CHAPTER 4. WATER QUALITY

METHODS

Water Temperature

Nine temperature recorders were originally installed in the San Juan and Animas rivers in July and August of 1992 at the locations shown in Table 4.1. Each station consisted of a temperature sensor, lead wires and an OMNIDATA DP-230 data pod. The temperature was sampled every 10 minutes and stored every 24 hours as a maximum, minimum and mean temperature for the day. Table 2.2 also shows the periods of record at each site. The missing data were caused by equipment problems. Due to equipment problems and other maintenance challenges, the temperature recorders were replaced in July 1999 with the Optic StowAway temperature loggers. These are manufactured by Onset Computer Corporation and are factory sealed, submersible units that communicate via an optic interface. The temperature sensor is embedded in the body of the unit, eliminating any external wires. Water temperature is currently recorded every 15-minutes. The "in place" phrase in Table 4.1 indicates that StowAway's are monitoring temperature at the indicated sites.

Water Chemistry

Twelve water quality monitoring sites (Table 4.2) were identified as necessary to characterize water quality in the San Juan River and key tributaries. Sampling interval are quarterly (trimonthly) in February, May, August, and November. This temporal spacing was adopted to ensure water sampling occurs during spring runoff in the upper portion of the San Juan River basin and during winter base flows.

Chemical analyses performed are listed in Table 4.3. Parameters listed in left column were measured quarterly. In addition, field measurements of water temperature, pH, redox potential, specific conductance, and dissolved oxygen were made. Annually, during low-flow periods in February, water samples were analyzed for all parameters listed in Table 4.3.

RESULTS

Water Temperature

The plot of the 1999 StowAway temperature data is shown in Figure 4.1. Maximum, minimum and average plots are shown for Archuleta and Montezuma Creek in Figures 4.2 and 4.3. The missing data in Figures 4-2 and 4-3 is the interval between getting the new temperature equipment installed and the old equipment running out of data strorage space and/or power. There is a lot of water temperature data missing from 1998 due to equipment problems and thus max, min and average plots are not shown for the other stations. The new equipment appears to be operating well and should provide a more consistent and reliable record.

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Table 4.1. Water temperature monitoring locations and period of record.

Location	RM	Period of Record
Near Navajo Dam	225	7/9/1999 to 11/17/99 (in place)
Archuleta - San Juan at USGS Gage Location	218.6	7/23/92 to 11/17/99 (in place)
Blanco - San Juan at US-64 Bridge	207.1	8/7/92 to 2/28/95 (missing 11/21 - 12/9/92)
Bloomfield - San Juan at Highway 44 Bridge	195.6	2/27/93 to 7/17/98
Lee Acres - San Juan at Lee Acres Bridge	188.9	8/8/92 to 12/2/92, 2/26/93 to 4/15/93, 5/27/93 to 9/6/94, 3/9/95 to 10/10/95
Farmington - San Juan at USGS Gage Location	180.1	8/5/92 to 1/16/96, 7/8/99 to 11/15/99 (in place)
Shiprock - San Juan at USGS Gage Location	148.0	7/8/99 to 11/16/99 (in place)
Four Corners - San Juan at USGS Gage Location	119.4	10/7/94 to 3/11/96*, 7/9/99 to 11/16/99 (in place)
Montezuma Creek - San Juan at Montezuma Creek Bridge	93.6	8/9/92 to 1/11/93, 2/25 to 3/14/93, 4/14 to 5/10/93, 5/28/93 to 11/16/99 (in place)
Mexican Hat - San Juan near Bluff Gage Location	52.1	7/9/99 to 11/16/99 (in place)
Cedar Hill - Animas at USGS Gage nr Cedar Hill	n/a	8/7/92 to 9/22/98
Farmington - Animas at USGS Gage Location	n/a	8/5/92 to 4/14/97, 5/7/97 to 8/26/97, 10/15/97 to 6/4/98, 7/8/99 to 11/15/99 (in place)
USGS Data - San Juan at Archuleta	218.6	10/1/50 - 9/30/68 with some missing data
USGS Data - San Juan at Shiprock	148.0	10/1/51 - 9/30/86,9/7/91 - 3/3/93 with some missing data
USGS Data - Animas	n/a	10/1/52 - 9/30/90 with some missing data

Note all locations missing October 1992 data
* installed 8/10/92 but bad data was logged until thermistor was changed in October 1994. Prior to this time it was thought sediment accumulation was causing the warmer readings instead of bad thermistor.

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Table 4.2. San Juan River water quality monitoring sites.

Station Name	USGS ID	USGS Record	BIA Record
San Juan River near Archuleta Bridge	9355500	1958 -1984	1991-1999
Animas River @ Farmington	9364500	1958 -1992	1991-1999
San Juan River @ Farmington	9365000	1974 -1991	1991-1999
LaPlata River near Farmington	9367500	1977-1991	1994-1999
San Juan River @ Shiprock	9368000	1958 -1992	1991-1999
Mancos River near Four Corners	9371005		1991-1999
San Juan River @ Four Corners	9371010	1977-1990	1991-1999
San Juan River @ Montezuma Creek	9378610		1991-1999
San Juan River @ Bluff	9379495		1991-1999
San Juan River near Bluff (@ Mex. Hat)	9379500	1974 -1993	1991-1999

Table 4.3. San Juan River Monitoring Program water quality parameters.

Quarterly	Annually
Arsenic (total & dissolved)	Aluminum (total & dissolved)
Calcium (dissolved)	Barium (total & dissolved)
Copper (total & dissolved)	Manganese (total & dissolved)
Lead (total & dissolved)	Nickel (total & dissolved)
Magnesium (dissolved)	Potassium (total & dissolved)
Mercury (total & dissolved)	Strontium (total & dissolved)
Sodium (dissolved)	Orthophosphate (total & dissolved)
Selenium (total, dissolved, & total recoverable)	Chloride (dissolved)
Zinc (total & dissolved)	Ammonia (dissolved)
Alkalinity (HCO_3)	Nitrate (dissolved0
Hardness	Nitrite (dissolved)
TDS	Silica (total & dissolved)
TSS	Sulfate (dissolved)
Turbidity	

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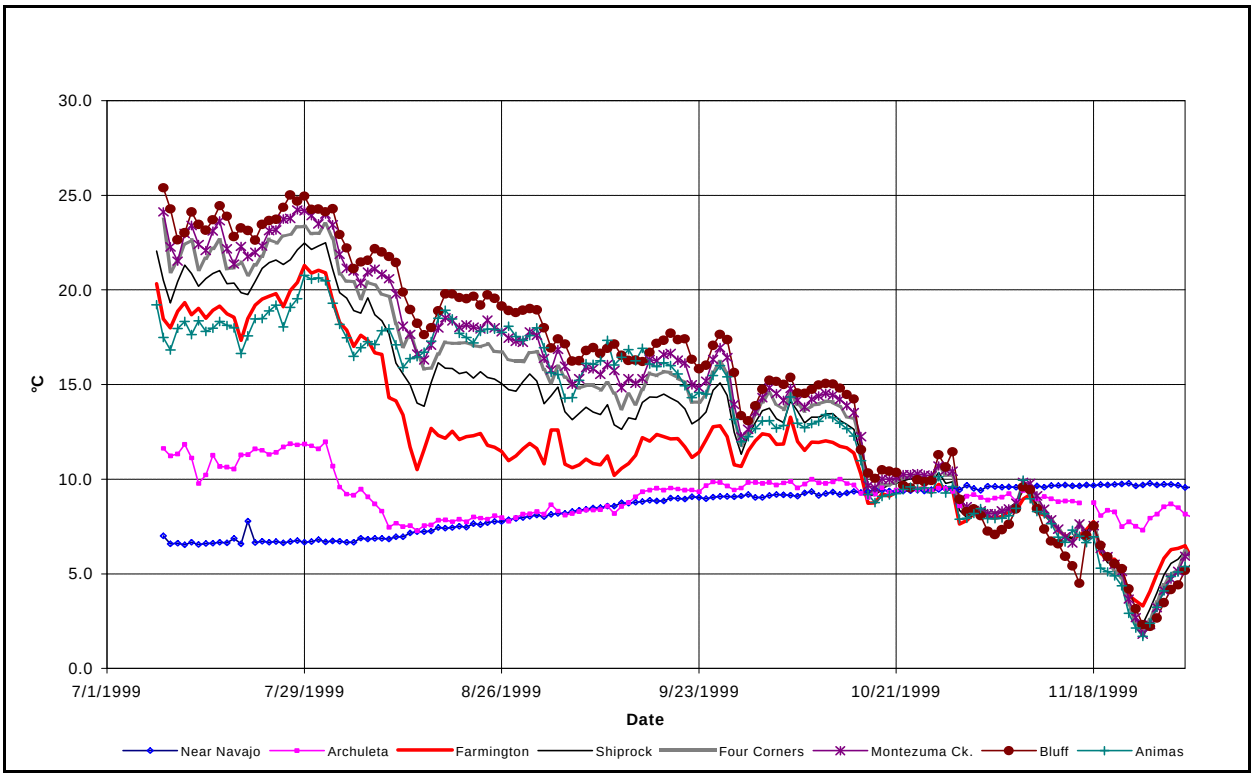

Figure 4.1. San Juan Basin Water Average Daily Temperature Data

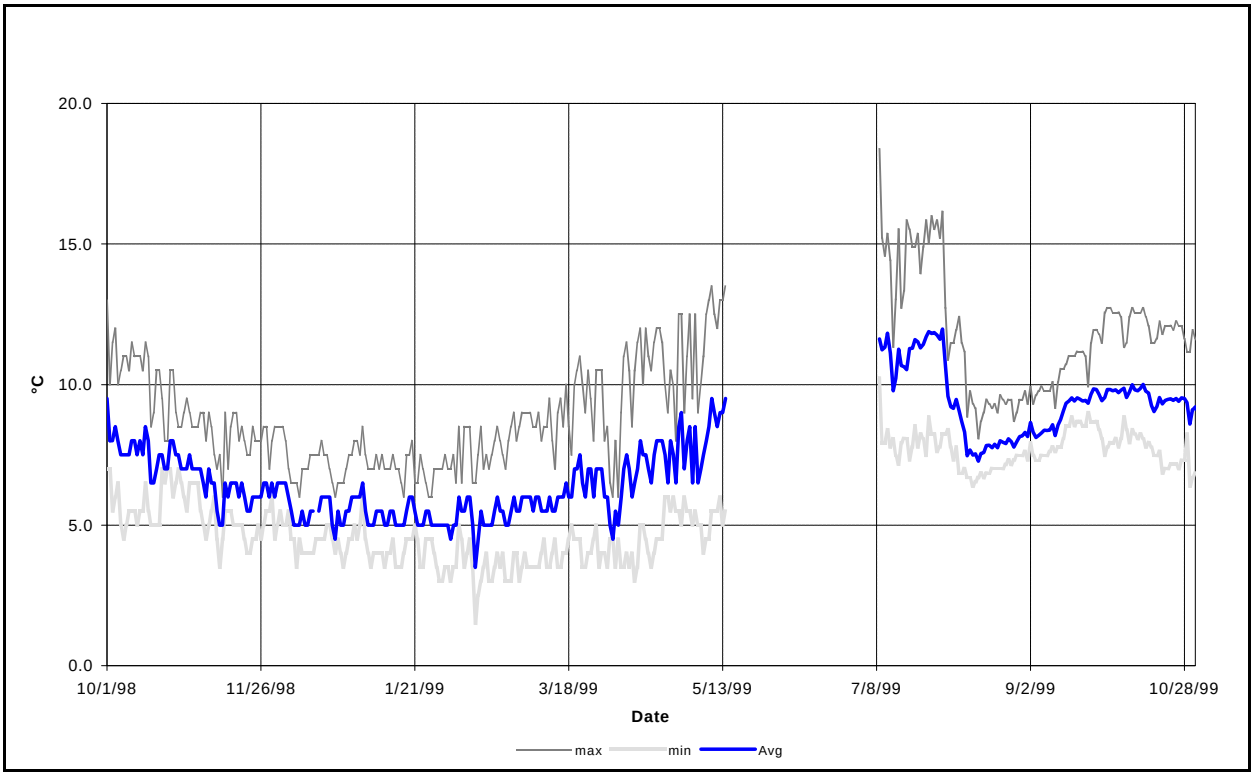

Figure 4.2. Archuleta Maximum, Minimum and Average Daily Water Temperatures

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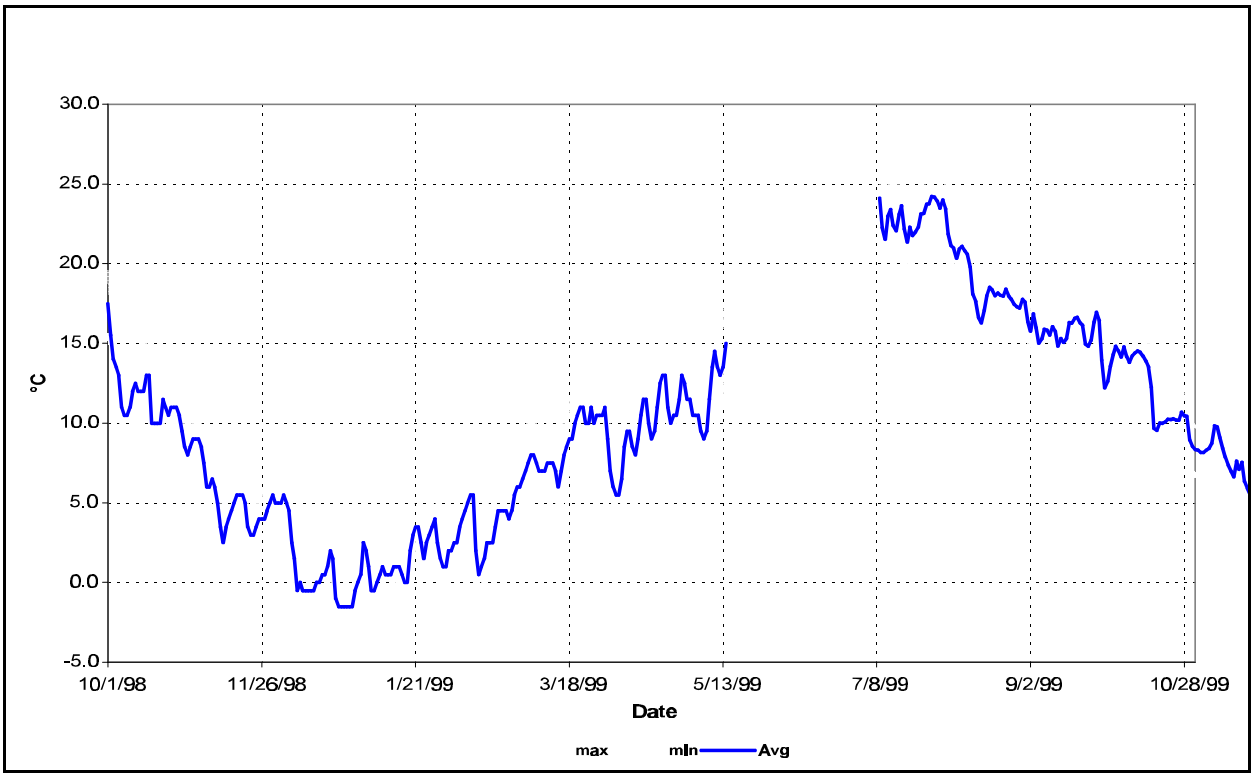

Figure 4.3. Montezuma Creek Maximum, Minimum and Average Daily Water Temperatures

Water Chemistry

Tables 4.4 through 4.13 summarize the water quality data for the 10 permanent stations, comparing the 1994-1998 statistics to those for 1999. In each case the minimum, maximum, mean and standard deviation is given for each parameter in Table 4.3.

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Table 4.4. Water chemistry data for San Juan River at Archuleta Bridge

San Juan River at Archuleta Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	31	43	99	74.8	9.5	4	54	78	69.8	10.8
Alkalinity (mg/l)	31	43	99	75.2	9.6	4	54	78	69.8	10.8
Arsenic dissolved (µg/l)	59	0.3	2.5	2	0.8	4	0.9	1	1	0.1
Arsenic total (µg/l)	59	0.5	642	13.2	83.3	4	0.5	5	1.9	2.1
Calcium dissolved (mg/l)	31	25.1	33.6	29.3	2.6	4	27.2	30	28.3	1.3
Copper dissolved (µg/l)	31	1	21	3.8	3.7	4	2	4	2.9	1.1
Copper total (µg/l)	31	1	41	8	10.4	4	1.5	5	3.4	1.5
Hardness ((mg/l)	31	83	112	96.4	8.6	4	90	98	93.5	3.7
Mercury dissolved (µg/l)	59	0.1	0.5	0.1	0.1	4	0.1	0.1	0.1	0
Mercury total (µg/l)	59	0.1	0.1	0.1	0	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	31	4.9	6.9	5.6	0.5	4	5.4	5.7	5.5	0.2
Sodium dissolved (mg/l)	8	10.7	15.3	12.9	1.5	4	11.9	13.2	12.6	0.7
Lead dissolved (µg/l)	59	0.1	5.7	0.6	0.9	4	0.1	1.6	0.5	0.8
Lead total (µg/l)	59	0.1	19.2	1.4	2.7	4	0.2	1	0.5	0.4
Selenium dissolved (µg/l)	59	0.5	0.5	0.5	0	4	0.5	0.5	0.5	0
Selenium total (µg/l)	59	0.5	3	0.5	0.3	4	0.5	1	0.6	0.3
Selenium total recoverable (µg/l)	9	0.5	0.5	0.5	0	4	0.5	0.5	0.5	0
Total dissolved solids (mg/l)	29	90	280	163.4	41.1	4	130	150	135	10
Total suspended solids (mg/l)	58	1	57	9.5	10.3	4	2.5	2.5	2.5	0
Turbidity (NTU)	56	0	33	6	5.4	4	2.1	8.3	4.9	3
Zinc dissolved (µg/l)	59	5	70	7.4	9.2	4	5	5	5	0
Zinc total (µg/l)	59	5	360	27.5	54.8	4	5	10	7.5	2.9
Temperature (°C)	59	3.4	19.9	8.1	3	4	6.1	9.3	7.6	1.3
pH	59	7.2	9	8.2	0.4	4	7.6	8.1	7.8	0.2
Conductance (µmhos/cm)	59	200	1210	260	128.8	4	210	250	230	18.9
Redox Potential (mv)	59	223	527	380	69.3	4	228	479	365	105
Oxygen dissolved (mg/l)	58	5.4	14.3	10.5	1.5	4	9.1	11.2	10.1	0.9

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Table 4.5. Water Chemistry data for Animas River at Farmington

Animas River at Farmington	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	30	43	167	116.8	34.5	4	86	171	126.8	35.2
Alkalinity (mg/l)	30	43	167	117.6	34.7	4	86	171	126.8	35.2
Arsenic dissolved (µg/l)	59	0.3	2.5	1.9	0.8	4	0.7	2	1.2	0.6
Arsenic total (µg/l)	59	0.5	13	2.6	1.8	4	0.5	4	2	1.6
Calcium dissolved (mg/l)	30	27.6	96.1	68.6	21.7	4	37.7	101	71.1	28.3
Copper dissolved (µg/l)	30	1	9	4	2.2	4	2	4.1	3.3	1
Copper total (µg/l)	30	2.5	68	14.8	15.1	4	1.5	13	7.9	5.5
Hardness ((mg/l)	30	85	304	217.7	71.2	4	117	319	224.8	91.8
Mercury dissolved (µg/l)	59	0.1	0.1	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	59	0.1	0.9	0.1	0.1	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	30	3.8	19.2	11.3	4.2	4	5.6	16.2	11.4	5.1
Sodium dissolved (mg/l)	7	6	34.6	25.9	9.3	4	7.3	37.7	22.1	15.1
Lead dissolved (µg/l)	59	0.1	4.5	0.6	0.6	4	0.1	0.3	0.2	0.1
Lead total (µg/l)	59	0.5	80	14.3	18.7	4	0.5	43.2	11.4	21.2
Selenium dissolved (µg/l)	59	0.5	3	0.6	0.3	4	0.5	0.5	0.5	0
Selenium total (µg/l)	59	0.5	4	0.6	0.5	4	0.5	1	0.6	0.3
Selenium total recoverable (µg/l)	9	0.5	0.5	0.5	0	4	0.5	1	0.6	0.3
Total dissolved solids (mg/l)	29	110	520	320.7	120	4	180	500	330	154.5
Total suspended solids (mg/l)	58	1	2170	144.3	331.2	4	2.5	166	82.6	88.4
Turbidity (NTU)	56	0.9	1240	74.9	195.7	4	2.8	87	38.4	42.1
Zinc dissolved (µg/l)	59	5	40	9.6	7.4	4	5	20	10	7.1
Zinc total (µg/l)	59	5	430	89.1	86.6	4	10	100	52.5	44.3
Temperature (°C)	59	-0.2	27.3	11.5	7	4	5.2	16.3	11.5	5
pH	59	7.5	8.9	8.2	0.3	4	7.8	8.5	8.2	0.3
Conductance (µmhos/cm)	59	200	970	550	180.6	4	280	720	500	209.5
Redox Potential (mv)	59	253	545	395	66.2	4	357	482	412	51.9
Oxygen dissolved (mg/l)	58	3.7	13.2	9.5	2.1	4	7.6	11.1	9.5	1.7

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Table 4.6. Water Chemistry data for San Juan River at Farmington Bridge

San Juan River at Farmington Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	29	49	143	103	23.4	4	84	110	100	11.6
Alkalinity (mg/l)	29	49	143	103.3	23	4	84	110	100	11.6
Arsenic dissolved (µg/l)	59	0.3	5	2.1	0.9	4	0.9	2	1.2	0.5
Arsenic total (µg/l)	59	0.5	7	2.6	1.2	4	1	2.5	1.9	0.6
Calcium dissolved (mg/l)	29	28.8	83.5	54.3	15.4	4	32.8	55.9	49.5	11.2
Copper dissolved (µg/l)	29	1	10	4	2.5	4	1	5	3.2	2
Copper total (µg/l)	29	2.5	50	17.1	12.3	4	2.5	10	5.4	3.3
Hardness ((mg/l)	29	91	265	171.8	48.6	4	105	178	157.5	35.1
Mercury dissolved (µg/l)	59	0.1	0.2	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	59	0.1	0.2	0.1	0	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	29	4.6	13.9	8.8	2.5	4	5.6	9.4	8.2	1.8
Sodium dissolved (mg/l)	6	27.5	46.7	36.6	7.1	4	12.2	37	26	11.8
Lead dissolved (µg/l)	59	0.1	4	0.6	0.6	4	0.1	0.2	0.2	0.1
Lead total (µg/l)	59	0.5	105	12	16.3	4	0.5	19.3	6	8.9
Selenium dissolved (µg/l)	59	0.5	2	0.5	0.2	4	0.5	1	0.6	0.3
Selenium total (µg/l)	59	0.5	2.5	0.6	0.3	4	0.5	1	0.8	0.3
Selenium total recoverable (µg/l)	9	0.5	0.5	0.5	0	4	0.5	0.5	0.5	0
Total dissolved solids (mg/l)	29	140	450	293.4	87.4	4	190	330	265	59.7
Total suspended solids (mg/l)	58	2.5	2660	244.8	397.8	4	14	424	166	180.2
Turbidity (NTU)	56	2.5	1880	110.4	265.2	4	13	116	44.1	48.5
Zinc dissolved (µg/l)	59	5	30	7.7	5.8	4	5	5	5	0
Zinc total (µg/l)	59	5	320	63.1	53.5	4	5	100	43.7	45
Temperature (°C)	59	-0.3	24.3	10.6	6.3	4	5.5	14.8	9.9	3.9
pH	59	7.2	8.8	8.1	0.3	4	7.8	8.5	8.1	0.3
Conductance (µmhos/cm)	59	200	700	430	118.4	4	270	620	420	144.3
Redox Potential (mv)	59	252	535	400	61.3	4	384	477	431	38
Oxygen dissolved (mg/l)	58	0	12.5	8.9	2.2	4	6.8	9.7	8.6	1.3

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Table 4.7. Water chemistry data for La Plata River near Farmington

La Plata River near Farmington	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	21	111	370	230	57.6	4	197	290	240.3	45.8
Alkalinity (mg/l)	21	111	370	230	57.6	4	198	290	240.5	45.5
Arsenic dissolved (µg/l)	50	0.2	5	2.3	0.9	4	1	2.5	1.9	0.8
Arsenic total (µg/l)	50	0.5	29	4.2	5.4	4	2	7	4.1	2.3
Calcium dissolved (mg/l)	21	65.4	507	175.4	97.3	4	108	339	212.3	96.9
Copper dissolved (µg/l)	21	1	20	9.1	5.8	4	4	8	5.8	1.7
Copper total (µg/l)	21	2.5	136	24	30	4	1.5	39	18.1	17.9
Hardness ((mg/l)	21	279	2120	778.5	419.6	4	461	1410	901	389.6
Mercury dissolved (µg/l)	50	0.1	0.1	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	50	0.1	1.7	0.2	0.3	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	21	18.1	208	82.7	44.6	4	46.4	136	89.9	37.6
Sodium dissolved (mg/l)	1	118	118	118	.	4	56.7	453	238.9	177
Lead dissolved (µg/l)	50	0.1	1	0.4	0.2	4	0.1	0.5	0.3	0.2
Lead total (µg/l)	50	0.3	408	17.7	60.5	4	0.5	18.2	5.5	8.5
Selenium dissolved (µg/l)	50	0.5	4	1.2	0.9	4	0.5	1	0.6	0.3
Selenium total (µg/l)	50	0.5	10	1.5	1.7	4	0.5	3	1.1	1.3
Selenium total recoverable (µg/l)	5	0.5	2	1.1	0.6	4	0.5	2	1	0.7
Total dissolved solids (mg/l)	21	80	3240	1263.3	679.4	4	900	3220	1905	985.3
Total suspended solids (mg/l)	50	2	65600	2100	9689.7	4	2.5	1870	497.6	916.2
Turbidity (NTU)	50	0.6	18900	588.5	2692.6	4	0.1	430	108.4	214.4
Zinc dissolved (µg/l)	50	5	20	6.3	3.8	4	5	10	8.8	2.5
Zinc total (µg/l)	50	5	1850	86	273.9	4	10	70	25	30
Temperature (°C)	50	-0.3	32.2	12.8	8.7	4	2.3	24.9	14	10.5
pH	50	7.4	8.5	8.1	0.2	4	7	8.2	7.8	0.5
Conductance (µmhos/cm)	50	270	3740	1660	691.4	4	1040	3590	2180	1116.2
Redox Potential (mv)	50	239	498	390	61	4	287	460	391	75.2
Oxygen dissolved (mg/l)	49	3.1	12.8	8.8	2.2	4	7.1	10.4	8.6	1.7

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Table 4.8. Water chemistry data for San Juan River at Shiprock Bridge

San Juan River at Shiprock Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	55	17	165	108.4	29.6	8	47	139	105.8	28
Alkalinity (mg/l)	55	17	166	109.8	30.1	8	47	139	105.8	28
Arsenic dissolved (µg/l)	114	0.5	2.5	2	0.7	8	0.6	1	0.9	0.2
Arsenic total (µg/l)	113	1	44	4.2	5.9	8	0.5	9	3.9	3.7
Calcium dissolved (mg/l)	55	30.8	96.3	59.9	16.8	8	36.8	74.2	57.3	14.1
Copper dissolved (µg/l)	55	1	18	4.9	3.4	8	1.5	6	3.3	1.6
Copper total (µg/l)	55	2.5	155	28.7	32.5	8	3	65	27.9	25.7
Hardness ((mg/l)	55	98	317	195.9	56.9	8	115	248	186.3	49.6
Mercury dissolved (µg/l)	114	0.1	0.3	0.1	0	8	0.1	0.1	0.1	0
Mercury total (µg/l)	114	0.1	1.6	0.1	0.2	8	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	55	5.2	18.6	11.2	3.8	8	5.7	15.1	10.5	3.6
Sodium dissolved (mg/l)	8	13	58.5	41.4	13.5	8	21.8	48	33.3	11.6
Lead dissolved (µg/l)	114	0.1	18	1	2.5	8	0.1	0.9	0.3	0.3
Lead total (µg/l)	113	0.5	323	26.7	45.4	8	1	65.8	21.4	28
Selenium dissolved (µg/l)	114	0.5	1	0.5	0.1	8	0.5	0.5	0.5	0
Selenium total (µg/l)	114	0.5	3	0.6	0.4	8	0.5	2	0.8	0.5
Selenium total recoverable (µg/l)	18	0.5	1	0.6	0.2	8	0.5	2	0.9	0.5
Total dissolved solids (mg/l)	54	130	550	343.1	107.3	8	220	430	313.8	82.1
Total suspended solids (mg/l)	112	2.5	17700	1057.8	3091.6	8	28	3280	895	1443.1
Turbidity (NTU)	110	3.8	11100	546	1730.3	8	11.2	1800	430.7	743.5
Zinc dissolved (µg/l)	114	5	50	7.3	6.1	8	5	20	7.5	5.4
Zinc total (µg/l)	114	5	1380	121.3	229.4	8	10	490	136.3	160.5
Temperature (°C)	114	0.1	26.1	12.2	6.9	8	7.2	18.6	12.1	5.2
pH	114	7.7	9	8.3	0.3	8	7.7	9	8.2	0.5
Conductance (µmhos/cm)	114	240	830	520	150	8	330	650	510	130.2
Redox Potential (mv)	114	250	544	407	64.8	8	404	484	428	32.1
Oxygen dissolved (mg/l)	112	3.6	13.9	9.5	2.4	8	7.9	11.7	9.8	2

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Table 4.9. Water chemistry data for Mancos River near Four Corners

Mancos River near Four Corners	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	25	92	360	169.2	57	4	107	215	167	48.7
Alkalinity (mg/l)	25	92	360	172.4	56.6	4	107	215	167	48.7
Arsenic dissolved (µg/l)	48	0.3	5	2.1	0.9	4	1	4	2.2	1.3
Arsenic total (µg/l)	48	1	37	5.2	7.2	4	1	28	9.1	12.7
Calcium dissolved (mg/l)	25	43.6	201	129.1	49.8	4	66.5	211	167.6	68
Copper dissolved (µg/l)	25	2.5	19	8.7	5.5	4	6	20	11.3	6.7
Copper total (µg/l)	25	2.5	198	33	44.2	4	1.5	107	42.1	46
Hardness ((mg/l)	25	165	1040	617.7	276.6	4	283	1110	778.8	364.4
Mercury dissolved (µg/l)	48	0.1	0.1	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	48	0.1	0.5	0.1	0.1	4	0.1	2	0.6	1
Magnesium dissolved (mg/l)	25	13.7	136	71.8	37.5	4	28.4	145	87.3	56
Sodium dissolved (mg/l)	2	22	143	82.5	85.6	4	35.2	206	121.1	77.5
Lead dissolved (µg/l)	48	0.1	1	0.4	0.2	4	0.1	1	0.4	0.4
Lead total (µg/l)	48	0.2	77	10.8	17.8	4	0.4	78.6	20.1	39
Selenium dissolved (µg/l)	48	0.5	30	7.5	6.3	4	2	15	9.3	5.9
Selenium total (µg/l)	48	0.5	30	7.4	5.9	4	4	15	11	5
Selenium total recoverable (µg/l)	9	2	16	8	5.1	4	3	14	9.8	5
Total dissolved solids (mg/l)	24	240	2100	1135.8	538.1	4	440	2040	1407.5	696.1
Total suspended solids (mg/l)	47	2.5	6320	621.1	1221.5	4	12	33500	8650	16574.1
Turbidity (NTU)	47	3.9	2300	296.4	503.8	4	12.5	18500	4732.5	9180.1
Zinc dissolved (µg/l)	48	5	40	7.1	6.2	4	5	20	10	7.1
Zinc total (µg/l)	48	5	330	58.7	76.7	4	5	2300	596.2	1136.2
Temperature (°C)	48	-0.2	32.3	12.2	8.5	4	2.8	24.2	14	9.3
pH	48	7.8	8.8	8.2	0.2	4	7.8	8.4	8.1	0.3
Conductance (µmhos/cm)	48	380	2450	1510	589.6	4	650	2330	1610	745.9
Redox Potential (mv)	48	4	548	400	87.9	4	375	484	426	44.7
Oxygen dissolved (mg/l)	47	4.8	12.7	9.3	2	4	6	11.9	9.2	2.7

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Table 4.10. Water chemistry data for San Juan River at Four Corners Bridge

San Juan River at Four Corners Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	30	67	165	113.7	23.9	4	88	141	111.5	22
Alkalinity (mg/l)	30	67	165	114.4	24.2	4	88	141	112	21.9
Arsenic dissolved (µg/l)	59	0.5	2.5	2	0.7	4	0.5	2	1.1	0.6
Arsenic total (µg/l)	59	1	19	3.5	3.3	4	1	9	4.8	3.3
Calcium dissolved (mg/l)	30	31.7	99.9	64.8	18.9	4	37.8	78.7	59	16.8
Copper dissolved (µg/l)	30	1	11	5	2.7	4	4	6	5	0.8
Copper total (µg/l)	30	2.5	130	23.3	26.3	4	6	65	39.3	25.1
Hardness ((mg/l)	30	103	340	220.4	69.6	4	117	274	198.5	65
Mercury dissolved (µg/l)	59	0.1	0.3	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	59	0.1	0.8	0.1	0.1	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	30	5.8	23.8	14.2	5.7	4	5.5	18.7	12.4	5.6
Sodium dissolved (mg/l)	7	14	60.1	45.6	16.3	4	23.9	54.4	38.1	14
Lead dissolved (µg/l)	59	0.1	7	0.6	0.9	4	0.1	0.7	0.3	0.3
Lead total (µg/l)	59	0.5	271	22.4	46.3	4	1	52.7	15.6	24.8
Selenium dissolved (µg/l)	59	0.5	2	0.8	0.5	4	0.5	2	1	0.7
Selenium total (µg/l)	59	0.5	4	1	0.7	4	0.5	2	1.1	0.6
Selenium total recoverable (µg/l)	9	0.5	1	0.8	0.3	4	0.5	2	1.1	0.6
Total dissolved solids (mg/l)	29	110	640	391	137.4	4	240	480	340	108.6
Total suspended solids (mg/l)	59	2.5	11700	673.4	1972.5	4	20	3990	1100	1930.8
Turbidity (NTU)	57	2	7900	401.4	1319.9	4	8.5	2000	543.6	973.1
Zinc dissolved (µg/l)	59	5	30	6.9	4.7	4	5	5	5	0
Zinc total (µg/l)	59	5	920	84.3	143.8	4	20	230	97.5	97.1
Temperature (°C)	59	0	26.3	12.3	7.4	4	4.6	17.9	12.4	6.4
pH	59	7.5	8.8	8.2	0.3	4	7.9	8.7	8.2	0.4
Conductance (µmhos/cm)	59	250	870	580	179.7	4	370	710	530	148.4
Redox Potential (mv)	59	256	592	409	64.6	4	385	488	433	42.3
Oxygen dissolved (mg/l)	58	4.3	12.7	9.3	2	4	7.4	12.2	9.8	2.4

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Table 4.11. Water chemistry data for San Juan River at Montezuma Creek Bridge

San Juan River at Montezuma Creek Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	27	59	192	122.8	31.4	4	93	149	117	23.3
Alkalinity (mg/l)	27	59	192	123.6	31.7	4	93	149	117	23.3
Arsenic dissolved (µg/l)	55	0.5	2.5	2	0.8	4	0.9	2	1.2	0.5
Arsenic total (µg/l)	55	1	21	3.5	3.6	4	1	9	3.6	3.6
Calcium dissolved (mg/l)	27	33.9	132	73.9	25.8	4	39.9	88	65.6	19.8
Copper dissolved (µg/l)	27	2	15	5.4	3.5	4	2	4.3	3.6	1.1
Copper total (µg/l)	27	2.5	120	25.6	29.3	4	1.5	57	23.4	25.8
Hardness ((mg/l)	27	111	465	269	102.8	4	127	323	232	82.6
Mercury dissolved (µg/l)	55	0.1	0.2	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	55	0.1	0.8	0.1	0.1	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	27	6.5	40.5	20.5	9.6	4	6.7	25.1	16.6	8.2
Sodium dissolved (mg/l)	3	16	196	87.2	95.7	4	18.6	59	39.8	19.3
Lead dissolved (µg/l)	55	0.1	4	0.5	0.5	4	0.1	0.2	0.2	0.1
Lead total (µg/l)	55	0.5	129	18.4	27	4	0.5	50.8	13.4	25
Selenium dissolved (µg/l)	55	0.5	4	0.9	0.6	4	0.5	2	1.1	0.6
Selenium total (µg/l)	55	0.5	3	1	0.7	4	0.5	6	2.4	2.5
Selenium total recoverable (µg/l)	9	0.5	1	0.7	0.3	4	0.5	2	1.1	0.6
Total dissolved solids (mg/l)	25	170	800	456.4	176.1	4	220	560	377.5	159.7
Total suspended solids (mg/l)	54	2.5	9100	683.3	1544.6	4	16	3320	975.5	1581.2
Turbidity (NTU)	54	3.9	6900	356.8	1007.8	4	7.2	1600	466.4	764.3
Zinc dissolved (µg/l)	55	5	60	7.2	7.9	4	5	20	8.8	7.5
Zinc total (µg/l)	55	5	540	82.7	110.9	4	5	220	93.8	104.8
Temperature (°C)	55	-0.2	27.8	12.7	7.4	4	5.6	18.4	12.5	6.7
pH	55	7.7	8.7	8.2	0.2	4	7.7	8.6	8.2	0.4
Conductance (µmhos/cm)	55	280	1160	670	224.3	4	350	810	580	205.7
Redox Potential (mv)	55	250	516	403	65.1	4	385	459	422	30.7
Oxygen dissolved (mg/l)	54	5.1	12.3	9	1.9	4	7.2	11.6	9.5	2.2

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Table 4.12. Water chemistry data for San Juan River at Bluff Bridge

San Juan River at Bluff Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	57	47	175	122.6	31.9	8	94	146	116.9	19.6
Alkalinity (mg/l)	57	47	175	122.7	31.9	8	94	146	116.9	19.6
Arsenic dissolved (µg/l)	114	0.5	2.5	2.1	0.7	8	1	2	1.1	0.4
Arsenic total (µg/l)	113	1	20	4.3	4.5	8	0.5	10	2.9	3.2
Calcium dissolved (mg/l)	57	32.3	121	74	22.3	8	41.4	91.2	65.7	18.6
Copper dissolved (µg/l)	57	1	13	6.1	3.2	8	2	6.7	3.9	1.5
Copper total (µg/l)	57	2.5	200	34	37.8	8	1.5	50	21	20.7
Hardness ((mg/l)	57	106	507	271	94.1	8	134	337	233.4	77.7
Mercury dissolved (µg/l)	114	0.1	0.5	0.1	0	8	0.1	0.1	0.1	0
Mercury total (µg/l)	114	0.1	0.7	0.1	0.1	8	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	57	6.2	49.8	21.1	9.7	8	7.3	26.5	16.8	7.8
Sodium dissolved (mg/l)	10	18	83	55.4	24.2	8	18.3	62.3	40.3	19.3
Lead dissolved (µg/l)	114	0.1	4	0.6	0.7	8	0.1	0.2	0.2	0.1
Lead total (µg/l)	113	0.5	144	23.1	32.8	8	0.5	35	9.4	15.2
Selenium dissolved (µg/l)	114	0.5	3	0.9	0.6	8	0.5	2	0.9	0.5
Selenium total (µg/l)	114	0.5	8	1.2	1.1	8	0.5	2	1.1	0.6
Selenium total recoverable (µg/l)	18	0.5	1	0.7	0.2	8	0.5	1	0.9	0.2
Total dissolved solids (mg/l)	54	160	990	489.3	181.9	8	230	560	388.8	145
Total suspended solids (mg/l)	114	1	9820	903.4	1822.8	8	12	2390	787	1024.5
Turbidity (NTU)	112	2	7900	570.9	1327.7	8	8.1	1500	356.1	552.2
Zinc dissolved (µg/l)	114	5	40	7.4	5.8	8	5	20	6.9	5.3
Zinc total (µg/l)	114	5	650	104.6	142.5	8	5	150	66.9	66.2
Temperature (°C)	114	-0.3	29.4	12.4	7.7	8	5	18.9	12.3	6.6
pH	114	7.7	8.6	8.2	0.2	8	7.9	8.6	8.2	0.3
Conductance (µmhos/cm)	114	280	1150	690	228	8	360	820	600	191.1
Redox Potential (mv)	114	4	535	401	84.4	8	366	468	425	40.2
Oxygen dissolved (mg/l)	112	5.4	12.7	9	2	8	7.6	12.4	9.7	2.1

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Table 4.13. Water chemistry data for San Juan River at Mexican Hat Bridge

San Juan River at Mexican Hat Bridge	1994-1998					1999				
Parameter	N of cases	Minimum	Maximum	Mean	Standard Dev	N of cases	Minimum	Maximum	Mean	Standard Dev
Bicarbonate (mg/l)	30	71	180	130.3	28.4	4	91	146	119.5	23.3
Alkalinity (mg/l)	30	71	180	130.3	28.4	4	91	146	119.5	23.3
Arsenic dissolved (µg/l)	59	0.5	2.5	2	0.7	4	0.7	2	1.2	0.6
Arsenic total (µg/l)	59	1	50	5	7.1	4	1	7	2.9	2.8
Calcium dissolved (mg/l)	30	32.7	112	75.5	23.7	4	42.5	90.5	67	19.6
Copper dissolved (µg/l)	30	2	13	5.6	3.3	4	3	5	3.8	1
Copper total (µg/l)	30	2.5	170	23.9	31.2	4	1.5	40	13.6	17.7
Hardness ((mg/l)	30	108	460	278.7	99.8	4	138	331	238.3	79.5
Mercury dissolved (µg/l)	59	0.1	0.1	0.1	0	4	0.1	0.1	0.1	0
Mercury total (µg/l)	59	0.1	1.1	0.2	0.2	4	0.1	0.1	0.1	0
Magnesium dissolved (mg/l)	30	6.3	43.8	21.9	10.1	4	7.8	25.6	17.3	7.7
Sodium dissolved (mg/l)	7	15	77.5	55.4	21	4	17.9	61.7	41.2	20.2
Lead dissolved (µg/l)	59	0.1	1	0.4	0.2	4	0.1	0.2	0.2	0.1
Lead total (µg/l)	59	0.5	327	23.1	51.9	4	0.5	31.4	8.2	15.5
Selenium dissolved (µg/l)	59	0.5	2	0.9	0.6	4	0.5	1	0.8	0.3
Selenium total (µg/l)	59	0.5	5	1.2	0.9	4	0.5	2	1	0.7
Selenium total recoverable (µg/l)	9	0.5	2	1.1	0.6	4	0.5	2.5	1.8	0.9
Total dissolved solids (mg/l)	29	170	800	493.1	179.7	4	250	570	400	143.1
Total suspended solids (mg/l)	59	1	16090	1328.9	2793.5	4	2.5	2770	849.1	1312.2
Turbidity (NTU)	57	1	11000	755.6	1825.1	4	4.9	825	254	389.4
Zinc dissolved (µg/l)	59	5	100	8.5	13.1	4	5	5	5	0
Zinc total (µg/l)	59	5	1620	111.6	230	4	5	130	57.5	62.8
Temperature (°C)	59	-0.2	29.8	12.6	7.9	4	5.5	19.1	12.5	6.7
pH	59	7.7	8.6	8.2	0.2	4	7.7	8.6	8.1	0.5
Conductance (µmhos/cm)	59	270	1050	700	220.1	4	380	820	610	196.1
Redox Potential (mv)	59	245	537	403	70.6	4	367	475	421	46
Oxygen dissolved (mg/l)	58	5.8	12.9	9.1	2	4	7.2	11.4	9.4	1.9

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