3.7	2.9
Calcium dissolved (mg/L)	103	32.7	164	73.7	20.9	4	46.6	80.8	63.8	18.7
Copper dissolved (µg/L)	103	***0.25***	13.0	2.9	2.7	4	0.8	1.2	1.0	0.2
Copper total (µg/L)	103	1.4	255	27.6	42.1	4	1.0	31.5	12.7	13.4
Oxygen dissolved (mg/L)	120	2.5	15.1	9.0	2.1	4	7.4	10.6	8.9	1.7
Conductance (µmhos/cm)	124	269	1452	660	209	4	412	749	577	165
Hardness (mg/L)	103	108	530	259	81.5	4	148	289	214	69.4
Bicarbonate (mg/L)	103	69.0	1070	133	96.0	4	81.5	144	114	26.9
Mercury dissolved (µg/L)	124	***0.1***	***0.1***	***0.1***	0.0	4	***0.1***	***0.1***	***0.1***	0.0
Mercury total (µg/L)	124	***0.1***	4.4	***0.1***	0.4	4	***0.1***	***0.1***	***0.1***	0.0
Magnesium dissolved (mg/L)	103	5.9	43.8	18.3	7.7	4	7.6	21.1	13.2	6.0
Sodium dissolved (mg/L)	80	10.9	113	47.6	19.3	4	20.6	64.7	40.7	19.3
Lead dissolved (µg/L)	124	***0.05***	12.5	0.4	1.1	4	***0.05***	***0.1***	***0.1***	0.0
Lead total (µg/L)	124	0.3	327	23.3	44.4	4	0.4	36.8	12.7	16.6
pH	124	7.0	9.2	8.1	0.3	4	6.8	8.3	7.6	0.8
Redox Potential (mv)	119	40.0	537	351	104	4	111	425	255	150
Selenium dissolved (µg/L)	124	***0.5***	4.0	***0.5***	0.5	4	0.3	1.0	0.6	0.3
Selenium total (µg/L)	124	***0.5***	7.0	1.2	1.0	4	0.3	1.0	0.8	0.3
Selenium total recoverable (µg/L)	83	***0.5***	9.0	1.2	1.3	4	0.6	0.8	0.7	0.1
Total dissolved solids (mg/L)	103	170	1050	459	156	4	268	564	402	146
Temperature (°C)	124	0.1	29.8	12.2	7.8	4	7.5	23.5	14.6	8.1
Total suspended solids (mg/L)	124	***2.5***	18800	1286	2729	4	17.0	566	299	239
Turbidity (NTU)	122	3.0	24700	999	2740	4	4.8	451	254	217
Zinc dissolved (µg/L)	124	***5.0***	100	***5.0***	10.8	4	***5.0***	***5.0***	***5.0***	0.0
Zinc total (µg/L)	124	***5.0***	1620	114	214	4	10.0	250	80.0	114

Note: ***Bold Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00021

Table 17. Annual Sampling Parameters for San Juan River at Archuleta Bridge

Parameter	Sampling Date								
	2/7/2011	2/6/2012	2/4/2013	2/19/2014	2/2/2015	8/13/2015	2/16/2016	2/6/2017	3/6/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***
Aluminum (total) mg/L	*0.33*	*0.18*	*0.42*	*0.88*	*0.47*	*0.10*	*0.84*	*0.61*	*0.33*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Chloride (dissolved) mg/L	*3.0*	*3.0*	*3.0*	*3.0*	*3.2*	*3.1*	*2.9*	*2.9*	*3.0*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.05*	***0.01***	*0.10*	*0.44*	*0.17*	*0.16*	*0.19*	*0.18*	*0.29*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*40.0*	*38.0*	*41.0*	*46.4*	*45.0*	*38.5*	*39.7*	*38.6*	*36.8*

Note**: Bold *Italics*** indicate values are “below method detection limit” and shown at 1/2 the method detection level.

ED_004888_00072948-00022

Table 18. Annual Sampling Parameters for Animas River at Farmington

Parameter	Sampling Date								
	2/7/2011	2/6/2012	2/4/2013	2/19/2014	2/2/2015	8/13/2015	2/16/2016	2/6/2017	3/7/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	*0.09*	*0.04*	***0.015***	***0.015***	***0.015***
Aluminum (total) mg/L	*1.07*	*0.84*	*8.75*	*0.12*	*8.12*	*0.67*	*9.59*	*5.35*	*0.30*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Chloride (dissolved) mg/L	*26.0*	*26.0*	*27.0*	*25.0*	*23.6*	*12.9*	*17.9*	*23.7*	*27.1*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.21*	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.36*	*0.14*	*0.33*	*0.31*	*0.31*	*0.04*	*0.34*	*1.25*	*0.19*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*165*	*173*	*176*	*183*	*162*	*103*	*134*	*173*	*195*

Note: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00023

Table 19. Annual Sampling Parameters for San Juan River at Highway 371 Bridge

Parameter	Sampling Date								
	2/7/2011	2/6/2012	2/4/2013	2/19/2014	2/2/2015	8/10/2015	2/16/2016	2/6/2017	3/7/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	*0.21*	*0.04*	*0.04*	***0.015***	***0.015***
Aluminum (total) mg/L	*1.07*	*1.22*	*4.75*	*1.85*	*18.2*	*11.4*	*11.1*	*6.31*	*1.40*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	*0.013*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*21.0*	*13.0*	*30.0*	*30.0*	*26.1*	*7.6*	*18.4*	*24.8*	*16.4*
Nitrogen as NH_3 mg/L	*2.09*	*0.20*	*1.87*	*1.10*	*1.10*	***0.025***	*0.25*	*0.48*	***0.025***
Nitrogen as NO_3 mg/L	*0.33*	*0.30*	*0.82*	*0.69*	*0.75*	*0.36*	*0.67*	*0.52*	*0.52*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	*0.18*	*0.04*	*0.07*	***0.005***	*0.02*	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*140*	*119*	*177*	*177*	*165*	*71.2*	*143*	*170*	*141*

Note: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00024

Table 20. Annual Sampling Parameters for La Plata River at Mouth

Parameter	Sampling Date								
	2/7/2011	2/6/2012	2/4/2013	2/19/2014	2/4/2015	8/11/2015	2/16/2016	2/9/2017	3/6/2018
Aluminum (dissolved) mg/L	***0.015***	*0.04*	*-8888*	***0.015***	*-8888*	***0.015***	*0.040*	*0.050*	*0.080*
Aluminum (total) mg/L	*3.47*	*15.4*	*-8888*	*2.79*	*-8888*	*0.40*	*176.0*	*60.9*	*1.68*
Nickel (dissolved) mg/L	***0.005***	***0.005***	*-8888*	***0.004***	*-8888*	***0.004***	***0.004***	***0.004***	*0.009*
Nickel (total) mg/L	***0.005***	***0.005***	*-8888*	***0.004***	*-8888*	***0.004***	*0.049*	*0.013*	***0.004***
Chloride (dissolved) mg/L	*48*	*73*	*-8888*	*150*	*-8888*	*277*	*48.2*	*58.0*	*177*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*-8888*	***0.025***	*-8888*	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.350*	*0.1*	*-8888*	*0.120*	*-8888*	*0.040*	*0.250*	*0.540*	*0.070*
Nitrogen as NO_2 mg/L	0.020	***0.005***	*-8888*	***0.005***	*-8888*	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*680*	*1020*	*-8888*	*1660*	*-8888*	*2180*	*673*	*946*	*2150*

Note**: Bold *Italics*** indicate values are “below method detection limit” and shown at 1/2 the method detection level.

ED_004888_00072948-00025

Table 21. Annual Sampling Parameters for San Juan River at Shiprock Bridge

Parameter	Sampling Date								
	2/7/2011	2/6/2012	2/4/2013	2/19/2014	2/4/2015	8/10/2015	2/18/2016	2/9/2017	3/6/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	*0.30*	***0.015***	***0.015***	***0.015***	***0.015***
Aluminum (total) mg/L	*1.77*	*0.915*	*15.95*	*2.375*	*182*	*135*	*36.75*	*17.10*	*0.59*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	*0.011*
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	*0.055*	*0.050*	*0.013*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*16.0*	*17.5*	*22.0*	*20.0*	*18.0*	*7.7*	*14.7*	*17.0*	*19.3*
Nitrogen as NH_3 mg/L	*0.165*	*0.090*	*0.310*	***0.025***	*0.075*	***0.025***	***0.025***	*0.070*	***0.025***
Nitrogen as NO_3 mg/L	*0.555*	*0.380*	*1.930*	*0.630*	*0.980*	*0.350*	*0.675*	*0.925*	*0.355*
Nitrogen as NO_2 mg/L	***0.005***	0.02	***0.005***	***0.005***	*0.02*	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*145.0*	*146.5*	*189.0*	*187.0*	*172.0*	*83.3*	*133.0*	*159.5*	*161.5*

Notes: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level. This site has blind replicate samples for lab QA/QC. Replicate samples are averaged into a single value for each date. If one of the values is below detection and the other is above detection, the above detection value is used if it less than two times the method detection level otherwise the method detection level is used.

ED_004888_00072948-00026

Table 22. Annual Sampling Parameters for Mancos River near Four Corners

Parameter	Sampling Date								
	2/9/2011	2/7/2012	2/5/2013	2/20/2014	2/3/2015	8/11/2015	2/17/2016	2/7/2017	3/5/2018
Aluminum (dissolved) mg/L	***0.015***	*0.04*	***0.015***	***0.015***	***0.015***	*0.09*	***0.015***	***0.015***	*0.04*
Aluminum (total) mg/L	*1.38*	*4.68*	*8.29*	*0.95*	*2.96*	*34.5*	*21.9*	*14.2*	*0.45*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	*0.009*
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	*0.021*	*0.021*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*18.0*	*27.0*	*29.0*	*24.0*	*27.8*	*9.7*	*21.1*	*57.1*	*27.5*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.14*	***0.025***	***0.025***	***0.025***	*0.05*	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.93*	*1.71*	*0.61*	*0.61*	*1.78*	*1.10*	*0.72*	*3.02*	*0.32*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*900*	*1000*	*1160*	*901*	*944*	*300*	*788*	*1420*	*1150*

Note: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

ED_004888_00072948-00027

Table 23. Annual Sampling Parameters for San Juan River at Four Corners Bridge

Parameter	Sampling Date								
	2/9/2011	2/7/2012	2/5/2013	2/20/2014	2/4/2015	8/10/2015	2/18/2016	2/9/2017	3/6/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	***0.015***	*0.06*	***0.015***	***0.015***	***0.015***
Aluminum (total) mg/L	*0.93*	*0.50*	*19.0*	*1.10*	*208*	*104*	*83.8*	*27.8*	*0.28*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	*0.010*
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	*0.060*	*0.050*	*0.034*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*14.0*	*19.0*	*23.0*	*21.0*	*17.6*	*8.7*	*15.2*	*18.3*	*20.4*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.260*	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.57*	*0.30*	*0.77*	*0.59*	*1.14*	*0.47*	*0.70*	*0.95*	*0.16*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*180*	*165*	*210*	*199*	*189*	*88.9*	*175*	*231*	*190*

Note: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

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Table 24. Annual Sampling Parameters for San Juan River at Montezuma Creek Bridge

	Sampling Date								
Parameter	**2/9/2011**	**2/7/2012**	**2/5/2013**	**2/20/2014**	**2/3/2015**	**8/11/2015**	**2/17/2016**	**2/7/2017**	**3/5/2018**
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	*0.08*	*0.24*	*0.09*	*0.04*	***0.015***
Aluminum (total) mg/L	*1.44*	*1.26*	*33.4*	*0.69*	*221*	*124*	*100*	*18.2*	*0.33*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	*0.070*	*0.050*	*0.041*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*16.0*	*21.0*	*28.0*	*24.0*	*23.2*	*8.7*	*17.2*	*25.0*	*25.6*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.200*	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.50*	*0.33*	*0.90*	*0.56*	*1.12*	*0.42*	*1.07*	*1.20*	*0.34*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*230*	*210*	*330*	*260*	*274*	*95.2*	*249*	*336*	*227*

Note**: Bold *Italics*** indicate values are “below method detection limit” and shown at 1/2 the method detection level.

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Table 25. Annual Sampling Parameters for San Juan River at Bluff Bridge

	Sampling Date								
Parameter	**2/9/2011**	**2/7/2012**	**2/5/2013**	**2/20/2014**	**2/3/2015**	**8/11/2015**	**2/17/2016**	**2/7/2017**	**3/5/2018**
Aluminum (dissolved) mg/L	***0.015***	*0.05*	***0.015***	***0.015***	*0.13*	*0.05*	***0.015***	***0.015***	***0.015***
Aluminum (total) mg/L	*1.275*	*1.340*	*33.3*	*0.710*	*347*	*104*	*135*	*16.7*	*0.53*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	*0.008*
Nickel (total) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	*0.115*	*0.041*	*0.054*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*16.0*	*20.0*	*30.0*	*23.0*	*24.2*	*9.5*	*18.3*	*23.4*	*25.0*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.19*	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.60*	*0.32*	*0.97*	*0.335*	*1.26*	*0.50*	*0.745*	*1.15*	*0.31*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	*0.02*	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*235.0*	*215.0*	*340.0*	*252.0*	*306.5*	*100.0*	*257.5*	*301.5*	*236.0*

Notes: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level. This site has blind replicate samples for lab QA/QC. Replicate samples are averaged into a single value for each date. If one of the values is below detection and the other is above detection, the above detection value is used if it less than two times the method detection level otherwise the method detection level is used.

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Table 26. Annual Sampling Parameters for San Juan River at Mexican Hat Bridge

Parameter	Sampling Date								
	2/9/2011	2/7/2012	2/5/2013	2/20/2014	2/3/2015	8/10/2015	2/17/2016	2/7/2017	3/5/2018
Aluminum (dissolved) mg/L	***0.015***	***0.015***	***0.015***	***0.015***	*0.04*	*0.08*	*0.42*	***0.015***	*0.04*
Aluminum (total) mg/L	*1.29*	*2.99*	*97.5*	*1.08*	*159*	*263*	*135*	*24.0*	*0.67*
Nickel (dissolved) mg/L	***0.005***	***0.005***	***0.005***	***0.004***	***0.004***	***0.004***	***0.004***	***0.004***	*0.009*
Nickel (total) mg/L	***0.005***	***0.005***	*0.030*	***0.004***	*0.080*	*0.140*	*0.054*	***0.004***	***0.004***
Chloride (dissolved) mg/L	*15.0*	*20.0*	*29.0*	*25.0*	*24.4*	*9.7*	*18.3*	*22.8*	*25.2*
Nitrogen as NH_3 mg/L	***0.025***	***0.025***	*0.150*	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***	***0.025***
Nitrogen as NO_3 mg/L	*0.59*	*0.35*	*0.88*	*0.43*	*0.93*	*0.50*	*0.89*	*1.02*	*0.22*
Nitrogen as NO_2 mg/L	***0.005***	***0.005***	*0.020*	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***	***0.005***
Sulfate (dissolved) mg/L	*220*	*220*	*300*	*265*	*259*	*112*	*236*	*289*	*232*

Note: **Bold *Italics*** indicate values are "below method detection limit" and shown at 1/2 the method detection level.

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The MDL's reported in Tables 2 and 3 represent the minimum concentration of each parameter that can be measured and reported with 99% confidence that the constituent concentration is greater than zero. The PQL's are established by the lab and are typically 2 to 10 times the MDL. The PQL is the lowest concentration that can be quantified with statistical rigor. When lab results are between the MDL and PQL, the constituent concentration is detected but only broadly estimated, not quantified. These values are reported, but understanding that the concentration is only an estimate and an indication of the constituent's presence between the MDL and PQL.

There were no 2018 anomalies outside the historical data in the mainstem San Juan River water quality data. However, impacts to tributaries were significant in flows and water quality. There were several locations and monitoring events where water quality parameters exceeded the BIA historical record, including:

- Animas River at Farmington-Miller Bridge. The August monitoring event exceeded historical water quality maximum readings for total dissolved solids (TDS) and temperature.
- La Plata River near Farmington. The May monitoring data exceeds historical data in conductance, dissolved magnesium, dissolved sodium, and TDS. The November data also exceeded the pre-2018 maximum readings in conductance, dissolved sodium, and TDS.
- Mancos River near Four Corners. The May water quality data exceeds historical data in conductance, hardness, dissolved magnesium, dissolved sodium, and TDS.

These elevated tributary concentrations are primarily due to drought induced low-flows. The high hardness and TDS concentrations could be indicative of significant groundwater contributions in in samples collected.

Annual mean dissolved selenium concentrations are shown in Figures 2 through 11. The Mancos River near Four Corners is the only site with annual mean values consistently above the pre-2010 method detection limit. Figure 7 shows the 2018 Mancos River average annual selenium concentration of 14.8 µg/L and is the highest in the 1997 through 2018 record. The Mancos River was dry during the August and November sample events. Selenium concentrations have historically been elevated and highly variable (Figure 7). The 2018 Mancos selenium concentrations were also highly variable, ranging between 5.1 µg/L (March) and 24.5 µg/L (May). As was previously mentioned, there is no impact on the Mancos River water quality from the Navajo Indian Irrigation Project.

The complete 2018 water quality data set is contained in Appendix A. The data qualifiers "-9999" and "-8888" indicate missing data or that the sample site is dry, respectively. There were no "-9999" qualifiers used in the 2018 data. The "-8888" or dry qualifier was used in the Mancos and LaPlata River data. The LaPlata sample site was dry on August 6 (Table A-4) and the Mancos River site was dry on the August 8 and November 7 sampling events (Table A-6).

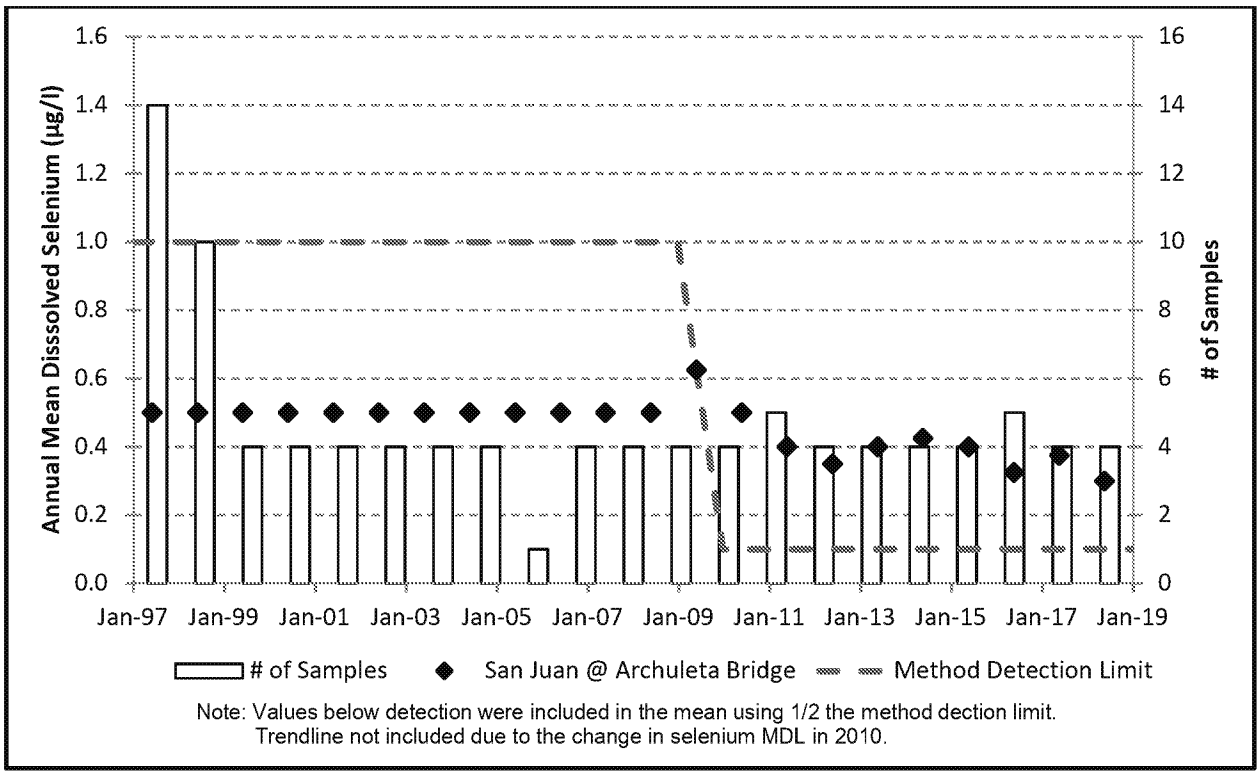

Figure 2. Mean Annual Dissolved Selenium Concentrations - San Juan River at Archuleta Bridge

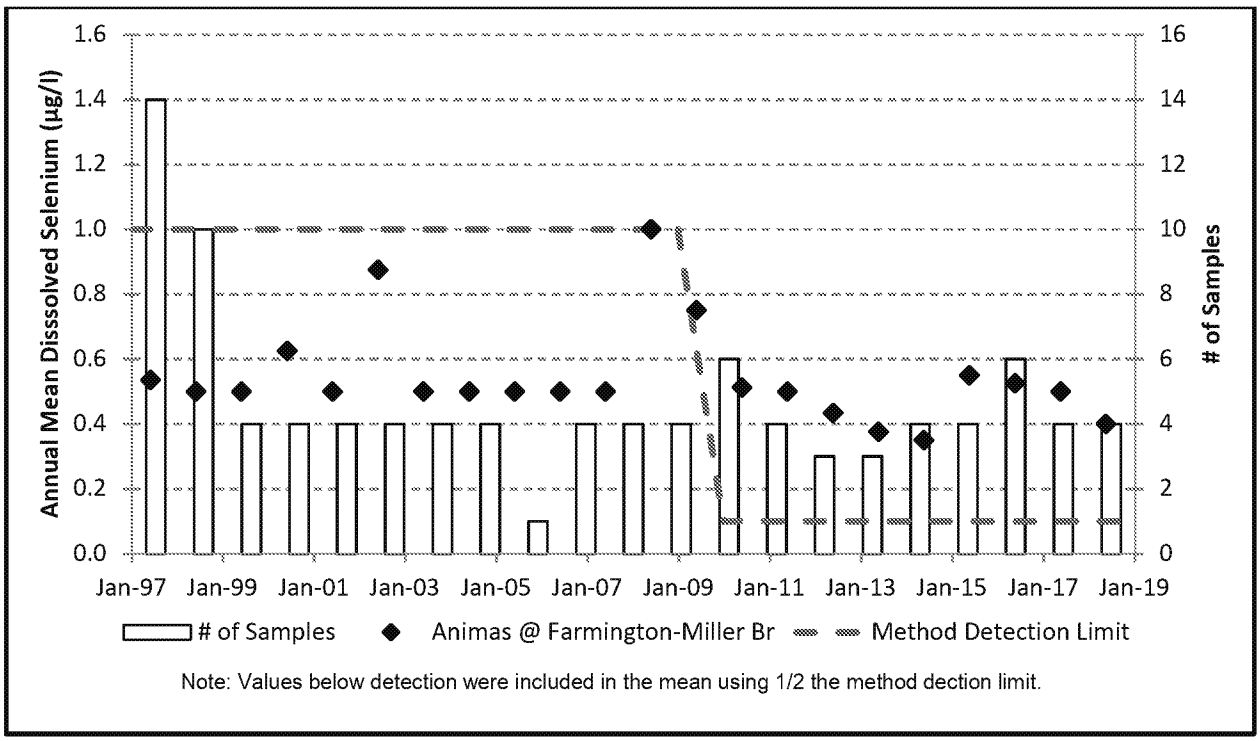

Figure 3. Mean Annual Dissolved Selenium Concentrations - Animas River at Farmington-Miller Bridge

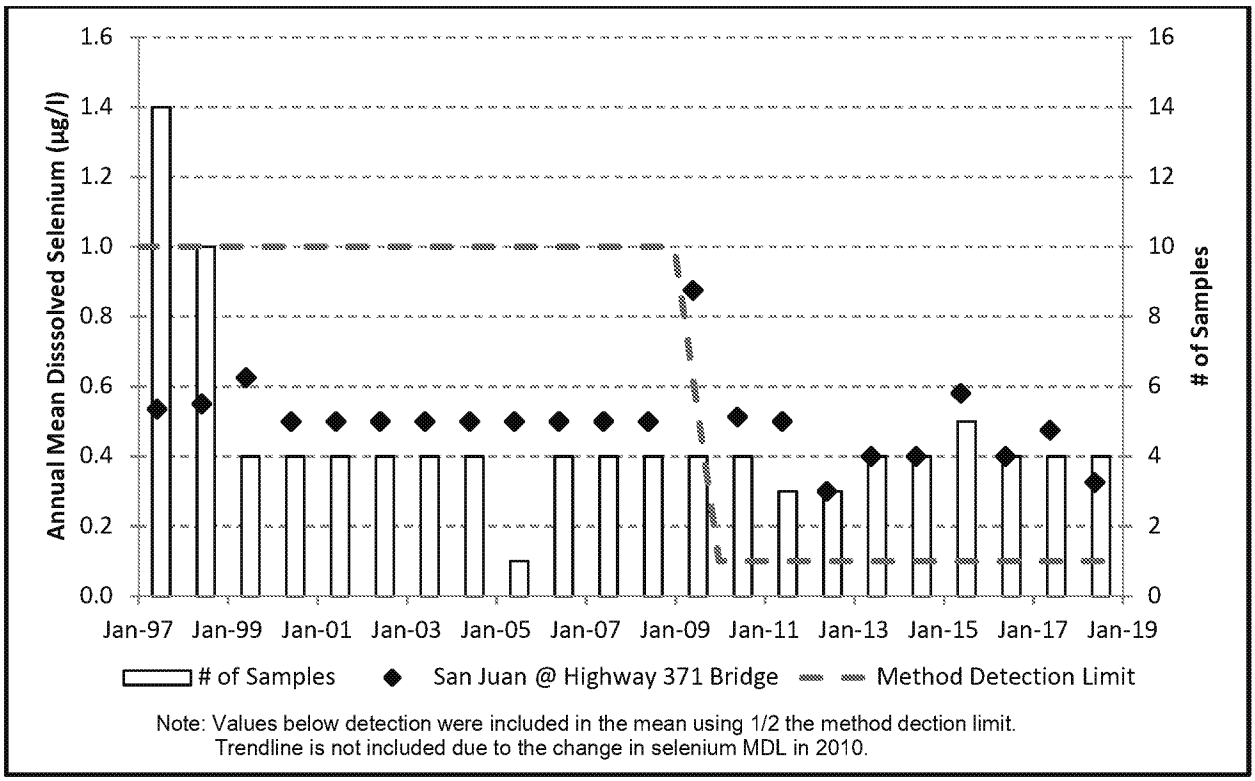

Figure 4. Mean Annual Dissolved Selenium Concentrations – San Juan River at Highway 371 Bridge

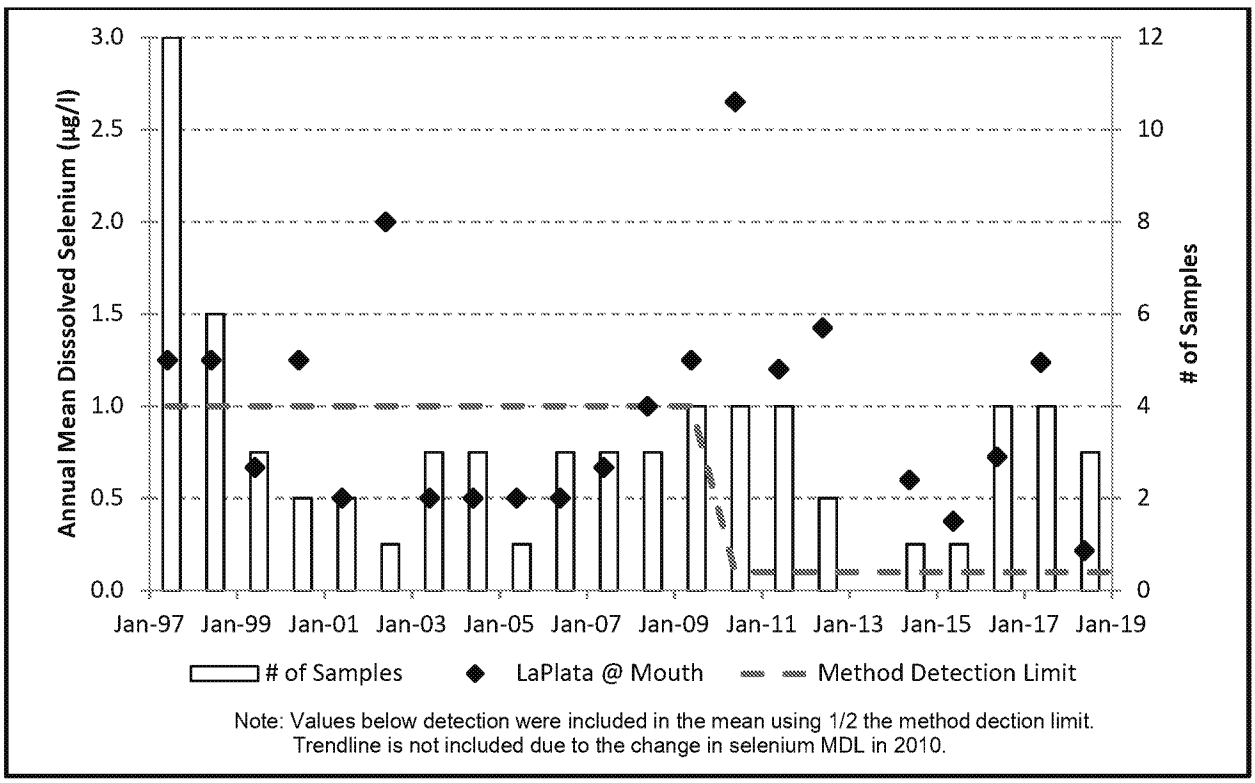

Figure 5. Mean Annual Dissolved Selenium Concentrations – La Plata River at Mouth

ED_004888_00072948-00034

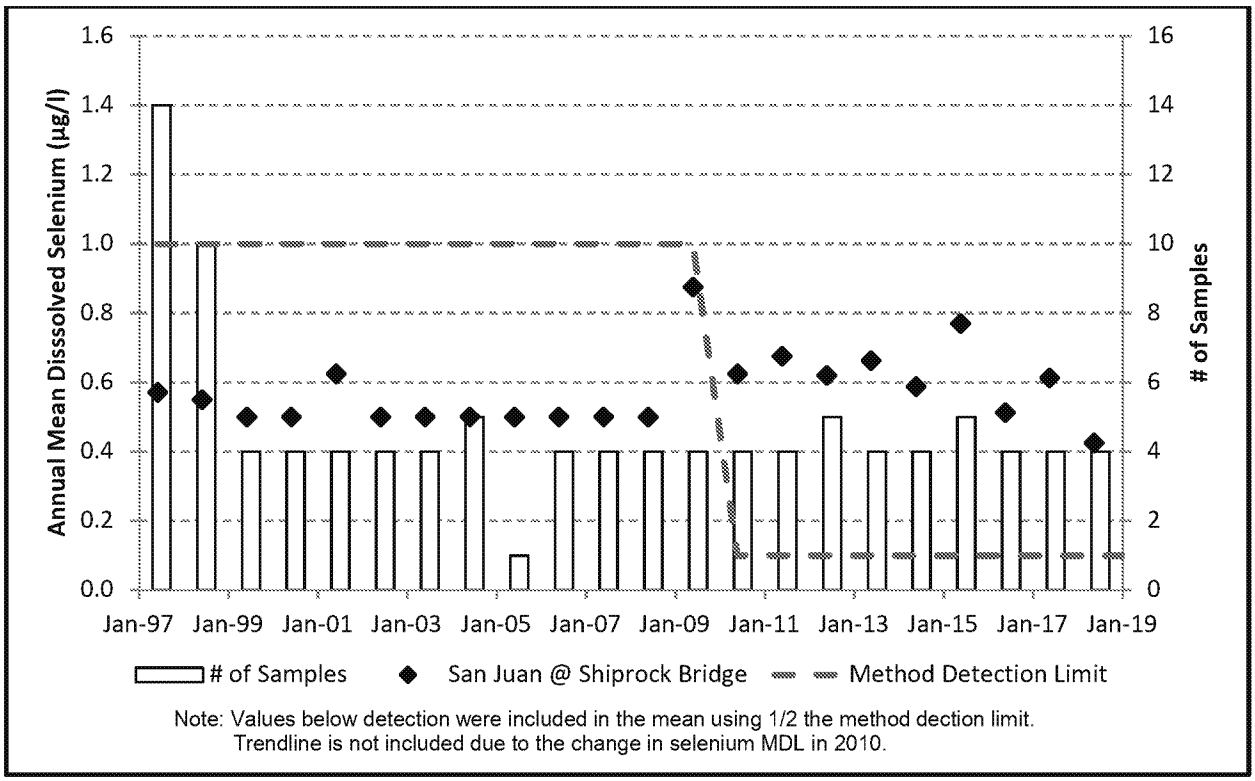

Figure 6. Mean Annual Dissolved Selenium Concentrations – San Juan River at Shiprock Bridge

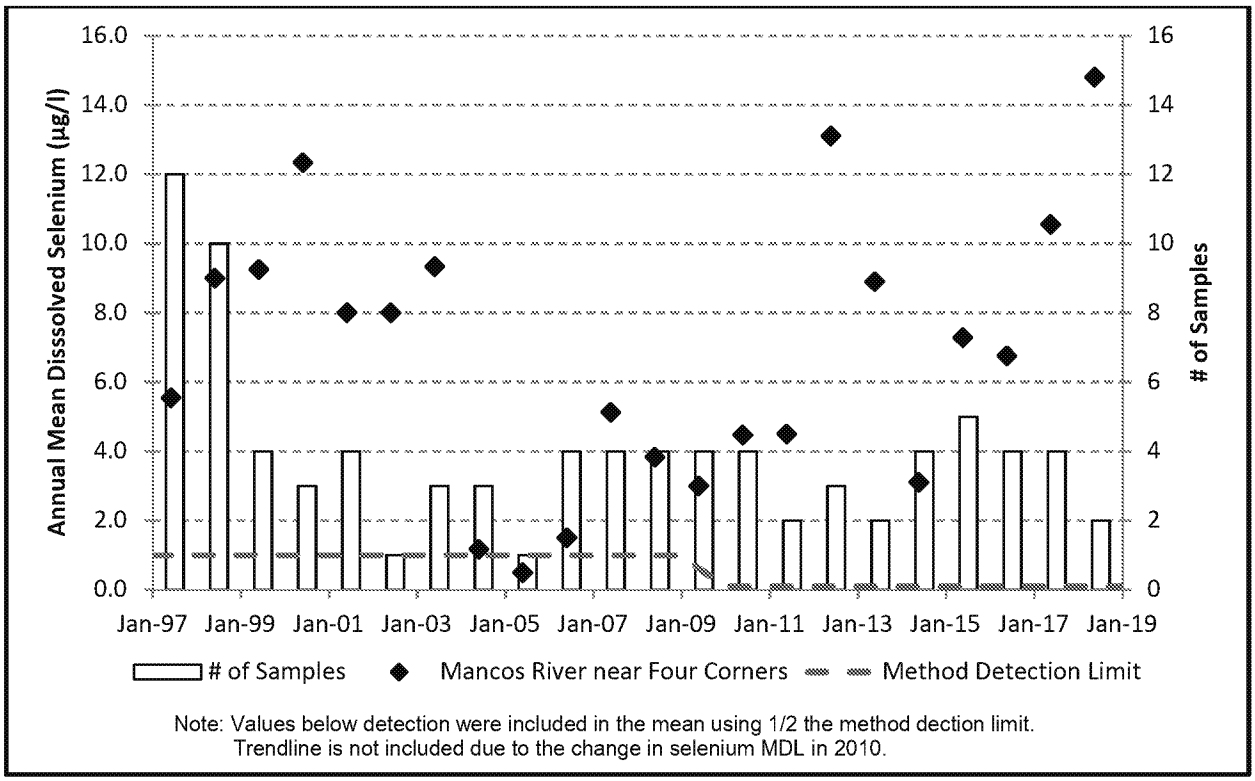

Figure 7. Mean Annual Dissolved Selenium Concentrations – Mancos River near Four Corners

ED_004888_00072948-00035

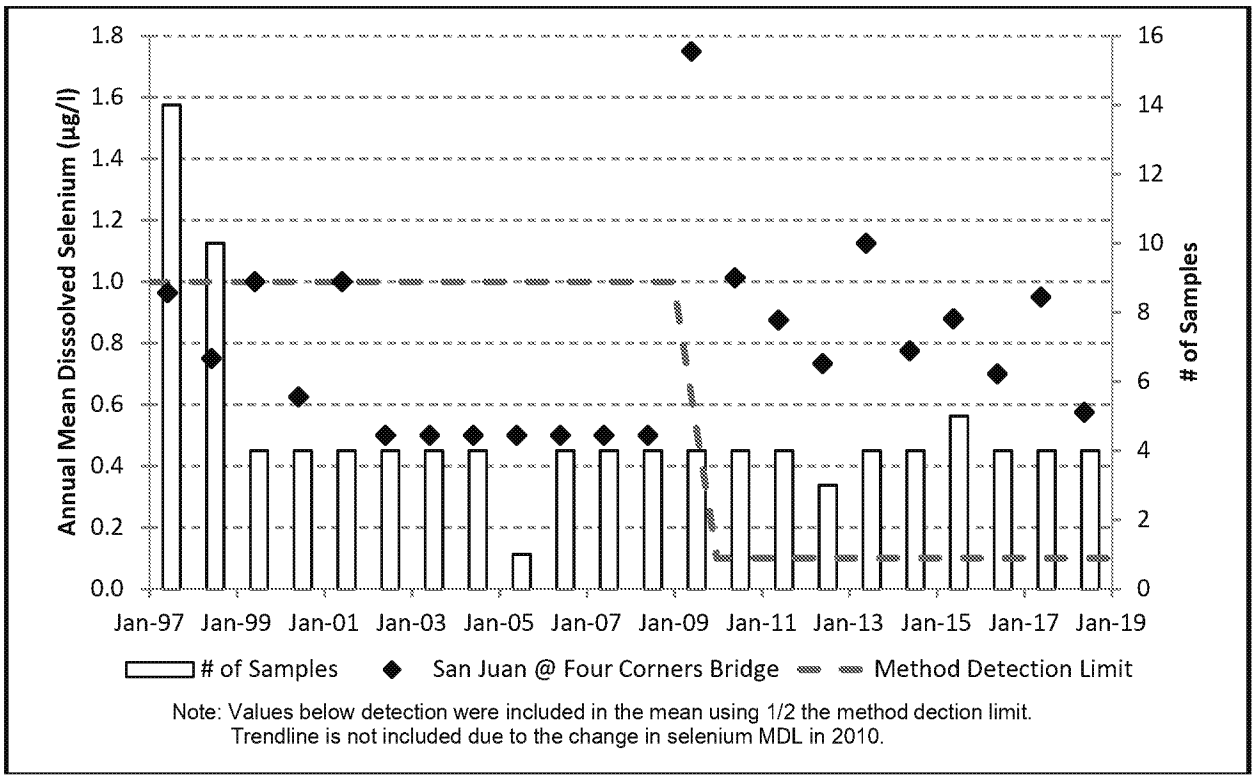

Figure 8. Mean Annual Dissolved Selenium Concentrations – San Juan River at Four Corners Bridge

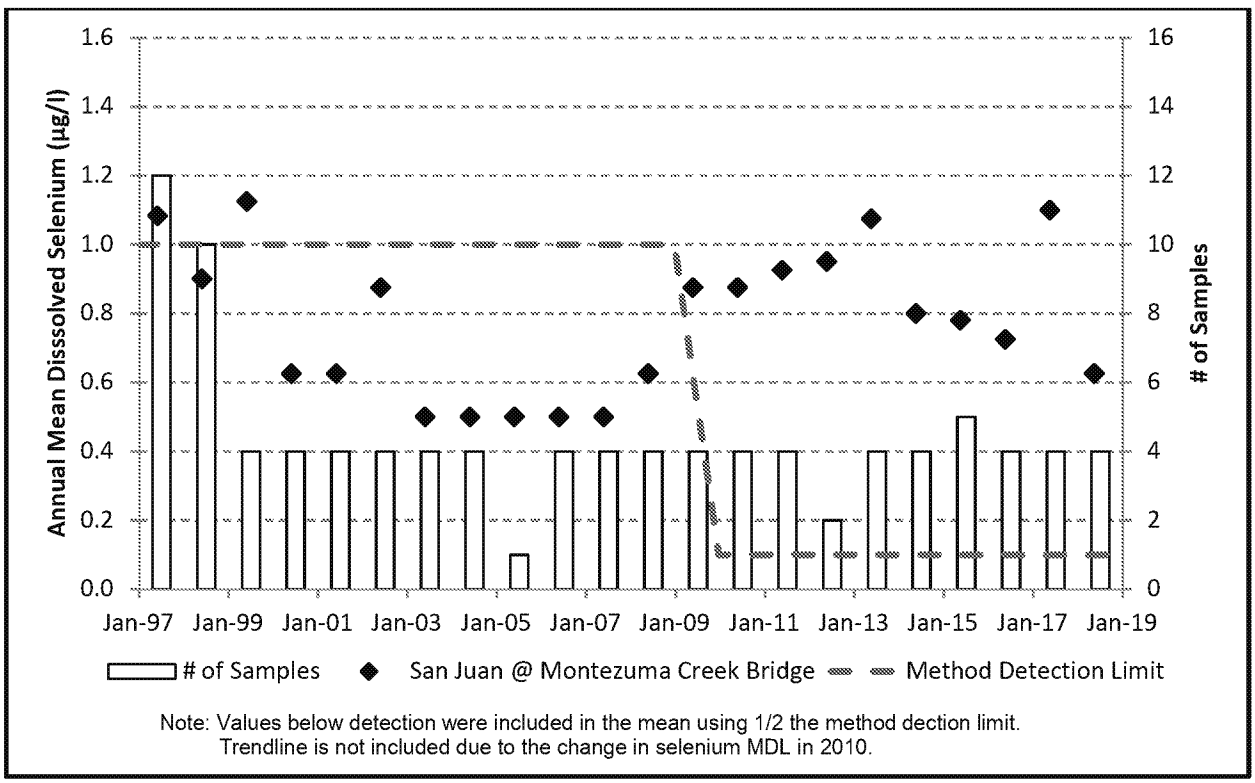

Figure 9. Mean Annual Dissolved Selenium Concentrations – San Juan River at Montezuma Creek Bridge

ED_004888_00072948-00036

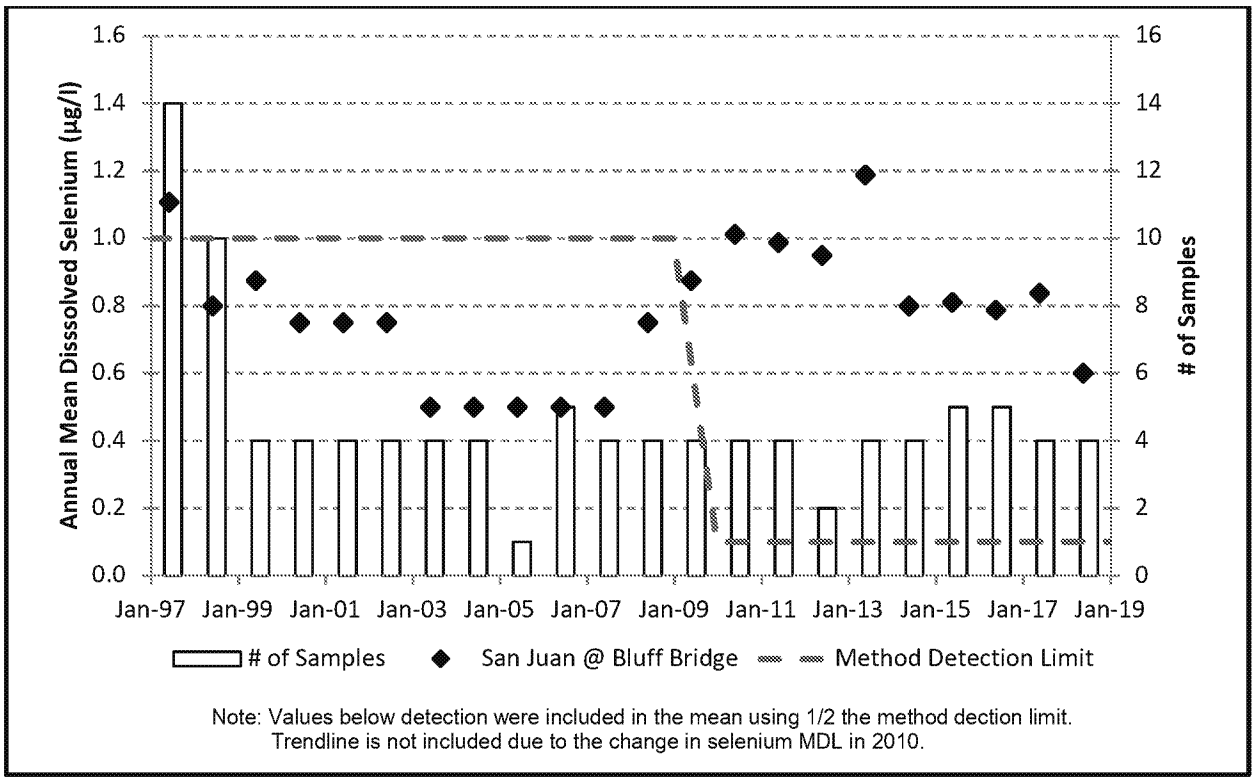

Figure 10. Mean Annual Dissolved Selenium Concentrations – San Juan River at Bluff Bridge

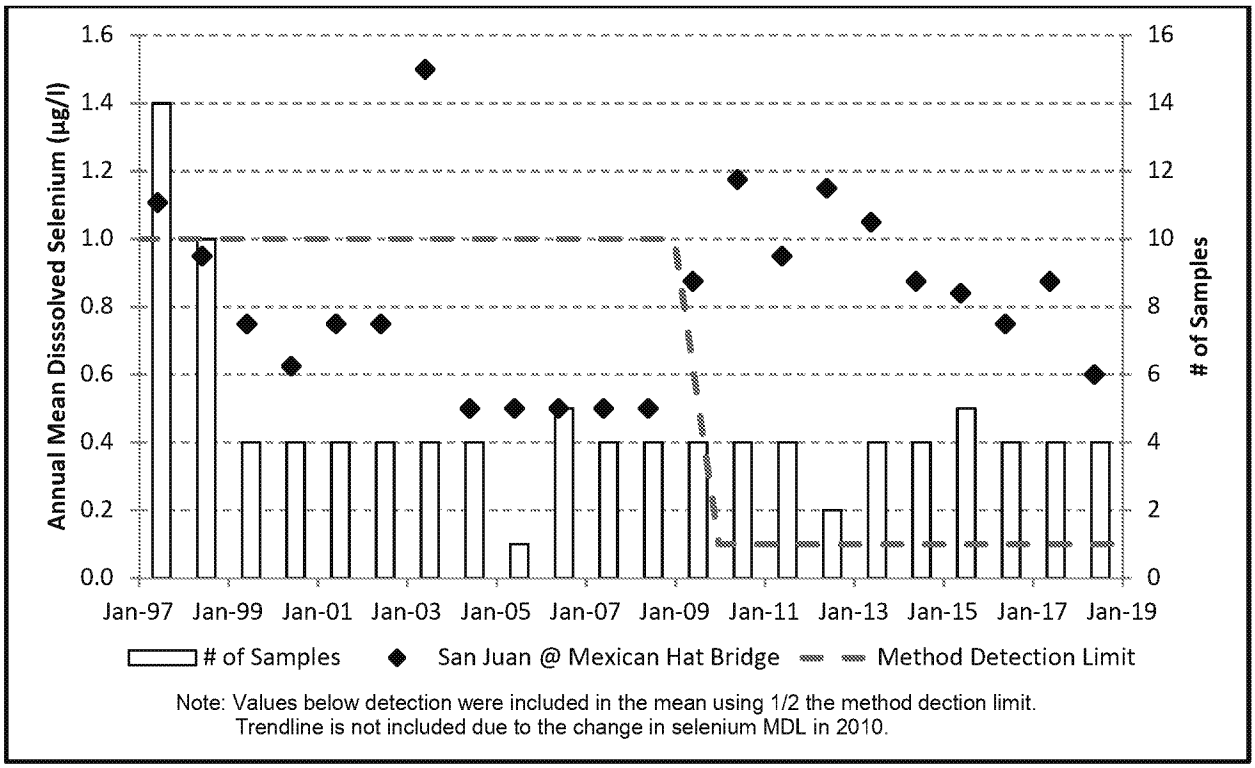

Figure 11. Mean Annual Dissolved Selenium Concentrations – San Juan River at Mexican Hat Bridge

ED_004888_00072948-00037

CONCLUSION

The San Juan River basin experienced one of the driest years on record in 2018. The drought caused lower than average flows throughout the basin and the tributaries were hit particularly hard. The Animas River was reduced to a trickle in July and the Mancos and LaPlata Rivers were dry during significant portions of the summer and fall months. These lower flows led to higher than average constituent concentrations for some parameters. Baseflows of approximately 500 cfs were maintained below Farmington by releasing water from Navajo Reservoir which is typical even in good water years.

The 2018 mainstem San Juan River water quality data has no anomalies outside BIA's historical water quality record. The tributaries' 2018 water quality were more significantly impacted due to low flows during the summer and fall months. In 2018, the dissolved selenium readings on the main stem of the San Juan River and its tributaries continue to be well below the EPA recommended chronic criterion (5 µg/L, Figures 2 through 11). The only exception being the Mancos River where selenium concentrations have historically been elevated. This tributary's selenium concentrations continue to be highly variable from year to year (Figure 7) and even from one sample to the next.

Other tributary samples collected in 2018 exceeded BIA's historical water quality record for some parameters. The exceedances included TDS, conductance, dissolved magnesium, hardness, and dissolved sodium. The Animas River water quality also has the potential to be impacted by the large 416 Fire near Durango. These potential impacts should be monitored closely in the spring and summer months of 2019.

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APPENDIX A
2018 Water Quality Sampling Data Tables

ED_004888_00072948-00039

Appendix Table A-1. 2018 San Juan River at Archuleta Bridge

Analysis	Units	3/6/2018	5/16/2018	8/6/2018	11/5/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	0.33			
Alkalinity	mg/L	77.3	77.6	76.0	92.5
As_diss	mg/L	0.0003	0.0004	0.0005	0.0006
As_total	mg/L	0.0008	0.0007	0.0007	0.0006
Ca_diss	mg/L	28.0	28.2	26.2	27.1
Chloride	mg/L	3.0			
CO3_as_CaCO3	mg/L	6.5	-2.0	-2.0	-2.0
Cu_diss	mg/L	0.0008	0.0007	0.0008	0.0008
Cu_total	mg/L	0.0013	0.0008	0.0008	0.0009
Diss_O2	mg/L	13.10	8.45	9.83	11.43
EC_field	dS/m	0.208	0.206	0.220	0.226
Hardness_as_CaCO3	mg/L	91	91	85	88
HCO3_as_CaCO3	mg/L	70.7	77.6	76.0	92.5
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	5.1	5.1	4.7	4.9
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.29			
N_as_NO3NO2	mg/L	0.29			
Na_diss	mg/L	13.1	12.7	11.3	12.0
Ni_diss	mg/L	-0.008			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2	-2	-2	-2
Pb_diss	mg/L	-0.0001	-0.0001	-0.0001	-0.0001
Pb_total	mg/L	0.0002	-0.0001	-0.0001	-0.0001
pH_field		8.73	6.66	7.66	8.13
Redox	mV	340	414	171	139
Se_diss	mg/L	0.0002	0.0003	0.0004	0.0003
Se_total	mg/L	0.0004	0.0003	0.0003	0.0003
Se_Trec	mg/L	0.0003	0.0003	0.0003	0.0002
SO4	mg/L	36.8			
TDS_at_180C	mg/L	162	148	142	156
TDS_calc		134			
TDS_ratio		1.21			
Temp	°C	7.26	9.99	7.72	5.68
TSS_at_103_5C	mg/L	-5	5	-5	-5
Turbidity	NTU	7.3	3.7	1.4	2.1
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.01	-0.01	-0.01	-0.01

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Appendix Table A-2. 2018 Animas River at Farmington

Analysis	Units	3/7/2018	5/16/2018	8/6/2018	11/5/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	0.30			
Alkalinity	mg/L	155	74	171	172
As_diss	mg/L	-0.0002	-0.0002	0.0007	0.0004
As_total	mg/L	0.0005	0.0012	0.0009	0.0007
Ca_diss	mg/L	103	47.4	110	94.7
Chloride	mg/L	27.1			
CO3_as_CaCO3	mg/L	7.6	-2.0	7.9	-2.0
Cu_diss	mg/L	0.0008	0.0007	0.0008	-0.0008
Cu_total	mg/L	0.0018	0.0056	0.0011	0.0016
Diss_O2	mg/L	10.21	8.26	8.30	9.69
EC_field	dS/m	0.693	0.342	0.890	0.690
Hardness_as_CaCO3	mg/L	321	143	345	293
HCO3_as_CaCO3	mg/L	148	74	163	172
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	15.5	6.1	17.2	13.8
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.19			
N_as_NO3NO2	mg/L	0.19			
Na_diss	mg/L	36.4	11.8	50.0	31.1
Ni_diss	mg/L	-0.01			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2	-2	-2	-2
Pb_diss	mg/L	-0.0001	0.0003	0.0002	-0.0001
Pb_total	mg/L	0.0007	0.0083	0.0007	0.0019
pH_field		8.24	6.76	8.20	8.43
Redox	mV	361	442	150	124
Se_diss	mg/L	0.0007	0.0002	0.0004	0.0003
Se_total	mg/L	0.0006	0.0003	0.0005	0.0003
Se_Trec	mg/L	0.0005	0.0003	0.0004	0.0004
SO4	mg/L	195			
TDS_at_180C	mg/L	502	216	594	474
TDS_calc		473			
TDS_ratio		1.06			
Temp	°C	7.66	15.34	28.05	10.82
TSS_at_103_5C	mg/L	22	103	-5	33
Turbidity	NTU	5.6	56.1	3.5	21.7
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.01	0.07	-0.01	-0.01

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Appendix Table A-3. 2018 San Juan River at Farmington Bridge

Analysis	Units	3/7/2018	5/17/2018	8/6/2018	11/5/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	1.40			
Alkalinity	mg/L	119	78	85	131
As_diss	mg/L	0.0003	0.0004	0.0005	0.0005
As_total	mg/L	0.0009	0.0013	0.0013	0.0010
Ca_diss	mg/L	67.4	49.6	35.5	70.7
Chloride	mg/L	16.4			
CO3_as_CaCO3	mg/L	5.0	-2.0	-2.0	2.4
Cu_diss	mg/L	0.0008	0.0008	0.0010	-0.0008
Cu_total	mg/L	0.0027	0.0076	0.0032	0.0020
Diss_O2	mg/L	10.33	8.14	8.36	9.80
EC_field	dS/m	0.654	0.398	0.404	0.690
Hardness_as_CaCO3	mg/L	211	152	113	220
HCO3_as_CaCO3	mg/L	114	78	85	129
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	10.4	6.9	5.8	10.5
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	0.01			
N_as_NO3	mg/L	0.52			
N_as_NO3NO2	mg/L	0.53			
Na_diss	mg/L	37.5	17.7	18.2	33.3
Ni_diss	mg/L	-0.01			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	0.0008	-0.0001	-0.0001
Pb_total	mg/L	0.0010	0.0099	0.0026	0.0024
pH_field		8.02	6.56	8.06	8.34
Redox	mV	342	463	139	124
Se_diss	mg/L	0.0005	0.0002	0.0003	0.0003
Se_total	mg/L	0.0005	0.0003	0.0004	0.0003
Se_Trec	mg/L	0.0005	0.0003	0.0003	0.0004
SO4	mg/L	141			
TDS_at_180C	mg/L	372	242	204	400
TDS_calc		348			
TDS_ratio		1.07			
Temp	°C	8.49		20.0	10.9
TSS_at_103_5C	mg/L	74	82	124	46
Turbidity	NTU	17.8	41.9	38.7	35.6
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	0.01	0.09	0.02	-0.01

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Appendix Table A-4. 2018 La Plata River near Farmington

Analysis	Units	3/6/2018	5/16/2018	8/6/2018	11/5/2018
Al_diss	mg/L	0.080			
Al_total	mg/L	1.7			
Alkalinity	mg/L	330	397		416
As_diss	mg/L	-0.0004	-0.0010		0.0006
As_total	mg/L	0.0008	-0.0010		0.0010
Ca_diss	mg/L	365	443		464
Chloride	mg/L	177.0			
CO3_as_CaCO3	mg/L	-2.0	10.1		-2.0
Cu_diss	mg/L	0.0009	-0.0020		0.0010
Cu_total	mg/L	0.0021	-0.0020		0.0050
Diss_O2	mg/L	9.07	6.26	-8888	10.32
EC_field	dS/m	4.178	6.503	-8888	6.198
Hardness_as_CaCO3	mg/L	1580	2020		1960
HCO3_as_CaCO3	mg/L	330	387		416
Hg_diss	mg/L	-0.0002	-0.0002		-0.0002
Hg_total	mg/L	-0.0002	-0.0002		-0.0002
Mg_diss	mg/L	163	222		195
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.07			
N_as_NO3NO2	mg/L	0.07			
Na_diss	mg/L	599	915		891
Ni_diss	mg/L	0.01			
Ni_total	mg/L	-0.020			
OH_as_CaCO3	mg/L	-2.0	-2.0		-2.0
Pb_diss	mg/L	-0.0002	-0.0005		-0.0001
Pb_total	mg/L	0.0007	-0.0005		-0.0005
pH_field		7.94	6.60	-8888	7.75
Redox	mV	336	450	-8888	157
Se_diss	mg/L	0.000	-0.0005		0.0002
Se_total	mg/L	0.001	-0.0005		-0.0005
Se_Trec	mg/L	0.000	-0.0005		-0.0005
SO4	mg/L	2150			
TDS_at_180C	mg/L	3910	5460		5800
TDS_calc					
TDS_ratio		1.07			
Temp	°C	8.73	30.03	-8888	16.65
TSS_at_103_5C	mg/L	62	9		14
Turbidity	NTU	48.4	1.3		7.0
Zn_diss	mg/L	-0.01	-0.01		-0.05
Zn_total	mg/L	-0.02	-0.05		-0.05

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Appendix Table A-5. 2018 San Juan River at Shiprock Bridge

Analysis	Units	3/6/2018	5/16/2018	8/6/2018	11/5/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	0.6			
Alkalinity	mg/L	123.5	88.8	95	140
As_diss	mg/L	0.0003	0.0005	0.00065	0.0006
As_total	mg/L	0.0010	0.0021	0.0020	0.0022
Ca_diss	mg/L	69.45	50.85	41.2	72.9
Chloride	mg/L	19.3			
CO3_as_CaCO3	mg/L	5.6	-2.0	7.3	5.3
Cu_diss	mg/L	0.0006	0.00060	0.00110	-0.0008
Cu_total	mg/L	0.0018	0.0084	0.0040	0.0058
Diss_O2	mg/L	13.14	7.76	9.43	9.94
EC_field	dS/m	0.568	0.434	0.380	0.619
Hardness_as_CaCO3	mg/L	225	158	133	229
HCO3_as_CaCO3	mg/L	118	88	88	135
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	12.4	7.55	7.2	11.4
N_as_NH3	mg/L	-0.050			
N_as_NO2	mg/L	-0.010			
N_as_NO3	mg/L	0.355			
N_as_NO3NO2	mg/L	0.355			
Na_diss	mg/L	46.0	23.9	23.6	40.0
Ni_diss	mg/L	0.01			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	0.0002	-0.0001	0.0001
Pb_total	mg/L	0.0006	0.0124	0.0055	0.0071
pH_field		8.47	6.75	8.51	7.99
Redox	mV	352	442	141	160
Se_diss	mg/L	0.0005	0.0003	0.0004	0.0005
Se_total	mg/L	0.0007	0.0004	0.0006	0.0005
Se_Trec	mg/L	0.0005	0.0004	0.0004	0.0005
SO4	mg/L	162			
TDS_at_180C	mg/L	423	271	239	486
TDS_calc		386			
TDS_ratio		1.10			
Temp	°C	4.77	18.98	22.64	9.25
TSS_at_103_5C	mg/L	25	221	122	181
Turbidity	NTU	8.9	100	61.5	143
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.01	0.08	0.02	0.01

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Appendix Table A-6. 2018 Mancos River near Four Corners

Analysis	Units	3/5/2018	5/15/2018	8/8/2018	11/7/2018
Al_diss	mg/L	0.040			
Al_total	mg/L	0.45			
Alkalinity	mg/L	221	196		
As_diss	mg/L	-0.0004	-0.0010		
As_total	mg/L	0.0005	-0.0010		
Ca_diss	mg/L	215	285		
Chloride	mg/L	27.5			
CO3_as_CaCO3	mg/L	9.7	5.7		
Cu_diss	mg/L	0.0011	0.0030		
Cu_total	mg/L	0.0009	0.0020		
Diss_O2	mg/L	11.64	11.09	-8888	-8888
EC_field	dS/m	2.184	4.833	-8888	-8888
Hardness_as_CaCO3	mg/L	1150	1930		
HCO3_as_CaCO3	mg/L	211	190		
Hg_diss	mg/L	-0.0002	-0.0002		
Hg_total	mg/L	-0.0002	-0.0002		
Mg_diss	mg/L	149	297		
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.32			
N_as_NO3NO2	mg/L	0.32			
Na_diss	mg/L	180	509		
Ni_diss	mg/L	0.009			
Ni_total	mg/L	-0.020			
OH_as_CaCO3	mg/L	-2.0	-2.0		
Pb_diss	mg/L	-0.0002	-0.0005		
Pb_total	mg/L	0.0002	0.0008		
pH_field		8.28	7.05	-8888	-8888
Redox	mV	347	406	-8888	-8888
Se_diss	mg/L	0.0051	0.0245		
Se_total	mg/L	0.0049	0.0258		
Se_Trec	mg/L	0.0046	0.0247		
SO4	mg/L	1150			
TDS_at_180C	mg/L	2110	4530		
TDS_calc		1860			
TDS_ratio					
Temp	°C	9.05	22.96	-8888	-8888
TSS_at_103_5C	mg/L	8	51		
Turbidity	NTU	6.8	47.3		
Zn_diss	mg/L	-0.01	-0.01		
Zn_total	mg/L	-0.02	-0.05		

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Appendix Table A-7. 2018 San Juan River at Four Corners Bridge

Analysis	Units	3/6/2018	5/17/2018	8/8/2018	11/7/2018
Al_diss	mg/L	0.030			
Al_total	mg/L	0.28			
Alkalinity	mg/L	121	90	97	139
As_diss	mg/L	0.0003	0.0007	0.0004	0.0008
As_total	mg/L	0.0008	0.0022	0.0016	0.0014
Ca_diss	mg/L	70.5	51.6	45.2	77.0
Chloride	mg/L	20.4			
CO3_as_CaCO3	mg/L	2	-2	10	4.0
Cu_diss	mg/L	0.0006	-0.0004	0.0011	-0.0008
Cu_total	mg/L	0.0012	0.0089	0.0036	0.0028
Diss_O2	mg/L	11.45	7.80	8.15	10.09
EC_field	dS/m	0.625	0.454	0.408	0.634
Hardness_as_CaCO3	mg/L	237	162	148	245
HCO3_as_CaCO3	mg/L	119	90	88	135
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	14.7	8.0	8.5	12.7
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.16			
N_as_NO3NO2	mg/L	0.16			
Na_diss	mg/L	54.4	24.8	26.5	41.1
Ni_diss	mg/L	0.010			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	0.0001	-0.0001	-0.0001
Pb_total	mg/L	0.0003	0.0109	0.0018	0.0026
pH_field		8.53	6.86	8.57	8.25
Redox	mV	348	443	149	121
Se_diss	mg/L	0.0008	0.0004	0.0005	0.0006
Se_total	mg/L	0.0009	0.0005	0.0006	0.0007
Se_Trec	mg/L	0.0009	0.0005	0.0005	0.0007
SO4	mg/L	190			
TDS_at_180C	mg/L	476	280	270	438
TDS_calc		425			
TDS_ratio		1.12			
Temp	°C	4.77	18.05	23.51	8.89
TSS_at_103_5C	mg/L	8	192	88	112
Turbidity	NTU	6.7	112	59.9	72.1
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.01	0.06	-0.01	-0.01

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Appendix Table A-8. 2018 San Juan River at Montezuma Creek Bridge

Analysis	Units	3/5/2018	5/15/2018	8/8/2018	11/7/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	0.33			
Alkalinity	mg/L	136	84	99	142
As_diss	mg/L	0.0003	0.0006	0.0008	0.0008
As_total	mg/L	0.0007	0.0041	0.0020	-0.0010
Ca_diss	mg/L	80.0	49.6	45.4	79.0
Chloride	mg/L	25.6			
CO3_as_CaCO3	mg/L	-2.0	-2.0	7.0	4.5
Cu_diss	mg/L	0.0009	0.0008	0.0012	0.0009
Cu_total	mg/L	0.0009	0.0169	0.0048	-0.0040
Diss_O2	mg/L	10.73	7.47	7.82	10.15
EC_field	dS/m	0.733	0.427	0.427	0.666
Hardness_as_CaCO3	mg/L	286	156	150	256
HCO3_as_CaCO3	mg/L	136	84	92	137
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	21.0	7.7	8.8	14.2
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.34			
N_as_NO3NO2	mg/L	0.34			
Na_diss	mg/L	63.0	22.8	28.2	45.5
Ni_diss	mg/L	-0.008			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	-0.0001	-0.0001	-0.0001
Pb_total	mg/L	0.0003	0.0201	0.0026	0.0043
pH_field		8.21	6.76	8.48	8.24
Redox	mV	271	421	143	108
Se_diss	mg/L	0.0010	0.0003	0.0005	0.0007
Se_total	mg/L	0.0010	0.0008	0.0005	0.0006
Se_Trec	mg/L	0.0009	0.0006	0.0005	0.0007
SO4	mg/L	227			
TDS_at_180C	mg/L	548	282	268	484
TDS_calc		501			
TDS_ratio		1.09			
Temp	°C	7.44	19.78	23.10	8.90
TSS_at_103_5C	mg/L	10	476	127	144
Turbidity	NTU	5	268	81	133
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.01	0.13	0.01	0.01

Appendix Table A-9. 2018 San Juan River at Bluff Bridge

Analysis	Units	3/5/2018	5/15/2018	8/8/2018	11/7/2018
Al_diss	mg/L	-0.030			
Al_total	mg/L	0.53			
Alkalinity	mg/L	127.0	81.7	106.5	143.5
As_diss	mg/L	-0.00020	0.00045	0.00100	0.00090
As_total	mg/L	0.00080	0.00345	0.00205	0.00240
Ca_diss	mg/L	80.30	47.05	47.95	80.25
Chloride	mg/L	25.0			
CO3_as_CaCO3	mg/L	-2.0	-2.0	6.0	4.4
Cu_diss	mg/L	0.0008	0.0009	0.0012	-0.00080
Cu_total	mg/L	0.0012	0.0133	0.0059	0.0072
Diss_O2	mg/L	10.61	7.37	7.27	10.15
EC_field	dS/m	0.774	0.409	0.453	0.668
Hardness_as_CaCO3	mg/L	289	148	158	260
HCO3_as_CaCO3	mg/L	125.00	81.65	100.30	139.50
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	21.35	7.40	9.30	14.40
N_as_NH3	mg/L	-0.050			
N_as_NO2	mg/L	-0.010			
N_as_NO3	mg/L	0.310			
N_as_NO3NO2	mg/L	0.310			
Na_diss	mg/L	63.55	21.05	30.25	45.85
Ni_diss	mg/L	0.008			
Ni_total	mg/L	-0.008			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	-0.0001	-0.0001	-0.0001
Pb_total	mg/L	0.0004	0.0170	0.0038	0.0058
pH_field		7.02	6.72	8.36	8.20
Redox	mV	297	437	148	111
Se_diss	mg/L	0.0010	0.0003	0.0005	0.0006
Se_total	mg/L	0.0010	0.0007	0.0005	0.0008
Se_Trec	mg/L	0.0008	0.0006	0.0005	0.0007
SO4	mg/L	236			
TDS_at_180C	mg/L	564	266	297	479
TDS_calc		505			
TDS_ratio		1.12			
Temp	°C	6.32	18.38	22.31	7.30
TSS_at_103_5C	mg/L	15	644	171	248
Turbidity	NTU	6.1	353	110.5	217
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.010	0.100	0.020	0.020

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Appendix Table A-10. 2018 San Juan River at Mexican Hat Bridge

Analysis	Units	3/5/2018	5/15/2018	8/8/2018	11/7/2018
Al_diss	mg/L	0.040			
Al_total	mg/L	0.67			
Alkalinity	mg/L	130	82	109	145
As_diss	mg/L	-0.0002	0.0005	0.0009	0.0009
As_total	mg/L	0.0007	0.0076	0.0030	0.0036
Ca_diss	mg/L	80.8	46.6	48.7	79.0
Chloride	mg/L	25.2			
CO3_as_CaCO3	mg/L	4.5	-2.0	5.2	-2.0
Cu_diss	mg/L	0.0008	0.0010	0.0012	0.0010
Cu_total	mg/L	0.0010	0.0315	0.0060	0.0122
Diss_O2	mg/L	10.59	7.50	7.40	10.06
EC_field	dS/m	0.749	0.412	0.461	0.684
Hardness_as_CaCO3	mg/L	289	148	162	256
HCO3_as_CaCO3	mg/L	125	82	104	144
Hg_diss	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Hg_total	mg/L	-0.0002	-0.0002	-0.0002	-0.0002
Mg_diss	mg/L	21.1	7.6	9.7	14.2
N_as_NH3	mg/L	-0.05			
N_as_NO2	mg/L	-0.01			
N_as_NO3	mg/L	0.22			
N_as_NO3NO2	mg/L	0.22			
Na_diss	mg/L	64.7	20.6	30.7	46.6
Ni_diss	mg/L	0.009			
Ni_total	mg/L	-0.020			
OH_as_CaCO3	mg/L	-2.0	-2.0	-2.0	-2.0
Pb_diss	mg/L	-0.0001	-0.0001	-0.0001	-0.0001
Pb_total	mg/L	0.0004	0.0368	0.0037	0.0097
pH_field		7.04	6.77	8.29	8.14
Redox	mV	334	425	149	111
Se_diss	mg/L	0.0010	0.0003	0.0005	0.0006
Se_total	mg/L	0.0009	0.0010	-0.0005	0.0009
Se_Trec	mg/L	0.0008	0.0006	0.0006	0.0008
SO4	mg/L	232			
TDS_at_180C	mg/L	564	268	288	486
TDS_calc		504			
TDS_ratio		1.12			
Temp	°C	7.49	19.54	23.48	7.93
TSS_at_103_5C	mg/L	17	566	205	408
Turbidity	NTU	4.8	421	140	451
Zn_diss	mg/L	-0.01	-0.01	-0.01	-0.01
Zn_total	mg/L	-0.02	0.25	0.02	0.04