Santa Fe River from Nichols Reservoir to the Outfall of the Santa Fe Wastewater Treatment Facility

Use Attainability Analysis

New Mexico Environment Department
November 2012

Summary

The subject of this Use Attainability Analysis (UAA) is the Santa Fe River from Nichols Reservoir to the outfall of the Santa Fe wastewater treatment facility. The purposes of this UAA are (1) to identify the attainable contact and aquatic life uses, and (2) to support the division of this portion of the river into two classified segments.

The Santa Fe River watershed supplies approximately 5,000 acre-feet of water per year, which is allocated by water property rights to the City of Santa Fe for public water supply and to other contractual deliveries. In February 2012, the Santa Fe City Council passed the *Target Flow for a Living River Ordinance*, which formalized the city's commitment to provide up to 1,000 acre-feet per year for the Santa Fe River. This UAA investigates the contact and aquatic life uses that are attainable commensurate with Santa Fe River *Target Flows*.

This UAA supports the following conclusions:

- For the Santa Fe River from Nichols Reservoir to the outfall of the Santa Fe wastewater treatment facility, the highest attainable contact use is primary contact;
- From Nichols Reservoir to Guadalupe Street, the highest attainable aquatic life use is coolwater, and from Guadalupe Street to the Santa Fe wastewater treatment facility, the highest attainable aquatic life use is limited aquatic life;
- From Guadalupe Street to the outfall of the Santa Fe wastewater treatment facility, the marginal warmwater aquatic life use is not attainable due to ephemeral, intermittent or low flow conditions or water levels that are the result of upstream dams and diversions.

The UAA supports the following changes to Water Quality Standards:

- For the Santa Fe River from Nichols Reservoir to the outfall of the Santa Fe wastewater treatment facility, change the current contact criteria to the default primary contact criteria of *E. coli* 126 cfu/100 ml (monthly geometric mean) and 410 cfu/100 ml (single sample);
- From Nichols Reservoir to Guadalupe Street, change the current marginal warmwater aquatic life use to the coolwater aquatic life use;
- From Guadalupe Street to the Santa Fe wastewater treatment facility, change the current marginal warmwater aquatic life use to the limited aquatic life use.

A contact or aquatic life use that supports the goals listed in Section 101(a)(2) of the federal Clean Water Act may be removed or changed to a use with less stringent criteria if the use is unattainable due to one or more of six factors listed in 40 CFR 131.10(g). For the reach of the Santa Fe River from Guadalupe Street to the outfall of the Santa Fe wastewater treatment facility, the currently designated aquatic life use is unattainable because of factor 40 CFR 131.10(g)(4): "Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use." For this reach, upstream dams (McClure and Nichols Reservoir dams) and diversions for city water supply and irrigation by acequias (Llano, Cerro Gordo, Muralla and Madre) result in ephemeral, intermittent or low flow conditions or water levels that preclude the attainment of the currently designated marginal warmwater aquatic life use. It is not feasible to restore this reach to conditions that support the currently designated use because the water available to the river can be less than water rights allocations for water supply and irrigation. Because marginal warmwater aquatic life use is unattainable, this UAA supports a change from the marginal warmwater aquatic life use to the limited aquatic life use.

Environmental Setting and Current Condition

The Santa Fe River extends from its headwaters east of Santa Fe at an elevation of 11,600 feet (3540 meters) to its discharge on the Rio Grande southwest of Cochiti Reservoir at an elevation of 5,230 feet (1590 meters). Except for a short stretch between Nichols Reservoir and Cerro Gordo Park in ecoregions 21c and 21d, the river to the wastewater treatment facility outfall is in ecoregion 22h (Griffith 2006). From Nichols Reservoir to the Santa Fe wastewater treatment facility, the river is currently considered by New Mexico Water Quality Standards (NMED 2012a) to be an unclassified intermittent stream. The portion of the river that is the subject of this UAA is shown in Figure 1.

The streamcourse through the eastern (downtown) area of the city is channelized and directed under roads and bridges, and through the western (residential and industrial) areas is surrounded by commercial and industrial operations and degraded by off-road vehicle activity. Recently, a portion of the streamcourse (primarily from the bridge at Saint Francis Drive to Frenchy's Field) has been planted in native riparian vegetation and modified with hydraulic structures to improve stream characteristics.

Borchert and Lewis (2010) provide the following description of the hydrology of the river:

> Historians, ecologists, and hydrologists disagree to what extent the pre-historic river flowed perennially and where, if at all, the ephemeral reaches began. Since the 1950s the amount of water in the urban reach is highly uncertain from year to year. In the city limits, without bypasses from upstream reservoirs, the Santa Fe River flows only as the result of precipitation events or when the upper watershed yield exceeds municipal water demand and upstream storage capacity. The 4,974 acre-feet median annual yield of the Santa Fe River is only slightly less than the city's water right of 5,040 acre-feet/year and half of the city's annual demand of 10,000 acre-feet/year. Since streamflow gauging downstream of the municipal reservoirs began in 1999, the urban Santa Fe River has been dry on average about 220 days of the year; of those days with flow, 30 percent result from storms.

As indicated above, the Santa Fe River watershed supplies approximately half of the City of Santa Fe's water demand. Water is impounded by McClure and Nichols Reservoirs and processed at the municipal water treatment plant for distribution to city residents, and some water is diverted for irrigation.

In February 2012, the Santa Fe City Council passed the *Target Flow for a Living River Ordinance* (Santa Fe 2012a), which formalized the city's commitment to use up to 1,000 acre-feet per year of the city's water supply (from bypass flows) for the Santa Fe River, depending upon hydrologic conditions in the Santa Fe River watershed. Bypass flows are defined in *Administrative Procedures for Santa Fe River Target Flows* (Santa Fe 2012b) to be "water that the City chooses not to store in the municipal reservoirs and thus allows to flow to the Santa Fe River below Nichols Reservoir provided that the rate at which the bypass flow is passed through the outlet works of Nichols Reservoir dam is always equal to or less than the stream inflow at the 'above McClure' gage."

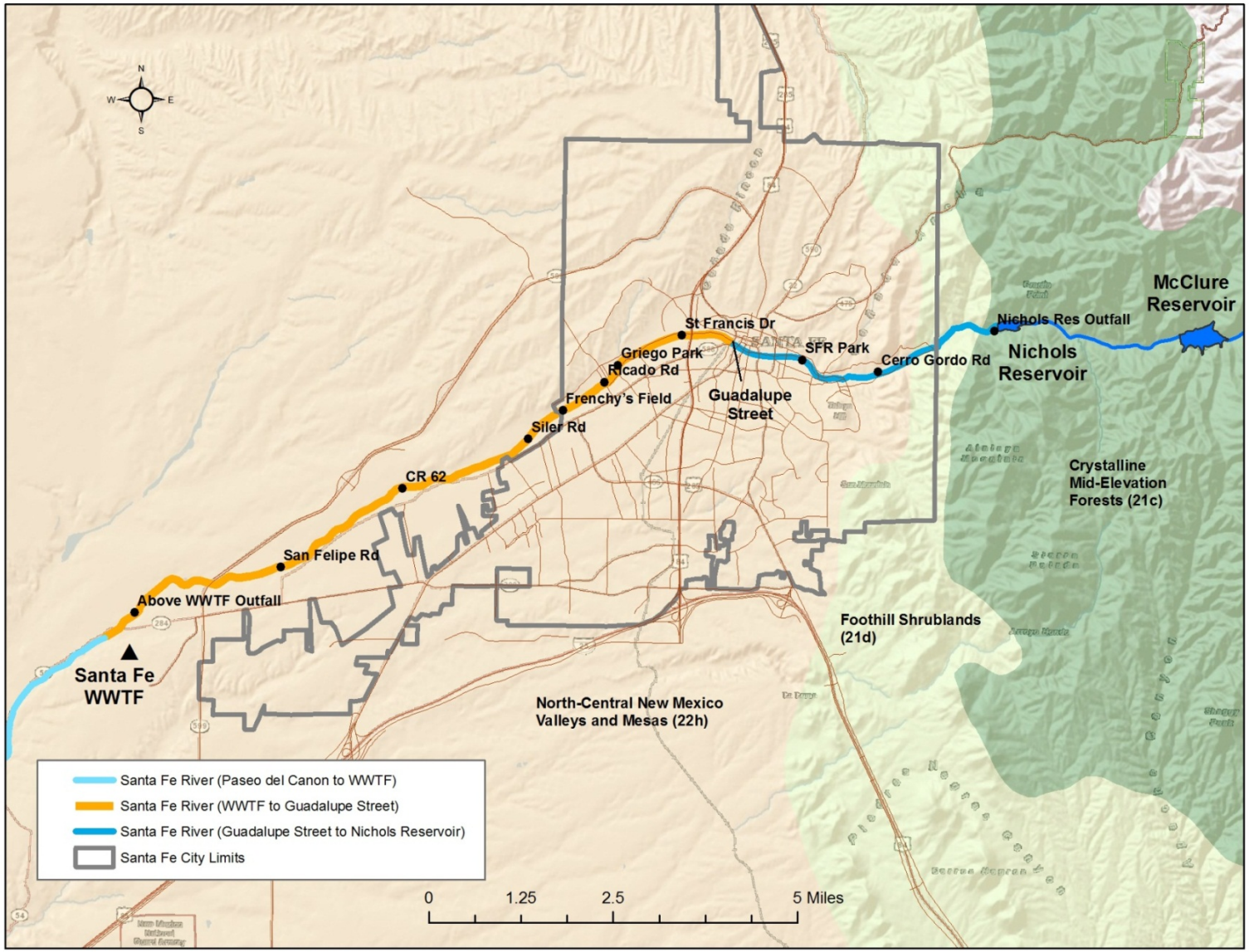

Figure 1.
Santa Fe River – McClure Reservoir to Cochiti Boundary

Physical Investigations

Santa Fe River Studies Modeling

Lewis and Borchert (2009) estimated flow percentiles at the gage above Saint Francis Drive, located approximately one-half mile downstream of Guadalupe Street, not considering the contribution of storm runoff below Nichols Reservoir. According to Lewis and Borchert, the 20th percentile (P20) represents a drought year; the 80th percentile (P80) represents a wet year, and the 50th percentile (P50) represents the median flow.

Table 1.
Estimated flow percentiles at the gage above Saint Francis Drive
(From Table 6, Lewis and Borchert 2009)

Gage Location	P20 ac-ft/yr (cfs)	P50 ac-ft/yr (cfs)	P80 ac-ft/yr (cfs)
Above Saint Francis Drive	0 (0)	234 (0.3)	3,360 (4.6)

The seasonal pattern is shown in Figure 2.

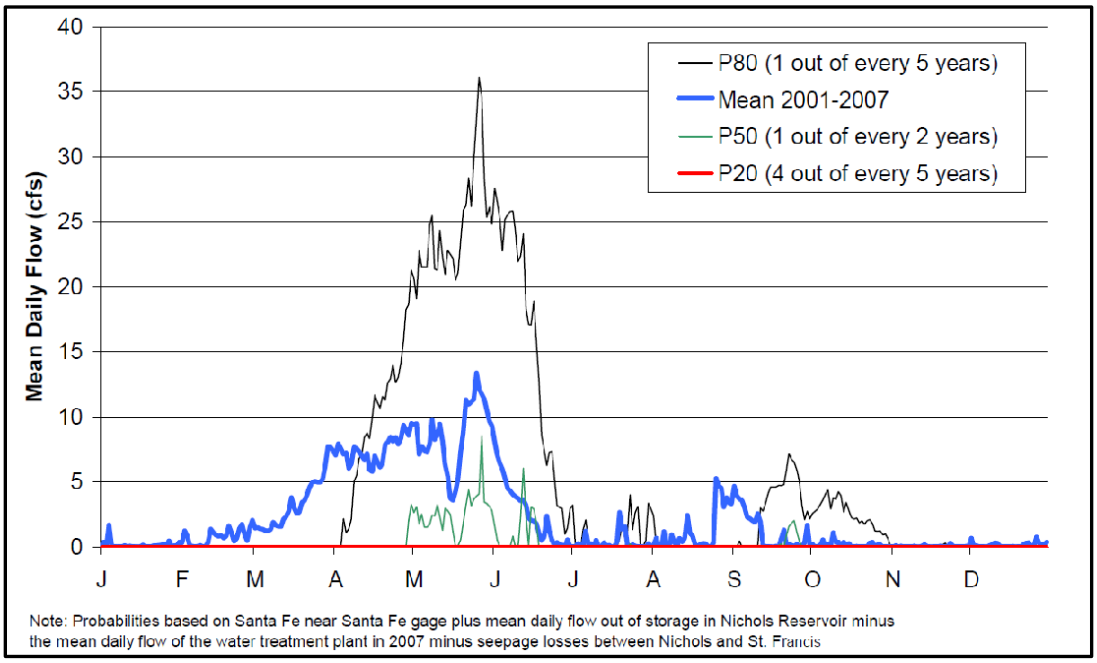

Figure 2.
Estimated probability of mean daily flow at the gage above Saint Francis Drive adjusted to the long-term record (From Figure 15, Lewis and Borchert 2009)

The definition of intermittent in the New Mexico Water Quality Standards (NMED 2012a) is: "the water body contains water for extended periods only at certain times of the year, such as when it receives seasonal flow from springs or melting snow." Although the pattern above may not correspond to future patterns, modeled flows indicate that at Saint Francis Drive, the river will at least meet the definition of intermittent (seasonal flow) on 1 of every 2 years. With the planned pattern of bypass flows that are designed to match seasonal patterns, the river may increasingly attain intermittent conditions at Guadalupe Street, which is located about one-half mile upstream of Saint Francis Drive.

Subsurface Water Levels and Geology

Subsurface water level elevation contours provide information about the possible extent of surface water flows. As indicated in the map in the appendix (Fig. A1), Johnson (2009) shows a closed depression in the water level contours in the vicinity of Saint Francis Drive resulting from pumping of Santa Fe city wells. This depression is a potential sink for perennial or intermittent flow.

Pantea et al. (2011) includes the following statement: "The Agua Fria fault system contains the principal east-dipping San Isidro Crossing fault and extends from the Tijeras-Cañoncito fault in the south to north of the Santa Fe River arroyo where it is exposed and dips approximately 70°." As indicated in the map from Pantea et al. (2011) in the appendix (Fig. A2), the San Isidro Crossing fault is located downstream of Guadalupe Street and might be a conduit for groundwater infiltration, which may also limit the extent of perennial and intermittent flows.

Hydrology Protocol and Results

As described in Section II of New Mexico's Water Quality Management Plan and Continuing Planning Process (NMED 2011a), the Hydrology Protocol (NMED 2011b) was conducted in spring/summer months during 2008, 2009, 2011 and 2012. This information was evaluated to determine the existing and attainable hydrology of the unclassified portion of the Santa Fe River, and provide technical support for this UAA.

The Hydrology Protocol (HP) was conducted at ten locations, and results are summarized in Table 2. HP determinations were made for up to 14 different attributes for each location and points assigned for each attribute (see Appendix, Table A2). According to HP guidelines, sites that score less than 9 are considered ephemeral; that score from 9 to 19 (inclusive) are considered intermittent; and that score greater than 19 are considered perennial. Table A2 includes a column labeled "excluding Water-in-Channel," which is the score if points for water in the channel are removed from the total score. The purpose for providing this column is to better indicate the condition of the hydrologic regime, whether or not water was present at the time the HP was conducted.

On May 22, 2012, because of a 3 cfs bypass flow from Nichols Reservoir, there was water in the channel from Nichols Reservoir almost to Siler Road. According to HP surveys on this date, three locations (Santa Fe River Park on old East Alameda, below Saint Francis Drive, and Griego Park) scored in the perennial range due to points assigned for the presence of water, and in the intermittent range if the points for water are not included in the score. Especially in the upstream portion of the river bounded by these locations, disconnected pools to base flows are generally present, although there may not always be continuous downstream flow.

At the Santa Fe River Park location on old East Alameda Street, the total HP score was in the perennial range, and benthic macroinvertebrates were observed. At the Saint Francis Drive and Griego Park locations, the total HP scores were in the perennial range. However, the location may not actually be perennial because the points assigned for lack of rooted vegetation may reflect the situation described in NMED (2011b) "high gradient sand bedded streams located within flashy watersheds," and not in fact be evidence of perennial flow.

The average HP score at Frenchy's Field is in the low intermittent range (10.8) when points for Water-in-Channel are excluded, and somewhat higher (12.8) when water is included; however as indicated above, points assigned for absence of upland plants in the streambed may not represent perennial or intermittent conditions. The HP score upstream of Siler Road is in the low intermittent range when Water-in-Channel is excluded (the score is 9) and somewhat higher (11) if water is included. However, the HP scores are elevated for this and other downstream locations by the absence of upland plants in the streambed, which is likely due to the character of the sand-bedded watercourse, vehicle activity in the streambed and nearby industrial operations. Although bypass or seasonal flows may reach Siler, water commonly sinks into the alluvium upstream of Siler Road.

According to the analysis described above, the Santa Fe River from Nichols Reservoir to a location upstream of Saint Francis Drive is perennial or intermittent, and should be recognized as perennial when there is flowing water due to bypass flows, seasonal snowmelt or storm flows. Largely as a result of the HP results, this UAA proposes that Guadalupe Street, located about one-half mile upstream of Saint Francis Drive, is the appropriate location to separate the perennial/intermittent portion from the downstream ephemeral portion of the Santa Fe River. That is, the portion river from Guadalupe Street upstream is perennial or intermittent, whether the water is from bypass flows, snowmelt, storm flows or base flow. Further, the portion of the river from Guadalupe Street downstream to the wastewater treatment facility is ephemeral.

Table 2.
Hydrology Protocol Results Summary

Location (listed from upstream to downstream)	HP Score excluding Water-in-Channel	HP Score including Water-in-Channel	Condition	Basis for Condition Statement
At Nichols Reservoir Outfall	19.5	25.5	Perennial	Score is in the perennial range. Water was present. Three points each were assigned due to surrounding riparian vegetation, lack of plants in the streambed and particle size sorting. Points were assigned for benthic macroinvertebrates and filamentous algae.
Below Cerro Gordo Road[1]	19.2	25.2	Perennial	Score is in the perennial range. Water was present. Points ranged from 1.5 to 3 for differences in vegetation and for lack of upland plants in the streambed. Points ranged from1 to 3 for riffle/pool sequence and for particle size sorting. Points were assigned for benthic macroinvertebrates and filamentous algae.
Near Santa Fe River Park on old E. Alameda Street	15.5	21.5	Intermittent or Perennial	Score is in the perennial range. Water was present due to bypass flow. Without water, the score is in the intermittent range. Three points were for surrounding riparian vegetation, 3 were for lack of upland plants in the streambed and 3 were for particle size sorting, and 2.5 points were for riffle/pool sequence. Points were assigned for presence of macroinvertebrates.
Below Saint Francis Drive	14.5	20.5	Intermittent or Perennial	Score is in the perennial range. Water was present due to bypass flow. Without water, the score is in the intermittent range. Three points were due to surrounding riparian vegetation. The location was assigned three points each for lack of upland plants in the streambed, presence of riffle/pool sequence, and particle size sorting.
Griego Park	15	21	Intermittent or Perennial	Score is in the perennial range. Water was present due bypass flow. Without water, the score is in the intermittent range. Points were assigned for differences in vegetation in part due to recent willow and cottonwood plantings; there is more established riparian vegetation immediately upstream. The location was assigned three points each for lack of upland plants in the streambed, presence of riffle/pool sequence and particle size sorting.
Frenchy's Field[2]	10.8	12.8	Ephemeral	Scores averaged in the intermittent range. However, three points were assigned for lack of upland plants in the streambed which is partly due to exposed rock and sandy substrate. Highly erosive flows and/or depth of scour in response to extreme rainfall events may limit the presence of rooted vegetation. Water was present due to bypass flow on one date.
Above Siler Road	9	11	Ephemeral	Score is at the bottom of the intermittent range. However, points were assigned for lack of upland plants in the streambed which is the result of vehicle activity and nearby commercial or industrial operations. Water was present due to bypass flow.
At CR 62 (Lopez Lane)	11.75	11.75	Ephemeral	Score is in the intermittent range. However, points were assigned for lack of upland plants in the streambed which may be partially due to sandy substrate and scouring during flood flows. Points were also assigned for a wide floodplain. Vehicle activity and nearby commercial operations influence both of these indicators.
Near San Felipe Road/Agua Fria[3]	12.4	12.4	Ephemeral	Score averages12.4, in the intermittent range. However, points were assigned for lack of upland plants in the streambed which may be partially due to sandy substrate and scouring during flood flows and for a wide floodplain. Vehicle activity and nearby sand and gravel operations influence both of these indicators.
Above WWTF Outfall	9	9	Ephemeral	Score is at the bottom of the intermittent range. However, three points were assigned for a wide floodplain which is the result of nearby sand and gravel operations.

[1]HP score is an average of three dates.
[2]HP score is an average of three dates.
[3]HP score is an average of two dates.

Water Temperature and Aquatic Life Use

The Air-Water Temperature Correlation (NMED 2011c) can be used to evaluate water-temperature based attainable aquatic life uses according to a correlation to July average air temperature. The summary page to the correlation document states that:

- high quality and coldwater uses may be attainable if July average air temperature is ≤ 18°C;
- marginal coldwater and coolwater uses may be attainable if July average air temperature is ≤ 23°C;
- uses more restrictive than warmwater are generally not attainable if July average air temperature is > 23°C.

July average air temperatures are available from PRISM (Parameter-elevation Regressions on Independent Slopes Model, http://prism.oregonstate.edu/). July average air temperatures are also available from Griffith (2006), which indicates that for the ecoregions relevant to this UAA, Level IV Ecoregions 21d and 22h, July average air temperature ranges from 19 to 22°C. The Air-Water Correlation includes a formula for predicting the maximum water temperature from the July average air temperature: TMAX = 1.07 * ATEMP + 4.95.

Table 3.
Air and Water Temperature Statistics

Location	Ecoregion (Griffith 2006)	July Average Air Temp (Griffith 2006) °C	July Average Air Temp (PRISM) °C	Predicted (from PRISM) Max Water Temp °C	Measured Max Water Temp °C
Below Nichols Reservoir	21d	19	18.10	24.32	---
Guadalupe Street	22h	22	21.00	27.42	---
Santa Fe River at WWTF outfall	22h	22	21.29	27.73	28.88

From the information in Table 3 and the guidelines from the Air-Water Correlation, the naturally occurring water temperature for the reach from Nichols Reservoir to the Santa Fe wastewater treatment facility outfall is in the coolwater or marginal coldwater aquatic life range (maximum 24 to 29°C) and coolwater or marginal coldwater aquatic life may be attainable.

The coolwater use describes conditions that support aquatic life whose physiological tolerances are intermediate between warm and coldwater aquatic life. For the Santa Fe River from Nichols Reservoir to the Santa Fe wastewater treatment facility outfall, naturally occurring water temperatures are in the coolwater range (29°C maximum temperature).

The marginal coldwater use is a coldwater use that is modified by the word “marginal” because the use is limited by intermittent or low flows or other natural habitat conditions (such as water temperatures that severely limit maintenance of a coldwater aquatic life population). For this reach, although intermittent or low flows may limit the use, naturally occurring water temperatures are in the coolwater range and a coldwater use (marginal or otherwise) is not the best description of the use.

Fish Collection Records

There are no well-documented fish collection records for this portion of the river. As indicated in Table A3, in the Santa Fe River at locations downstream of the wastewater treatment facility or at the Rio Grande/Santa Fe River confluence, *Catostomus (Pantosteus) plebeius* and *Pimephales promelas* have been collected in 1958, 1988, 1990, 1993, 2000 and 2009.

Conclusion

The majority of Santa Fe River water is impounded by McClure and Nichols Reservoirs and either processed at the municipal water treatment plant for public water supply or diverted for irrigation. Water property rights for these uses are subject to change only through a State legal process. As indicated by Section 101(g) of the Federal Clean Water Act and Subsection A of Section 74-6-12 NMSA 1978, neither the Clean Water Act nor the New Mexico Water Quality Standards have the power to modify water property rights.

Hydrologic modifications to the river include those listed in factor 131.10(g)(4): “Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition to operate such modification in a way that would result in the attainment of the use.” Hydrologic modifications that affect the river may also include pumping from city wells that are located downstream of Guadalupe Street. In addition, geologic conditions such as the San Isidro Crossing Fault may limit the extent of surface water flows.

For the Santa Fe River downstream of Guadalupe Street, evidence from the Hydrology Protocol and from Santa Fe River modeling studies indicates that bypass flows in combination with seasonal and storm flows do not provide sufficient water to support the current marginal warmwater aquatic life use. Flows are limited by hydrologic modifications including upstream dams and diversions, although natural causes such as sandy substrate and local geology may also contribute to low flows. Considering the flow regime, the highest aquatic life use that can be attained from Guadalupe Street to the wastewater treatment facility discharge is limited aquatic life.

For the Santa Fe River from the Nichols Reservoir to Guadalupe Street, estimated and modeled flows indicate that there is sufficient water during much of the year to support aquatic life. That is, bypass flows as a result of the city’s *Target Flow for a Living River Ordinance*, seasonal snowmelt, storm flow and base flow provide sufficient water to support aquatic life, although not necessarily fish. Therefore, because (1) of the presence of sufficient water, and (2) the naturally attainable water temperature is in the coolwater range, coolwater is the highest attainable aquatic life use for this reach.

For both the upper and lower portions of the river that are the subject of this UAA (Nichols Reservoir to the outfall of the Santa Fe wastewater treatment facility), primary contact can be expected and has been observed through the surrounding Santa Fe urban environment. As recently as 2010, seasonal snowmelt and reservoir releases have resulted in flows to the wastewater treatment facility. Therefore, this UAA supports changing from the current less stringent primary contact criteria of E*. coli* monthly geometric mean value of 206 cfu/100 ml and single sample value of 940 cfu/100 ml to the default primary contact criteria of *E. coli* monthly geometric mean value of 126 cfu/100 ml and single sample value of 410 cfu/100 ml.

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Appendix

Current Classification and Use Attainment Status

The Santa Fe River from Nichols Reservoir to the Santa Fe wastewater treatment facility is currently considered by New Mexico Water Quality Standards (NMED 2012a) to be an unclassified intermittent stream, Section 20.6.4.98, as indicated below:

20.6.4.98 INTERMITTENT WATERS - All non-perennial unclassified waters of the state, except those ephemeral waters included under 20.6.4.97 NMAC.

A. Designated Uses: livestock watering, wildlife habitat, marginal warmwater aquatic life and primary contact.

B. Criteria: the use-specific criteria in 20.6.4.900 NMAC are applicable to the designated uses, except that the following site-specific criteria apply: the monthly geometric mean of E. coli bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

This portion of the river is identified in the 2012-2014 303(d)/305(b) Integrated List (NMED 2012b) as Assessment Unit NM-9000.A_061. Use attainment status is shown below.

Table A1.
Use Attainment Status for Assessment Unit NM-9000.A_061

Designated Use	Attainment Status	Probable Causes of Impairment
Livestock Watering	Fully Supporting	
Wildlife Habitat	Not Supporting	PCBs
Marginal Warmwater Aquatic Life	Not Supporting	Aluminum, PCBs
Primary Contact	Not Supporting	E. coli

Relevant Contact and Aquatic Life Use Definitions

Primary contact means any recreational or other water use in which there is prolonged and intimate human contact with the water, such as swimming and water skiing, involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard. Primary contact also means any use of surface waters of the state for cultural, religious or ceremonial purposes in which there is intimate human contact with the water, including but not limited to ingestion or immersion that could pose a significant health hazard.

Secondary contact means any recreational or other water use in which human contact with the water may occur and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, wading, commercial and recreational boating and any limited seasonal contact.

Limited aquatic life as a designated use means the surface water is capable of supporting only a limited community of aquatic life. This subcategory includes surface waters that support aquatic species selectively adapted to take advantage of naturally occurring rapid environmental changes, ephemeral or intermittent water, high turbidity, fluctuating temperature, low dissolved oxygen content or unique chemical characteristics.

Marginal warmwater in reference to an aquatic life use means natural intermittent or low flow or other natural habitat conditions severely limit the ability of the surface water of the state to sustain a natural aquatic life population on a continuous annual basis; or historical data indicate that natural water temperature routinely exceeds 32.2 ºC (90 ºF).

Coolwater in reference to an aquatic life use means the water temperature and other characteristics are suitable for the support or propagation of aquatic life whose physiological tolerances are intermediate between and may overlap those of warm and coldwater aquatic life.

Marginal coldwater in reference to an aquatic life use means that natural intermittent or low flows, or other natural habitat conditions severely limit maintenance of a coldwater aquatic life population or historical data indicate that the temperature in the surface water of the state may exceed 25°C (77°F).

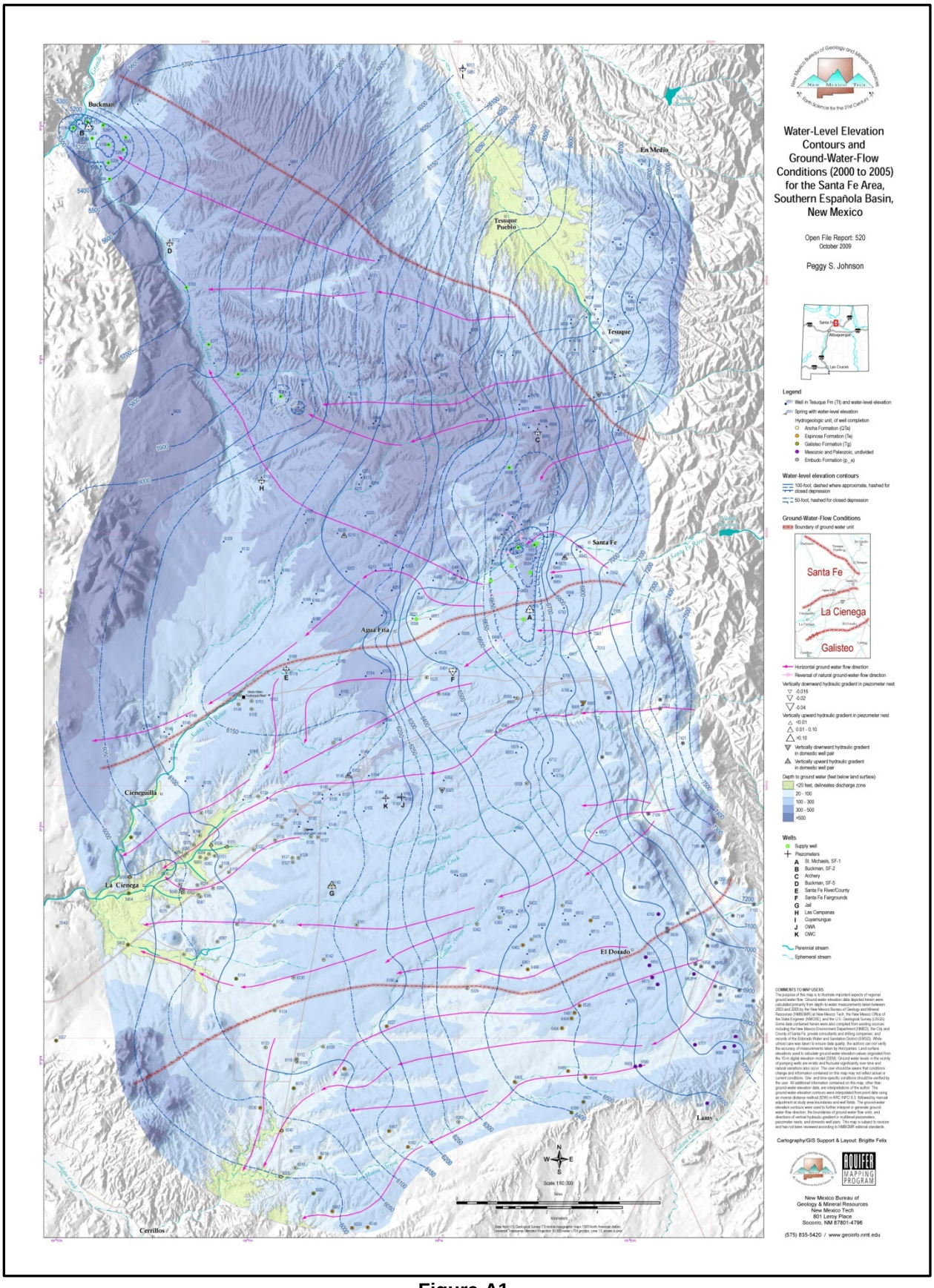

Figure A1.
Water Level Elevation Contours and Ground Water Flow
(From Johnson 2009)

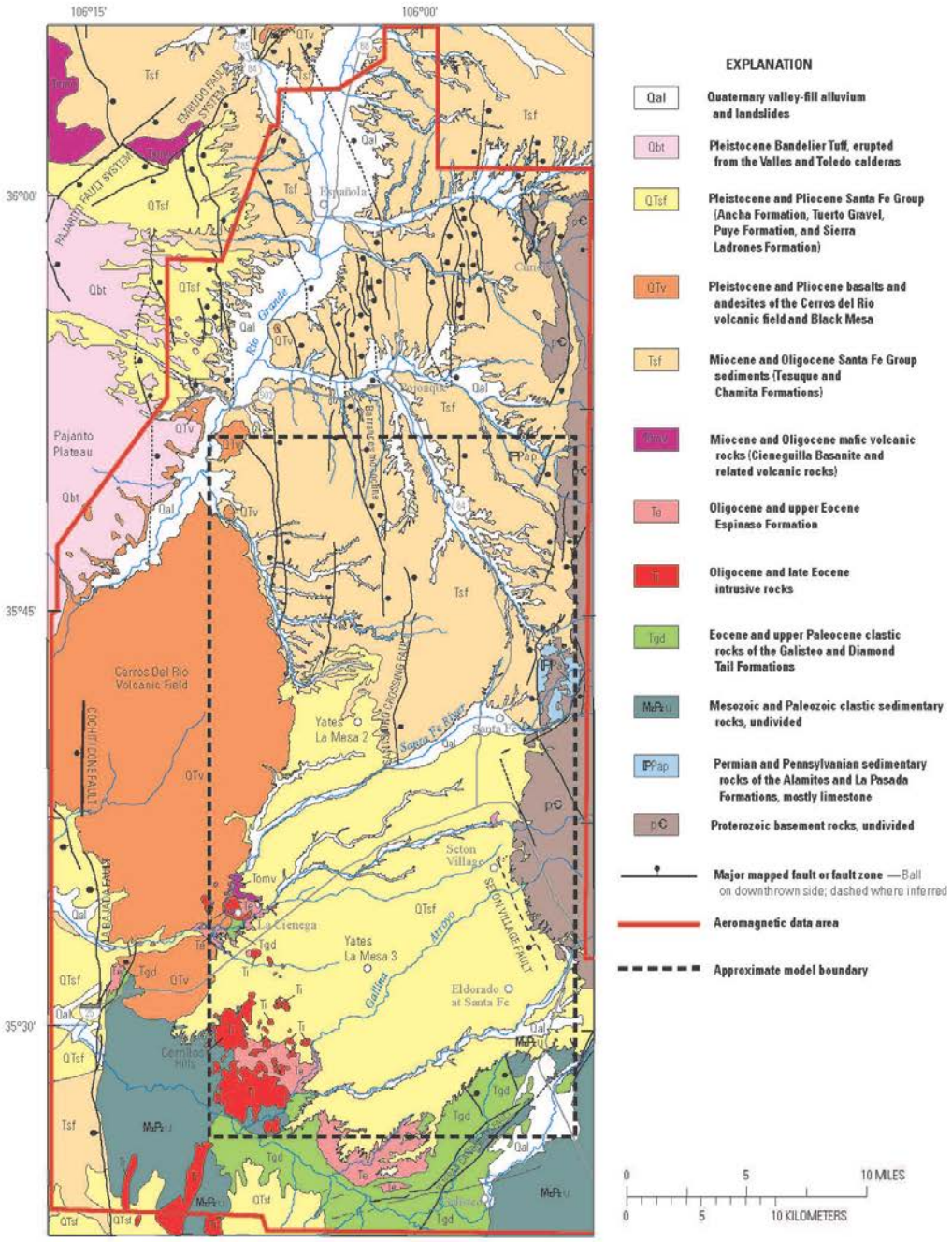

Figure 3. Generalized geology and geography of the study area. Geologic contacts are generalized from Read and others (2005), Minor (2006), New Mexico Bureau of Geology and Mineral Resources, (2003), Koning (2005), and Koning and others (2005).

Figure A2.
Generalized Geology and Geography
(From Pantea et al. 2011)

Table A2. Hydrology Protocol Details

Site Name	Santa Fe River abv WWTF Outfall	Santa Fe River near San Felipe Rd/Agua Fria	Santa Fe River near San Felipe Rd/Agua Fria	Santa Fe River at CR 62 (Lopez Lane)	Santa Fe River abv Siler	Santa Fe River below Frenchy's Field	Santa Fe River below Frenchy's Field	Santa Fe River at Frenchy's Field abv Foot Bridge	Santa Fe River at Griego Park	Santa Fe River below Saint Francis Drive	Santa Fe River near SFR Park on Old E. Alameda	Santa Fe River below Cerro Gordo Rd	Santa Fe River below Cerro Gordo Rd	Santa Fe River below Cerro Gordo Rd	Santa Fe River at Nichols Reservoir Outfall
Date	5/22/2012	3/15/2011	5/22/2012	5/22/2012	5/22/2012	6/26/2008	3/15/2011	5/22/2012	5/22/2012	5/22/2012	5/22/2012	9/11/2008	5/13/2009	3/15/2011	3/15/2011
Site ID (km upstream)						44.5	44.5	44.5				52.4	52.4	52.4	55.3
Lat	35.63271	35.64196	35.64233	35.65768	35.66767	35.67283	35.67335	35.67356	35.68232	35.68836	35.68372	35.68157	35.68148	35.68148	35.68972
Long (west)	106.08758	106.05254	106.05054	106.02339	105.9932	105.98618	105.98489	105.98480	105.97173	105.95638	105.92730	105.90949	105.9091	105.9091	105.88108
Elevation	6290	6425	6430	6566	6688	6732	6732	6732	6810	6890	7053	7185	7185	7185	7425
Ecoregion	22h	22h	22h	22h	22h	22h	22h	22h	22h	22h	22h	21d	21d	21d	21c
HP Score 1.01 - 1.14	9	13.3	11.5	11.75	11	8.5	11.9	18	21	20.5	21.5	27	21	27.5	25.5
HP Score 1.02 - 1.14	9	13.3	11.5	11.75	9	8.5	11.9	12	15	14.5	15.5	21	15	21.5	19.5
1.01 Water in Channel (0 - dry channel; 6 - flow evident)	0	0	0	0	2	0	0	6	6	6	6	6	6	6	6
1.02 Fish (0 - fish absent; 3 - fish easily found)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.03 Benthic Macro-invertebrates(0 - absent; 3 - found easily and consistently)	0	0	0	0	0	0	0	0	0	0	2	3	1	3	3
1.04 Filamentous Algae - Periphyton (0 - absent; 3 - found easily and consistently)	0	0	0	0	0	0	0	0	0	0	0	2.5	1	3	3
1.05 Differences in Vegetation(0 - no differences; 3 - dramatic differences)	1.5	2	2	2	2	1.5	1	2	3	3	3	1.5	2.5	3	3
1.06 Upland Plants in Streambed Score(0 - upland plants present; 3 - upland plants absent)	0.5	3	2	2	2	3	3	3	3	3	3	3	2.5	3	3
1.07 Sinuosity (0 - stream straight; 3 - stream highly sinuous)	1	1	1.5	2	1	1	1	1	1	1	1	1	1.75	1	1
1.08 Entrenchment Ratio Score (0 - stream entrenched; 3 - stream slightly entrenched)	3	1.8	1.5	1.5	1	1	1.4	1.5	1	0	0	3	3	2	1
1.09 Riffle-Pool Sequence (0 - absent; 3 - frequent riffles and pools)	1	1	1.5	1	1	0	1	2	3	3	2.5	2	1	2	1

Site Name	Santa Fe River abv WWTF Outfall	Santa Fe River near San Felipe Rd/Agua Fria	Santa Fe River near San Felipe Rd/Agua Fria	Santa Fe River at CR 62 (Lopez Lane)	Santa Fe River abv Siler	Santa Fe River below Frenchy's Field	Santa Fe River below Frenchy's Field	Santa Fe River at Frenchy's Field abv Foot Bridge	Santa Fe River at Griego Park	Santa Fe River below Saint Francis Drive	Santa Fe River near SFR Park on Old E. Alameda	Santa Fe River below Cerro Gordo Rd	Santa Fe River below Cerro Gordo Rd	Santa Fe River below Cerro Gordo Rd	Santa Fe River at Nichols Reservoir Outfall
1.10 Particle Size / Stream Substrate Sorting (0 - none; 3 - channel ≠ upland & substrate sorting)	1.5	3	2.25	2.25	1.5	1.5	3	1.5	3	3	3	1.5	1.5	3	3
1.11 Hydric Soils (0 - absent; 3 - present)	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
1.12 Sediment on Plants & Debris (0 - absent; 1.5 - found easily)	0.5	1.5	0.75	1	0.5	0.5	1.5	1	1	1.5	1	0.5	0.75	1.5	1.5
1.13 Seeps & Springs (0 - absent; 1.5 - present)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.14 Iron Oxidizing Bacteria & Fungi (0 - absent; 1.5 - present)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A3. Summary of Fish Collection Records

Genus	Species	Locality	Lat	Long	Collector	Date Collected	Project
Pimephales	promelas	15N08E06 SANTA FE 12 MI SW AT LA CIENE	35.561167	-106.147330		08/22/1958	
Catostomus	plebeius	15N08E06 SANTA FE 12 MI SW AT LA CIENE	35.561167	-106.147330		08/22/1958	
Pimephales	promelas	Rio Grande, immediately downstream of Santa Fe River confluence (Site 8)	35.600497	-106.341212	K.R. Bestgen and S.P. Platania	7/20/1988	
Pantosteus	plebeius	Rio Grande, immediately downstream of Santa Fe River confluence (Site 8)	35.600497	-106.341212	K.R. Bestgen and S.P. Platania	7/20/1988	
Pimephales	promelas	Rio Grande, at Santa Fe River confluence, Cochiti Pueblo.	35.600935	-106.34056	S.P. Platania and J.P. Larson	7/24/1993	Cochiti Dam Area 1993 Survey
Pantosteus	plebeius	Rio Grande, at Santa Fe River confluence, Cochiti Pueblo.	35.600935	-106.34056	S.P. Platania and J.P. Larson	7/24/1993	Cochiti Dam Area 1993 Survey
Pimephales	promelas	Rio Grande, Santa Fe River confluence, Cochiti Pueblo.	35.600872	-106.340492	S.P. Platania and B.M. Burr	10/29/1990	
Pantosteus	plebeius	Rio Grande, Santa Fe River confluence, Cochiti Pueblo.	35.600872	-106.340492	S.P. Platania and B.M. Burr	10/29/1990	
Pimephales	promelas	Rio Grande, Santa Fe River confluence, Cochiti Pueblo.	35.6009	-106.340462	S.P. Platania and D.A. Young	4/19/1990	
Pantosteus	plebeius	Santa Fe River, at the confluence with Rio Grande.	35.600661	-106.340238	S.P. Platania, C.S. Altenbach, and J.P. Larson	7/23/1993	Cochiti Dam Area 1993 Survey
Pimephales	promelas	Santa Fe River, 100 m upstream of the confluence with the Rio Grande (Site 5)	35.600029	-106.339427	K.R. Bestgen and S.P. Platania	7/20/1988	
Pantosteus	plebeius	Santa Fe River, 100 m upstream of the confluence with the Rio Grande (Site 5)	35.600029	-106.339427	K.R. Bestgen and S.P. Platania	7/20/1988	
Pantosteus	plebeius	Santa Fe River, at NM State HWY 22 bridge.	35.593371	-106.330239	S.P. Platania, C.S. Altenbach, and J.P. Larson	7/23/1993	Cochiti Dam Area 1993 Survey
Pantosteus	plebeius	Santa Fe River, at State Highway 22 crossing on Cochiti Pueblo (Site 6)	35.593371	-106.330236	K.R. Bestgen, S.P. Platania, and J.N. Stuart	7/19/1988	
Pimephales	promelas	Santa Fe River, 1.0 km upstream of State Highway 22 at flume (Cochiti Pueblo) (Site 7).	35.589796	-106.320098	K.R. Bestgen, S.P. Platania, and J.N. Stuart	7/19/1988	
Pantosteus	plebeius	Santa Fe River, 1.0 km upstream of State Highway 22 at flume (Cochiti Pueblo) (Site 7).	35.589796	-106.320098	K.R. Bestgen, S.P. Platania, and J.N. Stuart	7/19/1988	
Pimephales	promelas	Santa Fe River, ca. 250 meters upstream of the USGS gauge near La Bajada.	35.5468	-106.2154	G. Schiffmiller	4/28/2000	New Mexico Environment Department, 2000 Collections
Pantosteus	plebeius	Santa Fe River, ca. 250 meters upstream of the USGS gauge near La Bajada.	35.5468	-106.2154	G. Schiffmiller	4/28/2000	New Mexico Environment Department, 2000 Collections
Pimephales	promelas	Santa Fe River, at wastewater treatment plant effluent channel and immediately below, off Paseo Real	35.6307	-106.0822	G. Schiffmiller	4/27/2000	New Mexico Environment Department, 2000 Collections
Pantosteus	plebeius	Santa Fe River, at wastewater treatment plant effluent channel and immediately below, off Paseo Real	35.6307	-106.0822	G. Schiffmiller	4/27/2000	New Mexico Environment Department, 2000 Collections
Pimephales	promelas	Santa Fe River, at Cochiti Springs.			S.P. Platania and C.S. Altenbach	7/23/1993	Cochiti Dam Area 1993 Survey
Pantosteus	plebeius	Santa Fe River, at Cochiti Springs.			S.P. Platania and C.S. Altenbach	7/23/1993	Cochiti Dam Area 1993 Survey
Pantosteus	plebeius	Santa Fe River, ca. 1.0 mile above NM State HWY 22 bridge.			S.P. Platania, C.S. Altenbach, and J.P. Larson	7/23/1993	Cochiti Dam Area 1993 Survey
Pimephales	promelas	Santa Fe River, ca. 4.0 miles west of La Cienega, off US Interstate HWY 25.			B.L. Christman	5/14/2009	2009 Miscellaneous Collections of Fishes
Pimephales	promelas	Santa Fe River, at Cañon, just west of US Interstate 25.			R. Hansen, B. Weinstock, Enriquez, McGuire, and G. Gustina	5/19/2009	BLM Taos Vouchers From Water Surveys
Pantosteus	plebeius	Santa Fe River, at Cañon, just west of US Interstate 25.			R. Hansen, B. Weinstock, Enriquez, McGuire, and G. Gustina	5/19/2009	BLM Taos Vouchers From Water Surveys