

2016 Taos Water Quality Sampling Report – Rio Hondo, Rio Fernando and Rio Pueblo de Taos

*Sentinels-Rios de Taos
Amigos Bravos*

Summary:

Surface water quality sampling was conducted in the Taos NM area in June, July, and August, 2016. Samples were collected from 6 sites in the Rio Hondo, 4 sites in the Rio Pueblo de Taos, 6 sites in the Rio Fernando de Taos, 4 sites in the Red River, and 2 sites in the Rio Grande. All sample sites were monitored for dissolved oxygen, temperature, electrical conductivity, pH, and *E. coli*. Several sites near the Taos Wastewater Treatment Facility were also monitored for nutrients. Sites on the Red River were monitored for hardness and total Aluminum. Water quality standards for at least one parameter were exceeded in the Red River, Rio Fernando, Rio Pueblo, and Rio Grande.

In all three sampling events the Rio Fernando did not meet standards for dissolved oxygen, electrical conductivity and *E. coli*. High *E. coli* levels and high electrical conductivity at Fred Baca Park also continue to be a problem in the summer months. Sampling results in 2016 again confirm the New Mexico Environment Department's previous listing of the lower segment of the Rio Fernando de Taos *E. coli* in the upper two segments, and for *E. coli*, Nutrient/Eutrophication Biological Indicators, Sedimentation/Siltation, Specific Conductance, and Temperature in the lower segment. High *E. coli* levels also continue to plague the upper and lower Rio Fernando sites.

In 2016 we continued to monitor the impact of the Taos wastewater treatment plant on the Rio Pueblo and on a small perennial unnamed stream that flows from the wastewater treatment plant. The results from the perennial unnamed wastewater stream had high conductivity readings (though there is still not an electrical conductivity standard for the unnamed perennial stream, so a standard was not exceeded). There is also no nitrate or phosphate standard for the lower Rio Pueblo sites. If the standard that applies to all other river systems in the area (including the upper Rio Pueblo) were to apply, there would have been extreme nitrate exceedences in the unnamed perennial stream. There was an *E. coli* exceedance in the lower Pueblo site during the June sampling event.

Sampling from two sites on the Rio Grande were completed for the second time this year. All water quality standards were met in 2015, however this year, dissolved oxygen was not met at RG2 in July and at RG3 in August.

Aluminum levels continue to be high in the Red River. In June the chronic criteria was exceeded at 3 sites, including at RR3, where this is the third year in a row with a chronic aluminum exceedance. The sample at RR3 in June also exceeded the acute criteria. Aluminum standards are dependent on hardness, please see the Red River section for more information on aluminum levels.

Introduction:

This sampling project was initiated by Sentinels – Rios de Taos due to a concern that inadequate data were available to accurately assess the health of the Rio Hondo, Rio Fernando, and Rio Pueblo de Taos watersheds. Sentinels – Rios de Taos contacted Amigos Bravos in 2005 with concerns about water quality in local watersheds. Specifically, there was some concern about nutrient loading in the upper Rio Hondo. With Amigos Bravos’ assistance Sentinels-Rios de Taos identified sampling locations and developed a monitoring plan. National representatives from Sierra Club’s Water Sentinels program traveled to Taos and gave several trainings to the Sentinels – Rios de Taos’ volunteers. Sentinels – Rios de Taos and Amigos Bravos initiated sampling in February of 2007. In 2012 four sites in the Red River were also monitored. Eight previous sampling reports have been prepared for sampling that occurred in 2007 - 2015. This report covers the sampling that occurred in 2016.

Methods:

Surface water quality sampling was conducted in the Taos NM area in June, July, and August, 2016. Samples were collected from 6 sites in the Rio Hondo, 4 sites in the Rio Pueblo de Taos, 6 sites in the Rio Fernando de Taos, 4 sites in the Red River, and 2 sites in the Rio Grande. (Appendix A and Appendix C). All samples were kept on ice until they were processed by Sangre de Cristo labs in Alamosa Colorado. Laboratory samples were collected for *E. coli*. For some samples nitrates, ammonia, hardness, or aluminum were also analyzed. All laboratory samples were collected and processed within an 8hr holding time. EPA approved methods and holding times were used to analyze the samples (Appendix B). Field measurements for pH, temperature, dissolved oxygen and conductivity were conducted. Field measurements of hardness were collected for all samples for which laboratory samples for aluminum were collected (Appendix B).

The concentration of aluminum in natural waters can vary significantly depending on various physicochemical and mineralogical factors. Dissolved aluminum concentrations in waters with near-neutral pH values usually range from 1 - 50 $\mu\text{g/L}$ but rise to 500–1000 $\mu\text{g/L}$ in more acidic waters or water rich in organic matter. At the extreme acidity of waters affected by acid mine drainage, dissolved aluminum concentrations of up to 90,000 $\mu\text{g/L}$ have been measured. The current New Mexico Water Quality Standards provide a table for maximum aluminum values, which are now dependent on hardness following the 2010 updates. They provide values for both acute and chronic criteria (see (3) Table of Selected Values, pg. 45-46 of the March 2, 2017 NM Standards for Interstate and Intrastate Surface Waters).

Acute criteria is for toxicity involving a stimulus severe enough to induce a response in 96 hours of exposure or less. Compliance with acute water quality criteria is determined from the analytical results of a single grab sample and cannot be exceeded. Chronic criteria effects include, but are not limited to, lethality, growth impairment, behavioral modifications, disease, and reduced reproduction. Compliance with chronic water quality criteria is determined from the arithmetic mean of the analytical results of samples collected using the appropriate protocols. Chronic criteria cannot be exceeded more than once every three years.

Acute Ammonia standards are dependent on pH and the presence or absence of salmonids (species of fish that spawn in fresh water including trout and salmon; See table K of NM water quality standards). Chronic ammonia standards are dependent on pH, temperature, and the presence or absence of salmonids (See table L of NM water quality standards).

Results:

A list of the full sampling results for 2016 can be found in Appendix C.

Rio Hondo:

June 9, 2016: Laboratory samples were collected from 5 sites in the Rio Hondo. All 5 samples were analyzed in the lab for *E. coli*. Phosphate and nitrate were measured for site H2E. Field readings for temperature, pH, conductivity, and dissolved oxygen (DO) were also taken at these 5 locations. No water quality standard exceedences were recorded for the tested parameters during this period (Appendix C).

July 6, 2016: Laboratory samples were collected from 4 sites in the Rio Hondo. All 4 samples were analyzed in the lab for *E. coli*. Phosphate and nitrate were measured for site H2E. Field readings for temperature, pH, conductivity, and dissolved oxygen were also taken at all locations. No water quality standard exceedences were recorded for the tested parameters during this period (Appendix C).

August 31, 2016: Laboratory samples were collected from 4 sites in the Rio Hondo. . All 4 samples were analyzed in the lab for *E. coli*. Phosphate and nitrate were measured for site H2E. Field readings for temperature, pH, conductivity, and dissolved oxygen were also taken at these 4 locations. No water quality standard exceedences were recorded for the tested parameters during this period (Appendix C).

Rio Pueblo:

June 9, 2016: Laboratory samples were collected from 4 sites in Rio Pueblo de Taos and analyzed for *E. coli*. Nitrates, ammonia, and phosphorous were collected for sites PS2 and PS3. Field readings for temperature, pH, DO, and conductivity were taken. Conductivity at PS2 (unnamed perennial stream below wastewater plant) had an electrical conductivity of 723 (higher than the normal standard) and nitrate levels at PS2 were 8.53 mg/L – about 42 times higher than levels at other sites (normally <0.20 mg/L). Though it is important to note that there is no standard for nitrate, phosphate/phosphorous or electrical conductivity at PS2 and PS3. PS3 also exceeded the *E. coli* standard during this periods (312 Colonies/100ml). No other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

July 6, 2016: Laboratory samples were collected at 3 sites in the Rio Pueblo de Taos and analyzed for *E. coli*. Phosphate and nitrate levels were taken from PS2 and PS3. Field readings for temperature, pH, DO, and conductivity were taken at all 3 sites. The nitrate level of 8.77 at PS2 is about 43 times higher than the normal levels of <0.2 mg/L. No

other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

August 31, 2016: Laboratory samples were collected at 3 sites in the Rio Pueblo de Taos and analyzed for *E. coli*. Phosphate and nitrate levels were analyzed at PS2 and PS3. Field readings for temperature, pH, DO, and conductivity were taken at all 3 sites. The nitrates level continued to rise at PS2 (unnamed perennial stream below the wastewater plant) to 11.08 mg/L, which is about 55 times higher than the expected levels. Electrical conductivity at PS2 measured at 709, which is above the standard that applies to the other river segments (400-500 microsiemens/cm) that we sample in this project. This has occurred at this site for the past several years. No other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

Rio Fernando de Taos:

June 9, 2016: Laboratory samples were collected at 5 sites in the Rio Fernando and analyzed for *E. coli*, phosphates and nitrates. Field readings for temperature, pH, DO, and conductivity were also taken. Electrical conductivity was exceeded at 4 of the 5 sites, and site F5 (Taos Land Trust office property) had dissolved oxygen below the standard, Electrical conductivity exceeded, and *E. coli* exceeded. No other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

July 6, 2016: Laboratory samples were collected at the same 5 sites in the Rio Fernando and analyzed for *E. coli*. Field readings for temperature, pH, DO, and conductivity were also taken. Dissolved oxygen, and *E. coli* at FLJ (the La Jara Pasture) exceeded standards. The *E. coli* at FLJ levels were Too Numerous to Count, (TNTC), meaning levels were over 8,000 colonies/100ml. Those levels are over 34 times the surface water quality standard for the Rio Fernando. F4 (Fred Baca Park) exceeded electrical conductivity, dissolved oxygen and *E. coli*. standards. Electrical conductivity was also exceeded at FRE, F1 and F5. No other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

August 31, 2016: Laboratory samples were collected at the same 6 sites in the Rio Fernando and analyzed for *E. coli*, nitrate, and phosphate. Field readings for temperature, pH, DO, and conductivity were also taken. Water quality standards *E. coli* were not met at FRE (The riparian pasture). Electrical conductivity levels were also above standards at F1, and *E. coli* was exceeded at FRE (the Riparian Enclosure). The *E. coli* levels at FRE were Too Numerous to Count, (TNTC), meaning levels were over 8,000 colonies/100ml. Those levels are over 34 times the surface water quality standard for the Rio Fernando. Electrical conductivity was exceeded at 4 of the 6 sites (F1, F4, F5 and F6). Dissolved oxygen also did not meet standards at F5 and F6 (Both near the Taos Land Trust office).

Red River:

On June 9, July 6 and August 31 2016, samples were collected from 4 sites (RR1, RR2, RR3 and RR4) on the Red River. All of the sites were tested for hardness, aluminum, dissolved oxygen, electrical conductivity, pH and temperature. RR3 exceeded the chronic aluminum standard for the 3rd year in a row. In 2014 Aluminum levels measured at 4,731µg/L at RR3 and in July 2015, Aluminum levels were: >2,400µg/L at RR3. Each year from 2014-2016, Aluminum chronic criteria were exceeded. Chronic criteria cannot be exceeded more than once every 3 years without resulting in an impairment listing.

June 9, 2016: RR3 again officially exceeded chronic and acute criteria standards for Aluminum with results of 4,100 µg/L. Samples from RR2 and RR4 also exceeded the chronic criteria. No other tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

July 6, 2016: Nitrates and phosphates were also tested for during this sampling date. No tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

August 31 2016: No tested parameters, either in the laboratory samples or field samples, were above water quality standards (Appendix C).

Rio Grande:

Samples were taken at two locations on the Rio Grande during all three sampling days. During each sampling event, both sites were analyzed for *E. coli*, temperature, pH, DO, and conductivity. Site RG3 exceeded dissolved oxygen standards in July and RG2 exceeded in dissolved oxygen in August. No other exceedences of water quality were found at these two sites in 2016.

Discussion:

Rio Hondo

In 2016 The Rio Hondo continued to have good water quality. In 2014, there was one exceedence of pH at site H6 (near confluence with Rio Grande), and in 2015, that site had a pH within the limits, but showed *E. coli* levels of over 8,000 colonies/100ml (the water quality standard for *E. coli* is 235 cfu/100ml). No water quality standard exceedences were observed during 2013 or 2016. In 2007 and 2008 we did observe some high levels of *E. coli* in the lower sections of the Rio Hondo but these high *E. coli* levels had not been observed since 2008.

Rio Fernando

Amigos Bravos and Sentinels Rios de Taos have been collaborating to collect water quality samples and prepare the attached reports for rivers in the Taos area, including the Rio Fernando de Taos, for the past 10 years. Our sampling results show numerous *E. coli* water criteria exceedences in the Rio Fernando.

The New Mexico Environment Department and the USFS both conducted a special study of *E. coli* levels in the upper Rio Fernando that also demonstrated high and in some cases extremely high levels of *E. coli* in the upper Rio Fernando.¹ In 2010 NMED/USFS sampling showed *E. coli* concentrations at 461 cfu/100ml (about twice the allowable level) in the La Jara Pasture, 921 cfu/100ml (about 4 times the allowable level) in the Riparian enclosure, and >2,419 cfu/100ml (more than 10 times the allowable level) in the Gathering Pasture in the Upper Rio Fernando.² Sampling in 2007 and 2009 also found levels of *E. coli* above water quality standards in all three pastures.³

In 2016, we continued to see exceedences in the upper Rio Fernando following the beginning of cattle grazing. Dissolved oxygen, electrical conductivity, and *E. coli* levels exceeded standards at several of the sites during all 3 sampling events. *E. coli* was Too Numerous To Count at one of the upper sites in both June and July (FLJ in July and FRE in August).

Samples taken in June and July, 2014⁴ on the Rio Fernando at the mouth of La Jara Canyon (sites FLJ, FRE, FAP1) conclusively show the impact of cattle to the stream. Samples taken on June 13, 2014 prior to the seasonal release of cattle into La Jara Canyon showed *E. coli* at 0 CFU (Colony Forming Units) per 100 ml. However, samples taken on July 21, 2 days after the cows were removed after grazing for 26 days in La Jara Canyon, showed elevated levels of *E. coli* at 365 CFUs per 100 mls, or over 1.5 times higher than the allowable water quality standard of 235 CFUs per 100 mls. We will conduct similar monitoring before and after the cattle in 2017 if possible.

The contamination in the Rio Fernando is a threat to the public health and safety of the Taos Community and is unacceptable. The US Forest Service, the New Mexico Environment Department and our local decision makers must take action to restore the water quality of the Rio Fernando watershed and stop on-going pollution. Amigos Bravos will begin the Watershed Based Planning 319 process in January 2017.

Rio Pueblo de Taos

While there is no standard electrical conductivity standard for the lower Rio Pueblo de Taos and therefore no exceedences of standards, the electrical conductivity readings in the lower Rio Pueblo continue to be some of the highest recorded in the four river systems sampled. The levels

¹Carson National Forest *E. coli* Sampling Summaries for Apache Canyon and Rio Fernando de Taos, USFS 2007, 2009, and 2010.

²Ibid (2010 Report)

³Sampling in the La Jara Enclosure in 2007 showed levels of *E. coli* at 1986 cfu/100ml (about 8.5 times the allowable level) and 1732 cfu/100ml (7.4 times the allowable level) in 2009. Sampling in 2007 showed levels of *E. coli* in the riparian enclosure to be as high as 1732 cfu/100ml (7.4 times the allowable level) and >802 cfu/100ml (more than 3.4 times the allowable level) in 2009. No sampling was conducted in these pastures in 2008, 2011, 2012 or 2013.

were well above the standards that apply to similar river systems such as the Rio Hondo and Red River where the electrical conductivity standard is ≤ 400 microsiemens/cm. PS2 exhibited high levels of electrical conductivity in the first and third sampling events. PS2 also showed high levels of nitrates this year, with readings up to 44 times higher than the levels we see at other sites (0.2mg/L). Dissolved oxygen was also exceeded at this site in August.

Red River

Aluminum results from immediately below the Chevron mine (RR3) were well above the chronic and acute criteria during the June 9th, 2016 sampling event. Two additional sites, RR2 and RR4 also exceeded the chronic criteria during the June 9th sampling event. In addition to the mine there is also a lot of natural scaring in the drainages that feed into the Red River in this section of the river. The high aluminum levels could be coming from either or both of these sources.

Additionally, July 16, 2015 aluminum levels were: $>2,400\mu\text{g/L}$ at RR3 (Hardness of 140). This is over the chronic criteria for a hardness of 100 (1,370mg/L). In 2014, RR2, RR3 and RR4 were all in exceedence of acute criteria standards for aluminum, and all 4 Red River sites exceeded levels for chronic criteria aluminum standards. Chronic criteria cannot be exceeded more than once every 3 years, and RR3 has, for the third year in a row, officially exceeded chronic criteria. Combined with the acute Aluminum criteria exceedances in 2014 and in 2016, these results indicate that Aluminum should be listed as impaired Aluminum in New Mexico's 2018-2020 303d list of impaired waters.

Rio Grande

Dissolved oxygen standards were exceeded for the Rio Grande in both July and August. We will continue to keep these Rio Grande sites on our sampling plan for the next few years.

Conclusion/Recommendations:

- Sampling done in the Rio Hondo in 2016 did not show any water quality exceedances.
- Fred Baca Park and the adjacent Taos Land Trust property continues to have serious water quality problems with *E. coli*, dissolved oxygen and electrical conductivity. Efforts should be made to further identify sources and restore water quality at the Fred Baca site and in the headwaters.
- The upper Rio Fernando continues to be impacted by elevated levels of *E. coli* following the use of the La Jara canyon grazing pasture. Cattle grazing and wildlife use on Forest Service land has been suggested as a source of contamination. The Rio Fernando Watershed Based Planning Process will allow us to determine the sources of *E. coli* contamination in 2017-2018.
- Electrical conductivity readings in the lower Rio Pueblo de Taos continue to be high in 2016, as they have been for the past several years. Though standards are not exceeded since there is no standard applied to this section of the Rio Pueblo, similar river systems such as the Rio Hondo and Red River have an electrical conductivity standard of ≤ 400 microsiemens/cm. An electrical conductivity

standard should be considered for the lower stretch of the Rio Pueblo de Taos during the next Triennial Review process. New this year were also finding of very high Nitrate levels at PS3. We will be sure to monitor for this again in 2017.

- Phosphate levels in the lower Rio Pueblo de Taos were also high in the past several years, though standards are not exceeded since there is no standard applied to this section of the Rio Pueblo. Levels were not found to be high in 2016, but instead nitrates seems to be increasing.
- While some aspects of water quality have improved since 2011 in the perennial arroyo to the Rio Pueblo, which receives flow from the wastewater treatment plant, electrical conductivity, phosphate in past years, and not nitrates continue to greatly exceed the standards given to neighboring waterways.
- The huge difference between the Aluminum standard that applied to the Red River prior to 2010 and the current standard continues to be of concern. Especially since many samples in 2013-2015 were above the 2010 standard and below the 2013 standard. More investigation should be done to determine if the current 2013 standard is protective of designated uses in the Red River. Amigos Bravos fought for more protective standards during the 2015 New Mexico Triennial Review of Water Quality Standards but the standards remain the same.

APPENDIX A

SENTINELS-RIOS de TAOS WATER SAMPLING SITES

-2015 sites are in BOLD

ON THE RIO FERNANDO

FLJ	La Jara Canyon, about 200 meters upstream from HWY 64. N 36 25.160 W 105 20.592
FRE	Rio Fernando Riparian Exclosure, Taos Canyon Riparian Exclosure N 36 24.231 W 105 20.706
F1A	Above Shadybrook Development, about 5 miles east of Taos, by bridge on road to Valle Escondido N 36 22' 19.76" W 105 23' 07.75" (GE)
F1B	About 200 meters downstream from Shadybrook, by NF La Sombra campground. N 36 22' 10.45" W 105 28' 08.51" (GE)
F 1	About 10 yards downstream from the west bridge by the USFS parking lot at the Divisidero/South Boundary trailhead. On the north bank. N 36 22' 32.56" W 105 32' 49.92"
F2	About 10 yards upstream from Paseo del Pueblo Sur, across street from ABC Lock. On the north bank. We'll usually use this site only when a storm is in progress. N 36 23' 54.99" W 105 34' 38.76" (GE)
F3	About 25 yards downstream from Paseo del Pueblo Sur, by ABC Lock. On the south bank, by a concrete bar. N 36 23' 55.02" W 105 34' 39.25" (GE)
F4	Fred Baca Park, about 50 yards downstream from the footbridge at the bend. On northwest side. of stream. N36 23' 56.8" W105 35' 23.2"
F5	Taos Land Trust Property Office, pas the office by the wetland area.
F6	Taos Land Trust Property Office, near the entrance to the driveway.

FAP1 Small stream . Sample upstream of Apache Canyon Road about 15 feet below fence line.
N 36 23' 08.09"
W 105 19' 33.43"

ON THE RIO PUEBLO

P 1 About 27 yards downstream from the stop sign on Upper Ranchitos Road at Paseo del Pueblo Norte. On north side of stream by the car wash.
N36 25' 13"
W105 34' 23"

P1A Perennial spring about 100 feet from where it feeds into Rio Pueblo de Taos. Right where spring comes out of culvert that goes under Upper Ranchitos Rd about 200 feet from intersection with Ranchitos Rd.
N 36 24' 16.01"
W 105 35' 53.35

P1B Ranchitos Rd. Near bridge by Callegon Rd and SR 240 (near Hacienda de los Martinez). Mile Marker 4.
N 36 24' 1.30"
W 105 36' 25.71"

P1C Ranchitos Rd near mile marker 13 go down dirt road to the left by road to Blackstone Ranch.
N36 23' 34.6"
W 105 37' 26.4"

P 2 About 15 yards downstream from bridge (right near turn to Los Cordovas Rd) at Ranchitos Road and Culebra Road. On north side of stream by survey sign.
N 36 23' 23.74
W105 37' 50.46"

P2A Brad Hockmeyer and Janet Gauthier's property on the Rio Pueblo de Taos. Take Los Cordovas Rd. south towards the wastewater treatment facility. Take a right at number 118C. Take this drive all the way to the end making a sharp right at the Webber's property to continue onto the geodesic domes. Park at the domes and walk down to the river from here.
N 36 23' 11.78"
W 105 39' 03.37"

PS1 mainstem of Rio Pueblo de Taos about 200 yards upstream from the town of Taos wastewater effluent discharge arroyo. Valerie Graves is the property owner. Sample on rocky point bar in the middle of her property.
N 36 22' 50.47"
W105 39' 44.30"

PS2 Perennial effluent dependent arroyo (town of Taos wastewater discharge). Turn right onto Thomas Romero Rd and then an immediate right onto

Paintbrush Rd. Sample immediately after the gate (which is usually left open) in the arroyo.

N 36 22' 32.05"

W 105 39' 25.36"

PS3

Rio Pueblo de Taos about a quarter mile downstream from the confluence of the town of Taos wastewater arroyo and the Rio Pueblo. Drive on Thomas Romero Rd, past the open gravel pit on right until you reach the small subdivision. The road is usually gated past this point. Take a right at the subdivision and then your first right (on small dirt road) at the large map sign then take your first right again onto a small two track that crosses a couple of rough patches and then winds down to the river. Park on grassy open area upstream from the gazebo.

N 36 22' 41.26"

W 105 40' 05.63"

P 3

About 10 yards upstream from the road barrier from the parking lot on the northeast corner of Taos Junction Bridge area. On east bank of stream.

N 36 20' 19.63"

W 105 43' 47.36" (GE)

ON THE RIO HONDO

H 1

Above Phoenix Restaurant, which is upstream from the Bavarian Inn

N 36 34' 30.67"

W 105 26' 20.47" (GE)

H 2A

Rio Hondo just upstream from where the branch coming from Bavarian Inn (after going through the culvert under the trail) empties into the Rio Hondo.

N 36 34' 41.38"

W 105 26' 25.62 (GE)

H2B

Branch coming from Bavarian Inn just before it empties into the main Rio Hondo.

N 36 34' 41.90"

W 105 26' 25.88" (GE)

H 2C

About 10 yards upstream from the bridge near the day care center in the Ski Village. On the north bank.

N 36 35' 47.23

W 105 27' 15.19" (GE)

H2B2

Across from Phoenix switch back @ culvert between two dirt roads.

N 36 34' 33.14'

W 105 26' 21.31" (GE)

H2C2

Directly above Taos Ski Valley Effluent Pipe

N 36 35' 46.85"

W 105 27' 41.76" (GE)

- H2D Just above the Riverside property, about 175 yards downstream from the stop sign at the intersection of the Village of TSV maintenance road and Route 150. North bank.
N 36 35' 41.78"
W 105 28 16.37" (GE)
- H2E Rio Hondo directly downstream of effluent pipe
N36 35' 47"
W105 27' 43"
- H2F Taos Ski Valley effluent pipe
N 36 35' 46.77"
W 105 27' 42.29" (GE)
- H 3 Cuchilla Campground, just downstream from entrance road. North bank.
N 36 32' 32.08
W 105 33' 22.90 (GE)
- H 4 Kaufman Property. About 20 yards downstream from footbridge. South bank.**
N 36 32' 14.8"
W 105 38' 43.4"
- H4A Just downstream from Route 522 Bridge, north bank.
N 36 32' 07.1"
W 105 40' 02.7"
- H 5 About 20 yards upstream from bridge in Lower Arroyo Hondo, just before the road crosses the Rio Hondo and goes uphill towards New Buffalo. North bank**
N 36 31' 58.62"
W 105 40' 55.43"
- H 6 About 10 yards upstream from confluence with Rio Grande.**
N 26 32' 02.12
W 105 42' 27.26" (GE)
- HVB N 36 31' 58.5"
W 105 35' 04.0"
- HVG 5 M downstream from bridge on lane to Jackie Garcia property
N 36 32' 07.6"
W 105 34' 12.2".

ON THE RED RIVER

- RR1 Junebug Campground, approximately 10 miles east of Questa on HWY 38.**
N 36 42' 28.25"

W105 26' 04.92

RR2 **Goat Hill Campground, approximately 3 miles east of Questa on Hwy 38.**

N 36 41' 20.65"

W105 32' 27.73

RR3 **By the bridge at Hwy 522 in Questa.**

N 36 41' 33.69

W105 36' 44.50

RR4 **Below Red River Fish Hatchery, approximately 0.5 miles down the foot trail.**

N 36 40' 57.14"

W 105 39' 19.11"

ON THE RIO GRANDE DEL RANCHO

RGDR1 **Right above bridge on Partrick Larkin's property.**

ON THE RIO LUCERO

RL1 **Rio Lucero, private land.**

ON THE RIO GRANDE

RG2 **Just below the confluence of the Rio Grande and the Rio Pueblo de Taos.**

RG3 **Just below the confluence of the Rio Grande and the Rio Hondo.**

APPENDIX B

SENTINELS--RIOS de TAOS

QUALITY ASSURANCE PROJECT PLAN (QAPP)

Project Description

The goal of the Sentinels--Rios de Taos water monitoring project is to provide additional water quality data to local, state, and federal decision makers, as well as the public at large. This project was initiated due to a concern that inadequate data was available to accurately assess the health of the Rio Hondo, Rio Fernando, and Rio Pueblo de Taos watersheds. The cumulative impact of point and nonpoint sources of pollution will be characterized by collecting data on those parameters that are basic indicators of water quality and watershed health. Surface water samples collected by volunteer monitors will be analyzed for some or all of the following constituents:

- Nitrates
- Phosphorous
- Total Dissolved Solids
- E. Coli
- pH
- Conductivity
- Dissolved Oxygen
- Temperature
- Biological Oxygen Demand (BOD)
- Aluminum
- Hardness
- Residual Chlorine
- Ammonia

Sampling Locations

Sampling sites may change each year in an attempt to identify sources of pollution. Sites sampled in 2016 are shown in **bold**.

SENTINELS-RIOS de TAOS WATER SAMPLING SITES

ON THE RIO FERNANDO

- FLJ** **About 200 yards from the parking spot for La Jara Canyon off of Hwy 64, walk up Forest Road #5.**
N 36 25.160
W 105 20.592
- FRE** **The riparian enclosure, just below the wooden sign for “Taos Canyon Riparian Pasture”**
N 36 24.231
W 105 20.706
- F1A Above Shadybrook Development, about 5 miles east of Taos, by bridge on road to Valle Escondido
N 36 22’ 19.76”
W 105 23’ 07.75” (GE)
- F1B About 200 meters downstream from Shadybrook, by NF La Sombra campground.
N 36 22’ 10.45”
W 105 28’ 08.51” (GE)
- FAP1 Small stream . Sample upstream of Apache Canyon Road about 15 feet below fence line.
N 36 23’ 08.09”
W 105 19’ 33.43”
- F 1** **About 10 yards downstream from the west bridge by the USFS parking lot at the Divisidero/South Boundary trailhead. On the north bank.**
N 36 22’ 32.56”
W 105 32’ 49.92”
- F2 About 10 yards upstream from Paseo del Pueblo Sur, across street from ABC Lock.
On the north bank. We’ll usually use this site only when a storm is in progress.
N 36 23’ 54.99”
W 105 34’ 38.76” (GE)
- F3 About 25 yards downstream from Paseo del Pueblo Sur, by ABC Lock. On the south bank, by a concrete bar.
N 36 23’ 55.02”
W 105 34’ 39.25” (GE)
- F4** **Fred Baca Park, about 50 yards downstream from the footbridge at the bend. On northwest side. of stream.**
N36 23’ 56.8”
W105 35’ 23.2”
- F5** **Taos Land Trust Land, near office on La Posta Road. Location near road as you enter driveway**

F6 Taos Land Trust Land, down past the shed near their office in wetland area.

ON THE RIO PUEBLO

**P 1 About 27 yards downstream from the stop sign on Upper Ranchitos Road at Paseo del Pueblo Norte. On north side of stream by the car wash.
N36 25' 13"
W105 34' 23"**

P1A Perennial spring about 100 feet from where it feeds into Rio Pueblo de Taos. Right where spring comes out of culvert that goes under Upper Ranchitos Rd about 200 feet from intersection with Ranchitos Rd.
N 36 24' 16.01"
W 105 35' 53.35

**P1B Ranchitos Rd. Near bridge by Callegon Rd and SR 240 (near Hacienda de los Martinez). Mile Marker 4.
N 36 24' 1.30"
W 105 36' 25.71"**

P1C Ranchitos Rd near mile marker 13 go down dirt road to the left by road to Blackstone Ranch.
N36 23' 34.6"
W 105 37' 26.4"

P 2 About 15 yards downstream from bridge (right near turn to Los Cordovas Rd) at Ranchitos Road and Culebra Road. On north side of stream by survey sign.
N 36 23' 23.74
W105 37' 50.46"

P2A Brad Hockmeyer and Janet Gauthier's property on the Rio Pueblo de Taos. Take Los Cordovas Rd. south towards the wastewater treatment facility. Take a right at number 118C. Take this drive all the way to the end making a sharp right at the Webber's property to continue onto the geodesic domes. Park at the domes and walk down to the river from here.
N 36 23' 11.78"
W 105 39' 03.37"

PS1 mainstem of Rio Pueblo de Taos about 200 yards upstream from the town of Taos wastewater effluent discharge arroyo. Valerie Graves is the property owner. Sample on rocky point bar in the middle of her property.
N 36 22' 50.47"
W105 39' 44.30"

**PS2 Perennial effluent dependent arroyo (town of Taos wastewater discharge). Turn right onto Thomas Romero Rd and then an immediate right onto Paintbrush Rd. Sample immediately after the gate (which is usually left open) in the arroyo.
N 36 22' 32.05"
W 105 39' 25.36"**

PS3 **Rio Pueblo de Taos about a quarter mile downstream from the confluence of the town of Taos wastewater arroyo and the Rio Pueblo. Drive on Thomas Romero Rd, past the open gravel pit on right until you reach the small subdivision. The road is usually gated past this point. Take a right at the subdivision and then your first right (on small dirt road) at the large map sign then take your first right again onto a small two track that crosses a couple of rough patches and then winds down to the river. Park on grassy open area upstream from the gazebo.**
N 36 22' 41.26"
W 105 40' 05.63"

P 3 About 10 yards upstream from the road barrier from the parking lot on the northeast corner of Taos Junction Bridge area. On east bank of stream.
N 36 20' 19.63"
W 105 43' 47.36" (GE)

ON THE RIO HONDO

H 1 Above Phoenix Restaurant, which is upstream from the Bavarian Inn
N 36 34' 30.67"
W 105 26' 20.47" (GE)

H 2A Rio Hondo just upstream from where the branch coming from Bavarian Inn (after going through the culvert under the trail) empties into the Rio Hondo.
N 36 34' 41.38"
W 105 26' 25.62 (GE)

H2B Branch coming from Bavarian Inn just before it empties into the main Rio Hondo.
N 36 34' 41.90"
W 105 26' 25.88" (GE)

H 2C **About 10 yards upstream from the bridge near the day care center in the Ski Village. On the north bank.**
N 36 35' 47.23
W 105 27' 15.19" (GE)

H2B2 **Across from Phoenix switch back @ culvert between two dirt roads.**
N 36 34' 33.14'
W 105 26' 21.31" (GE)

H2C2 Directly above Taos Ski Valley Effluent Pipe
N 36 35' 46.85"
W 105 27' 41.76" (GE)

H2D Just above the Riverside property, about 175 yards downstream from the stop sign at the intersection of the Village of TSV maintenance road and Route 150. North bank.
N 36 35' 41.78"

W 105 28 16.37" (GE)

- H2E** **Rio Hondo directly downstream of effluent pipe**
N36 35' 47"
W105 27' 43"
- H2F Taos Ski Valley effluent pipe
N 36 35' 46.77"
W 105 27' 42.29" (GE)
- H 3** **Cuchilla Campground, just downstream from entrance road. North bank.**
N 36 32' 32.08
W 105 33' 22.90 (GE)
- H 4 Kaufman Property. About 20 yards downstream from footbridge. South bank.
N 36 32' 14.8"
W 105 38' 43.4"
- H4A Just downstream from Route 522 Bridge, north bank.
N 36 32' 07.1"
W 105 40' 02.7"
- H 5 About 20 yards upstream from bridge in Lower Arroyo Hondo, just before the
road crosses the Rio Hondo and goes uphill towards New Buffalo. North bank
N 36 31' 58.62"
W 105 40' 55.43"
- H 6** **About 10 yards upstream from confluence with Rio Grande.**
N 26 32' 02.12
W 105 42' 27.26" (GE)
- HVB N 36 31' 58.5"
W 105 35' 04.0"
- HVG 5 M downstream from bridge on lane to Jackie Garcia property
N 36 32' 07.6"
W 105 34' 12.2".

ON THE RED RIVER

- RR1** **Junebug Campground, approximately 10 miles east of Questa on**
HWY 38.
N 36 42' 28.25"
W105 26' 04.92
- RR2** **Goat Hill Campground, approximately 3 miles east of Questa on Hwy**
38.
N 36 41' 20.65"
W105 32' 27.73

RR3 **By the bridge at Hwy 522 in Questa.**
N 36 41' 33.69
W105 36' 44.50

RR4 **Below Red River Fish Hatchery, approximately 0.5 miles down the**
foot trail.
N 36 40' 57.14"
W 105 39' 19.11"

ON THE RIO GRANDE DEL RANCHO

RGDR1 Right above bridge on Partrick Larkin's property.

ON THE RIO LUCERO

RL1 Rio Lucero, private land.

ON THE RIO GRANDE

RG2: Near the confluence of the Rio Hondo and the Rio Grande.

RG3: In Pilar, NM near the Rio Pueblo and Rio Grande confluence.

Testing results will be sent to Region 6 of the Environmental Protection Agency (EPA), the State of New Mexico Environmental Department's Surface Water Quality Bureau, Amigos Bravos, and local newspapers and publications. Sampling results will be stored in the Sierra Club Sentinels--Rios de Taos database.

Project Organization

Project Coordinator Contact information:

Eric E. Patterson
Box 334
Valdez, NM 87580
575-776-2833
eepatt@gmail.com

The project coordinator ensures all components of the project identified by this QAPP are completed in an efficient and timely manner. This includes oversight on sample collection, delivery, analysis, and reporting.

Sample Collector Contact Information

Eric E. Patterson, contact person (see above)

Mary Pickett	Nora Patterson	Rachel Conn
Gary Grief	Dorothy Wells	Betsy Wolf
Annouk Ellis	Jeanne Green	Moira O’Hanlon
Roberta Salazar	Flowers Espinosa	Shannon Romeling

Sample collectors will conduct sample collection activities according to the methods identified by this QAPP. Responsibilities include:

- Calibration, maintenance and utilization of field equipment for analysis of dissolved oxygen (DO), temperature, pH, and conductivity.
- Obtaining needed sample containers and preservatives for sampling events.
- Following quality assurance procedures for sample collection identified by this QAPP.
- Filling out chain of custody (COC) forms.

Sample Transport Contact Information

Eric E. Patterson (see above)

Sample Transport will ensure that water samples are delivered to Sangre de Cristo Laboratory, Inc., Alamosa, CO, or another EPA certified laboratory, in a secure and timely manner.

Responsibilities include:

- Keeping samples secure between sampling site and the laboratory.
- Maintaining COC document according to procedures identified.
- Delivering samples within specified holding times.

Sample Analysis/Laboratory Contact Information:

Sangre de Cristo Laboratory, Inc., an EPA certified laboratory
 Tierra del Sol Industrial Park
 2329 Lava Lane
 Alamosa, CO 81101

Sample Analysis Staff will ensure that samples are analyzed in a manner that provides the most accurate data possible. Responsibilities include:

- Analyzing samples according the methods identified in Standard Operating Procedures (SOPs).

- Analyzing samples within established holding times.
- Reporting results to Project Coordinator

Data Reporting Contact Information

Rachel Conn, Amigos Bravos Projects Director
 Box 238
 Taos, NM 87571
 575-758-3874
 rconn@amigosbravos.org

Data reporting will ensure the data collected by the project is stored appropriately and disseminated to interested parties. Responsibilities include:

- Organization of final report on data collected by the project.
- Dissemination of report to specified local, state and federal agencies.
- Dissemination of report to newspapers and other local news media and presentation of project information to the public upon request.
- Entering data into Sierra Club's Water Sentinel database.

Quality Assurance of Field Analysis

Measurements will be made using the following equipment:

- CHEMets Dissolved Oxygen Kit, Model K-7512 – tested dissolved oxygen
- Euteck Instruments PCTestr 35 from Oakton – tested pH, temperature, and electrical conductivity
- Hach Model 5-EP MG/L #1454-01 test kit – tests hardness (calcium carbonate)

PARAMETER	DETECTION LIMIT	ACCURACY
Dissolved Oxygen	1 to 12 mg/L	+/- 1 ppm
Temperature	0° to 50° C	+/- 0.5° C
Conductivity	0 to 1999 µS/cm	+/-10 µS/cm

pH	0.00 to 14.00 ph units	+/- .001 pH units
Hardness	0 to 400 mg/L calcium carbonate	+/- 20 mg/L

Field instruments will be calibrated according to manufacturers' instructions <24 hours prior to each sampling event. Chemicals used for dissolved oxygen will be replaced according to expiration dates provided by the manufacturer. Samples will be collected using the containers, preservatives, volumes and holding times identified in Appendix A.

Field Sample Collection Procedures

Samples will be collected:

- Midstream just below the water's surface.
- Facing upstream to avoid disturbances caused by the sample collector.
- Upstream of minor temporal or spatial impacts, such as bridges and campsites.
- Free of floating debris.
- Using appropriate sample containers and preservatives specified in Appendix A.

Samples will be tagged appropriately with identifying number/information and delivered to appropriate laboratory personnel accompanied by appropriately completed and signed Chain of Custody (COC) forms.

Quality Assurance of Laboratory Analysis

Quality assurance of laboratory methods is the sole responsibility of the sample analysis/laboratory coordinator previously identified. Samples with high turbidity (>30 NTU) are filtered through a 10um filter before being analyzed for Aluminum. Samples will be analyzed using methods contained in the laboratory's Standard Operating Procedures. These are located at Sangre de Cristo Laboratory, Inc. and can be obtained from the sample analysis coordinator upon request.

METHODS FOR LABORATORY ANALYSIS		
MATRIX	PARAMETER	METHOD
Nonpotable water	Total Dissolved Solids	EPA 160.1
Nonpotable water	Nitrates	EPA 300.0

Nonpotable water	Total Phosphorus	EPA 365.2
Nonpotable water	E. Coli	EPA 10030
Nonpotable water	BOD	SM 5210B
Nonpotable water	Ammonia	4500NH3D
Nonpotable water	Residual Chlorine	300.5
Nonpotable water	Phosphate	420.1
Nonpotable water	Aluminum	200.9

Containers, Volumes, Preservatives, and Holding Times

Parameter	Optimum Volume	Container Type	Preservation Method	Holding Time
Total Nitrogen (Calculation: TKN + (NO ₂ + NO ₃ as N))	250 mL	Plastic, Glass	Cool	48 Hours
Total Phosphorus	250 mL	Plastic, Glass	Cool	24 Hours
Total Suspended Solids (also called Non Filterable Residue)	500 mL	Plastic, Glass	Cool	24 Hours
E. coli or Fecal Coliform	150 mL	Sterile Bottle	Cool	8 Hours
Dissolved Oxygen	Determined On-Site			None
Temperature	Determined On-Site			None
Conductivity	Determined On-Site			None