January 2014

Norwest Corporation (Norwest) maintains three gaging stations for Pioneer Natural Resources USA Inc. (PNR) in the headwaters of the Apishapa River in northern Las Animas County, Colorado. The Apishapa River is a tributary of the Arkansas River. The gaging stations acquire "continuous" data on 15-minute intervals for pressure, temperature, conductivity, calculated SAR, and calculated flow using an In-Situ Aqua Troll. Communication of the near real-time continuous data is accomplished using Iridium satellite telemetry and is available online at www.apishapawatershed.org. Norwest visits the stations every two weeks to download the data, calibrate the equipment, acquire instantaneous flow measurements, collect field parameters of pH, temperature, conductivity and salinity, and collect water quality samples. All monitoring conducted at each station is voluntary and is not required by any regulatory agency.

The three stations on the Apishapa are shown on **Figure 1**. The Belarde station is furthest upstream and has a contributing watershed of 59.3 square miles. The Eichler station is located downstream, and has a contributing watershed of 72.9 square miles. The Lisonbee station is located further downstream, southwest of Aguilar, slightly upstream of the historic USGS gage 07118000, and has a contributing watershed of 141.7 square miles. The Eichler and Lisonbee stations are located downstream of the Apishapa's confluence with tributaries potentially influenced by coalbed methane discharge waters.

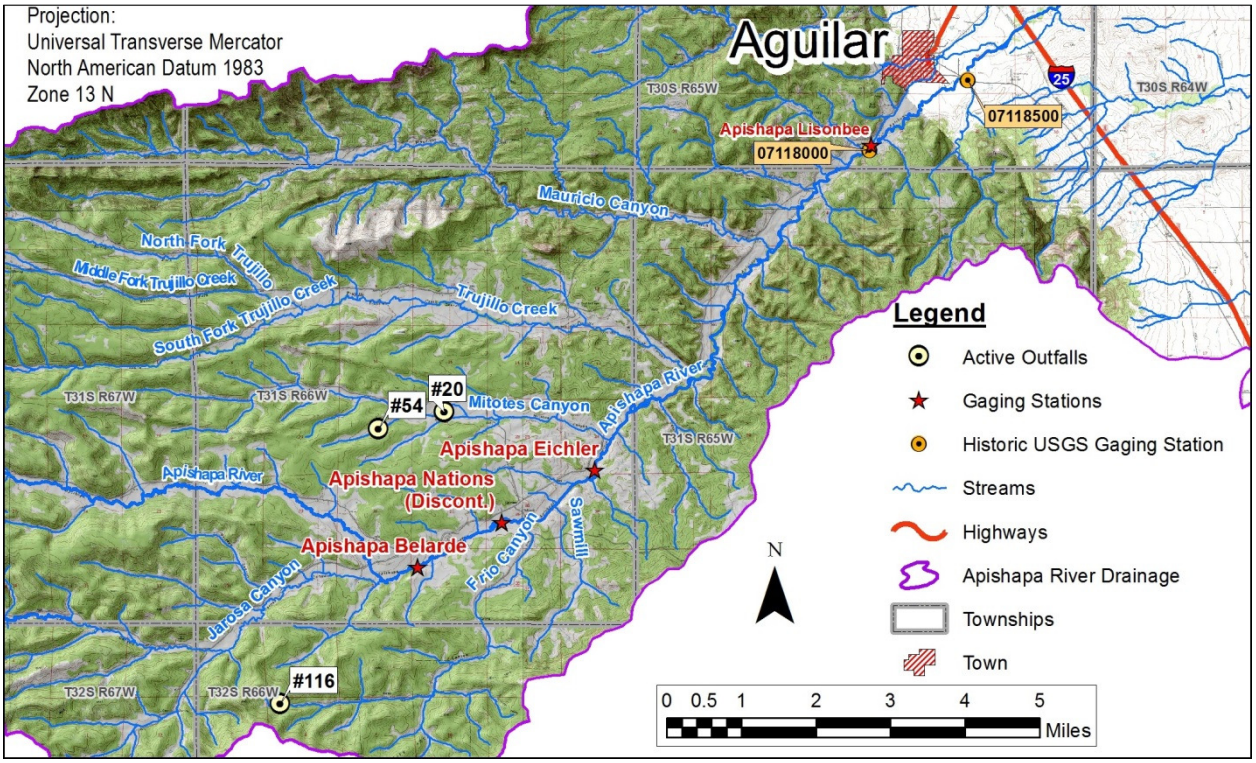

FIGURE 1
APISHAPA WATERSHED

The U.S. Drought Monitor prepares maps weekly for drought conditions throughout the contiguous United States. The U.S. Drought Monitor is produced in partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln (NDMC-UNL), the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. **Figure 2** depicts drought conditions in Colorado for data received as of 7 a.m. EST on December 31, 2013. **Figure 3** depicts drought conditions in Colorado for data received as of 7 a.m. EST on January 28, 2014. The drought intensity for Las Animas County remained the same throughout the month of January with D0 and D1 drought conditions in the western part of the county, D1 and D2 drought conditions in the central part of the county, and D2 drought conditions in the eastern part of the county, with a small amount of D3 drought conditions in the top northeast (Drought Monitor, 2014).

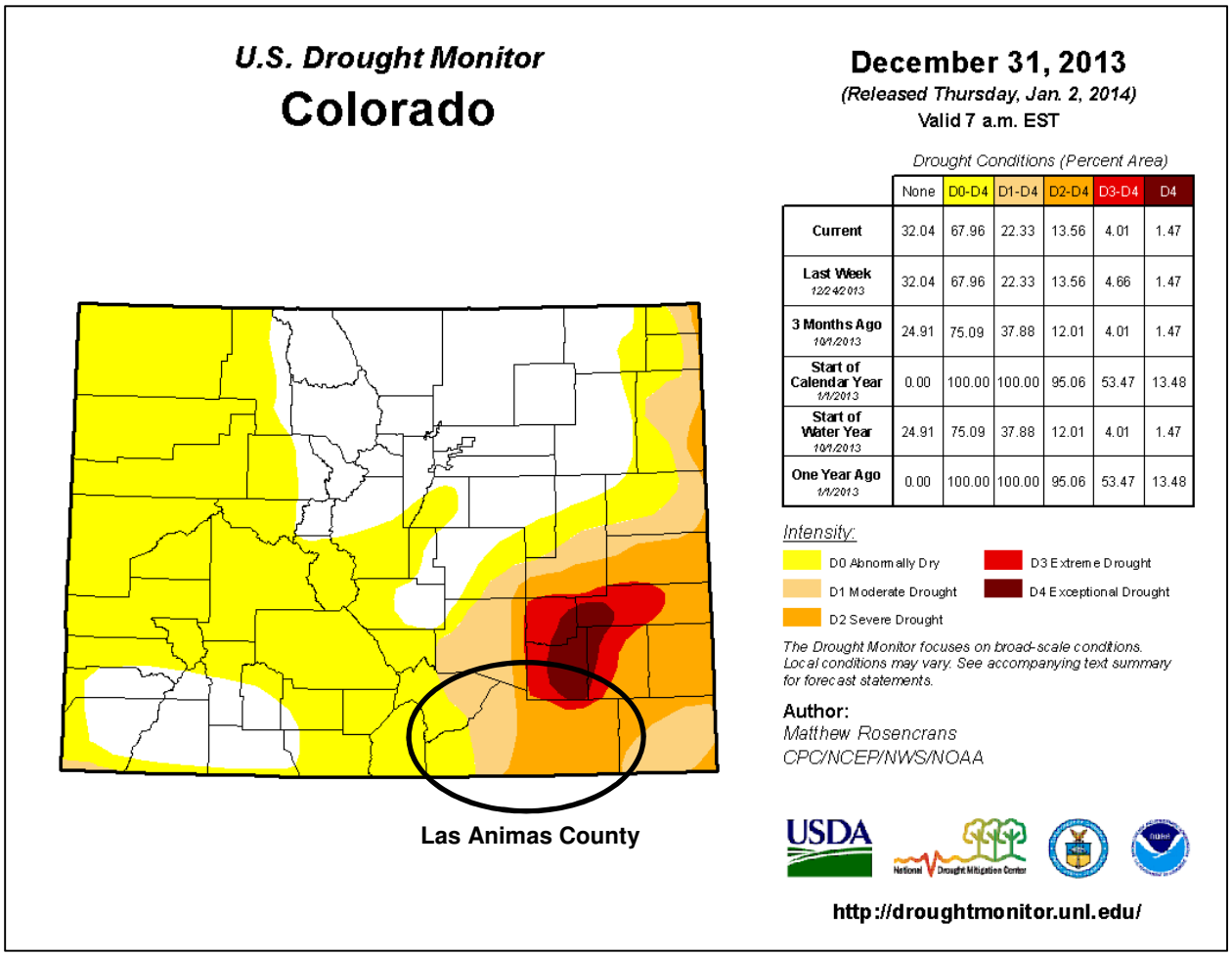

FIGURE 2
U.S. DROUGHT MONITOR COLORADO – DECEMBER 31, 2013

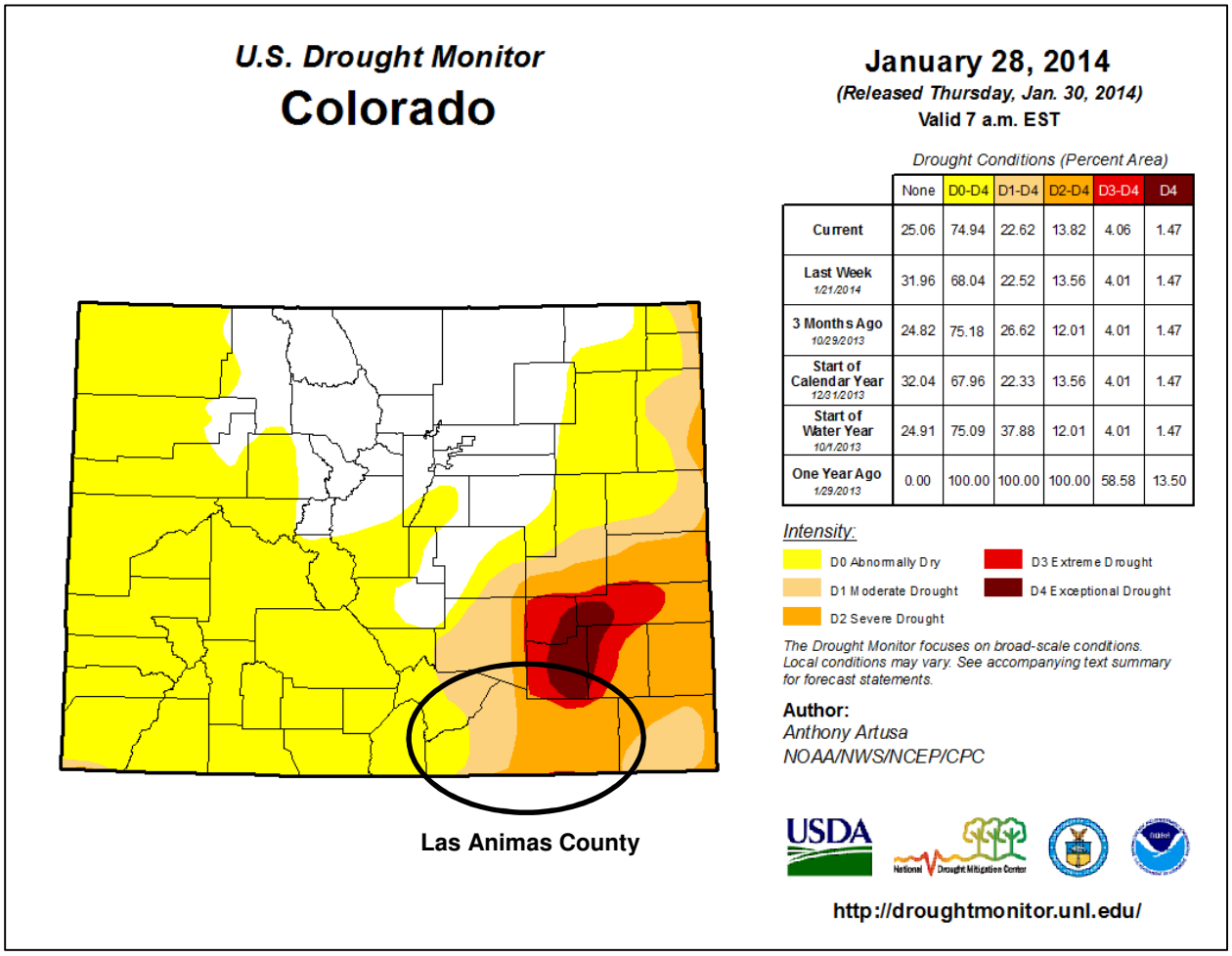

FIGURE 3
U.S. DROUGHT MONITOR COLORADO – JANUARY 28, 2014

The three gaging stations on the Apishapa River discussed in this report are located in the southwest part of the county with the D0 and D1 drought conditions mentioned above. Recordable flow was present at all three stations the entire month of January 2014. Laboratory water quality samples were collected at all three stations during the two January 2014 site visits. Streamflow was measured at the Lisonbee station during both site visits in January 2014. Streamflow was not measured during either site visit at the Belarde and Eichler stations due to frozen conditions.

January 2014 data exhibited a calculated daily average flow of 1.66 cfs at Belarde, 0.21cfs at Eichler, and 2.73 cfs at Lisonbee. Temperatures were seasonal. The daily average specific conductance at Belarde ranged from 290 µs/cm to 425 µs/cm, with a median value of 312 µs/cm (**Table 1**). The daily average specific conductance at Eichler ranged from 589 µs/cm to 741 µs/cm, with a median value of 642 µs/cm (**Table 1**). The daily average specific conductance at Lisonbee ranged from 626 µs/cm to 668 µs/cm, with a median value of 646 µs/cm (**Table 1**). The calculated daily average sodium adsorption ratio (SAR) values in January 2014 ranged from 0.58 to 0.78 at Belarde, 1.30 to 1.62 at Eichler, and 1.91 to 2.04 at Lisonbee (**Table 1**).

TABLE 1
JANUARY 2014 DAILY AVERAGE GAGE DATA

	Average Daily			
	Minimum	**Median**	**Average**	**Maximum**
Belarde - (31 days of flow data)				
Water Level (ft)	0.52	0.55	0.56	0.66
Flow[1] (cfs)	1.07	1.55	1.66	3.12
Temperature (°C)	-0.06	0.34	0.36	0.92
Conductivity (µs/cm)	290	312	329	425
TDS[2] (mg/l)	189	203	214	276
Sodium Adsorption Ratio[3] (SAR)	0.58	0.61	0.64	0.78
Eichler - (31 days of flow data)				
Water Level (ft)	0.35	0.46	0.45	0.56
Flow[1] (cfs)	0.04	0.17	0.21	0.64
Temperature (°C)	-0.04	0.11	0.15	1.07
Conductivity (µs/cm)	589	642	656	741
TDS[2] (mg/l)	383	417	427	482
Sodium Adsorption Ratio[3] (SAR)	1.30	1.41	1.45	1.62
Lisonbee - (31 days of flow data)				
Water Level (ft)	0.33	0.38	0.37	0.40
Flow[1] (cfs)	1.32	2.92	2.73	4.23
Temperature (°C)	0.97	2.08	2.08	3.50
Conductivity (µs/cm)	626	646	644	668
TDS[2] (mg/l)	407	420	419	434
Sodium Adsorption Ratio[3] (SAR)	1.91	1.97	1.97	2.04

[1] Calculated from pressure data

[2] Calculated from conductivity data with a conversion of 0.65 mg/l TDS per µs/cm specific conductance

[3] Derived from a historic multivariate regression analysis of conductivity and flow

The mainstem of the Apishapa River has been classified by the Colorado Water Quality Control Commission (WQCC) as supporting aquatic life, recreation, water supply, and agriculture (CDPHE WQCC, 2013 (1)). During the month of January 2014, the water type at the Belarde and Eichler stations was a calcium bicarbonate water, with a calcium-sodium bicarbonate water type at the Lisonbee station.

January 2014 field measured SC values and laboratory measured SAR values at the Belarde, Eichler and Lisonbee stations are illustrated in **Figure 4**. All three stations were below the SC threshold limit of 1300 µs/cm and the SAR threshold limit of 6.8 (**Figure 4**). These SC and SAR threshold limits have been identified by the Colorado Department of Public Health and Environment (CDPHE) for protection of downstream alfalfa crops (CDPHE, 2010).

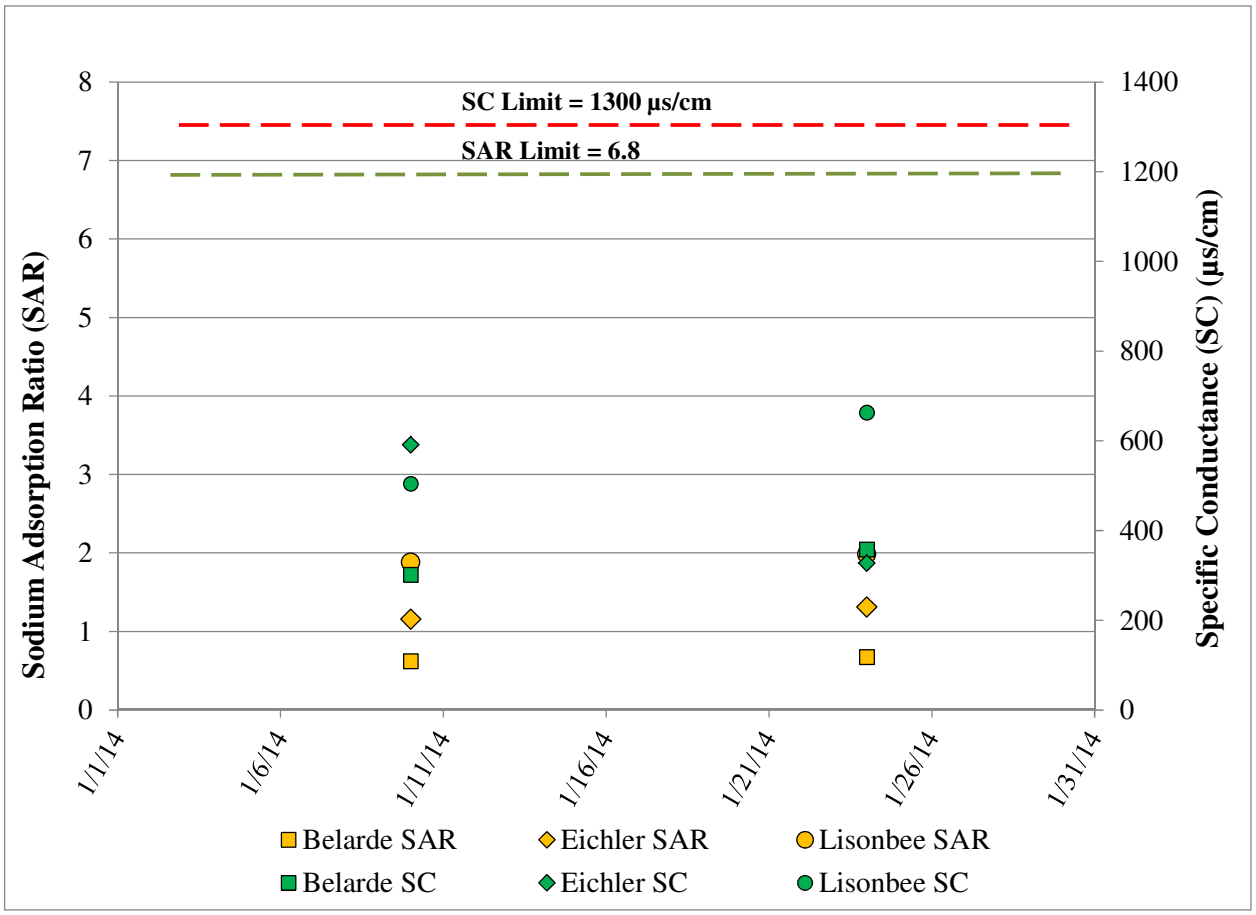

FIGURE 4
JANUARY 2014 SPECIFIC CONDUCTANCE AND SAR

The water in January exhibits a range of hardness, with Belarde ranging from 124 mg/l $CaCO_3$ to 149 mg/l $CaCO_3$ hardness, Eichler ranging from 246 mg/l $CaCO_3$ to 291 mg/l $CaCO_3$ hardness, and Lisonbee ranging from 215 mg/l $CaCO_3$ to 223 mg/l $CaCO_3$ hardness (**Table 2**). Based on toxicity testing, aquatic species protection from elevated heavy metal concentrations increases as hardness increases (CDPHE WQCC, 2013 (2)). Lower hardness values, closer to 25 mg/l $CaCO_3$, have lower hardness based metal standards to provide aquatic life protection and higher hardness values, closer to 400 mg/l $CaCO_3$, can afford higher hardness based metal standards to provide aquatic life protection (CDPHE WQCC, 2013 (2)).

Stream water quality is affected by the quantity of sediment in the stream. Sediment concentrations increase during storm events or snowmelt runoff. Analyses of the total recoverable forms of metals typically increase with increased sediment concentrations, as the laboratory analytical digestions dissolve the sediment. Total suspended solids (TSS) in January 2014 ranged from 6.8 mg/l to 17.6 mg/l at the Belarde station, ranged from <4 mg/l to 5.6 mg/l at the Eichler station, and ranged from <4 mg/l to 10.4 mg/l at the Lisonbee station (**Figure 5**). TSS values less than the detection limit of 4 mg/l are plotted as

½ the detection limit in **Figure 5**. Total recoverable iron concentrations ranged from 0.577 mg/l to 0.664 mg/l at Belarde, 0.176 mg/l to 0.190 mg/l at Eichler, and 0.202 mg/l to 0.228 mg/l at Lisonbee (**Figure 5**).

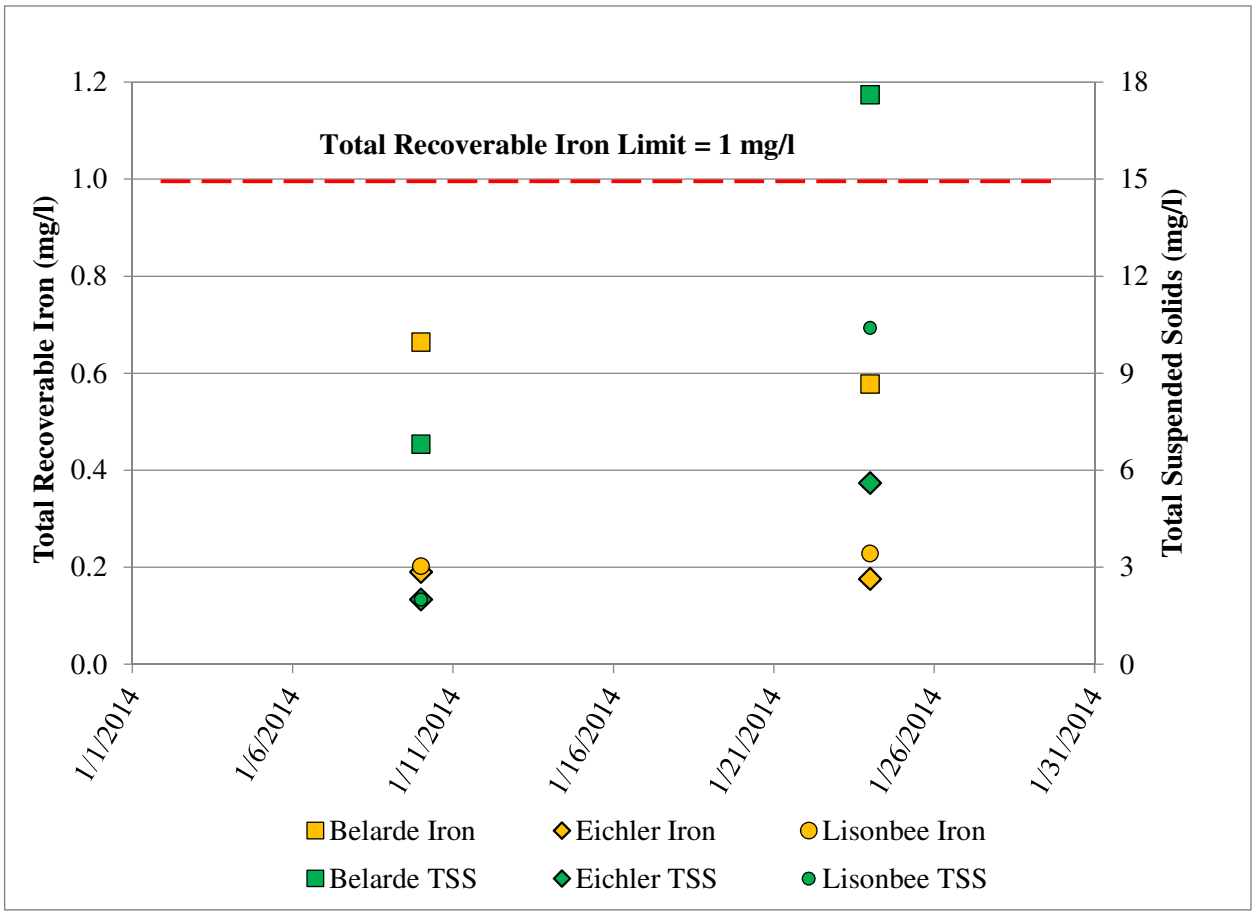

FIGURE 5
JANUARY 2014 INSTANTANEOUS TOTAL RECOVERABLE IRON (MG/L) AND TOTAL SUSPENDED SOLIDS (MG/L)

Constituents below the detection limit at all three stations in January 2014 include arsenic, boron, chromium, and selenium. Measured concentrations of potentially dissolved copper were below the detection limit of 15 µg/l at the Belarde and Eichler stations all of January (**Table 2**). However, the hardness adjusted stream standard for potentially dissolved copper at Belarde was lower than the 15 µg/l detection limit during both sampling events for chronic (**Table 2**). The January 10, 2014 potentially dissolved copper result of 37.2 µg/l at Lisonbee exceeded both the acute and chronic hardness adjusted stream standards. Measured concentrations of potentially dissolved manganese and potentially dissolved zinc were lower than the hardness adjusted stream standards established by the WQCC (**Table 2**). Chloride and sulfate were compliant with the stream standards at the Belarde, Eichler, and Lisonbee stations (**Table 3**). The field pH values in January 2014 were compliant with the stream standard of between 6.5 and 9.0 at all three stations (**Table 3**).

TABLE 2

HARDNESS BASED STREAM STANDARDS ASSOCIATED WITH APISHAPA RIVER INSTANTANEOUS SAMPLING, JANUARY 2014 (CDPHE WQCC, 2013 (2))

Site	Sample Date	Stream Segment	Calculated Hardness[1] (mg/l $CaCO_3$)	Acute Copper (Pot. Diss.) (µg/l)	Chronic Copper (Pot Diss.) (µg/l)	Chronic Iron (T-Rec.) (mg/l)	Acute Manganese (Pot. Diss.) (µg/l)	Chronic Manganese (Pot. Diss.) (µg/l)	Acute Zinc (Pot. Diss.) (µg/l)	Chronic Zinc (Pot. Diss.) (µg/l)
Belarde Hardness Based Standards	1/10/2014	3a	124	16.5	10.8	1	3207	1772	195	147
Belarde Hardness Based Standards	1/24/2014	3a	149	19.6	12.6	1	3410	1884	230	174
Belarde Maximum January Results			**NA**	**<15**	**<15**	**0.577**	**149**	**149**	**<20**	**<20**
Eichler Hardness Based Standards	1/10/2014	3a	246	31.4	19.3	1	4030	2226	363	275
Eichler Hardness Based Standards	1/24/2014	3a	291	36.8	22.3	1	4262	2355	423	320
Eichler Maximum January Results			**NA**	**<15**	**<15**	**0.190**	**587**	**587**	**<20**	**<20**
Lisonbee Hardness Based Standards	1/10/2014	3a	215	27.6	17.2	1	3853	2129	321	243
Lisonbee Hardness Based Standards	1/24/2014	3a	223	28.6	17.8	1	3900	2155	332	251
Lisonbee Maximum January Results			**NA**	**37.2**	**37.2**	**0.228**	**64.4**	**64.4**	**36.5**	**36.5**

[1] A hardness value of 400 mg/l CaCO3 is used to calculate the metal standards when the measured hardness values are greater than 400 mg/l CaCO3

TABLE 3
STREAM STANDARDS ASSOCIATED WITH APISHAPA RIVER INSTANTANEOUS SAMPLING, JANUARY 2014 (CDPHE WQCC, 2013 (2))

Site	Sample Date	Stream Segment	Arsenic (Total) (µg/l)	Boron (Total) (mg/l)	Acute Chromium (Total) (µg/l)	Chronic Chromium (Total) (µg/l)	Chloride (mg/l)	Acute Selenium (T-Rec.) (µg/l)	Chronic Selenium (T-Rec.) (µg/l)	Sulfate (mg/l)	pH-low (s.u.)	pH-High (s.u.)
Belarde Standards	1/10/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Belarde Standards	1/24/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Belarde Maximum January Results[1]			**<15**	**<0.05**	**<10**	**<10**	**10.4**	**<4**	**<4**	**47.9**	**7.83**	**8.06**
Eichler Standards	1/10/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Eichler Standards	1/24/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Eichler Maximum January Results[1]			**<15**	**<0.05**	**<10**	**<10**	**48.1**	**<4**	**<4**	**64.5**	**8.19**	**8.21**
Lisonbee Standards	1/10/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Lisonbee Standards	1/24/2014	3a	0.02	0.75	16	11	250	18.4	4.6	250	6.5	9
Lisonbee Maximum January Results[1]			**<15**	**<0.05**	**<10**	**<10**	**12.7**	**<4**	**<4**	**79.5**	**8.37**	**8.52**

[1] Minimum result identified for pH-low

References

Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Commission (WQCC), 2013 (1). 5 CCR 1002-32, Regulation No. 32 Classifications and Numeric Standards for Arkansas River Basin, Amended August 12, 2013, Effective December 31, 2013.

Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Commission (WQCC), 2013 (2). 5 CCR 1002-31, Regulation No. 31 The Basic Standards and Methodologies for Surface Water, Amended September 11, 2012, Effective January 31, 2013.

Colorado Department of Public Health and Environment (CDPHE), 2010. Apishapa CBM Facility, Water Quality Assessment, Draft Discharge Permit CO0048313, Pioneer Natural Resources, USA, Inc.

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