WATER QUALITY SURVEY SUMMARY

FOR THE

UPPER RIO GRANDE WATERSHED

(Cochiti Reservoir to the Colorado border)

2009

Prepared by

Surface Water Quality Bureau
New Mexico Environment Department
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LIST OF ACRONYMS

ALU	Aquatic Life Use
AU	Assessment Unit
DO	Dissolved Oxygen
MAS	Monitoring and Assessment Section
NMAC	New Mexico Administrative Code
SCI	Stream Condition Index
SFNF	Santa Fe National Forest
STORET	Storage and Retrieval System
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WWTP	Wastewater Treatment Plant
WQS	Water Quality Standards

EXECUTIVE SUMMARY

The Surface Water Quality Bureau conducted a water quality survey of the Upper Rio Grande watershed between March and October, 2009. The project area includes the Rio Grande watershed upstream from Cochiti Reservoir to the Colorado border (Figure 1). Some of the major tributaries included in this study are Embudo Creek, the Red River, Rio Hondo, Rio Pueblo de Taos, Rio Costilla, and the Santa Cruz River. The Rio Chama, tributaries that drain Los Alamos and the Pajarito Plateau, and several streams in the Valle Vidal unit of the Carson National Forest were not sampled in this survey due to previous and on-going monitoring in the area.

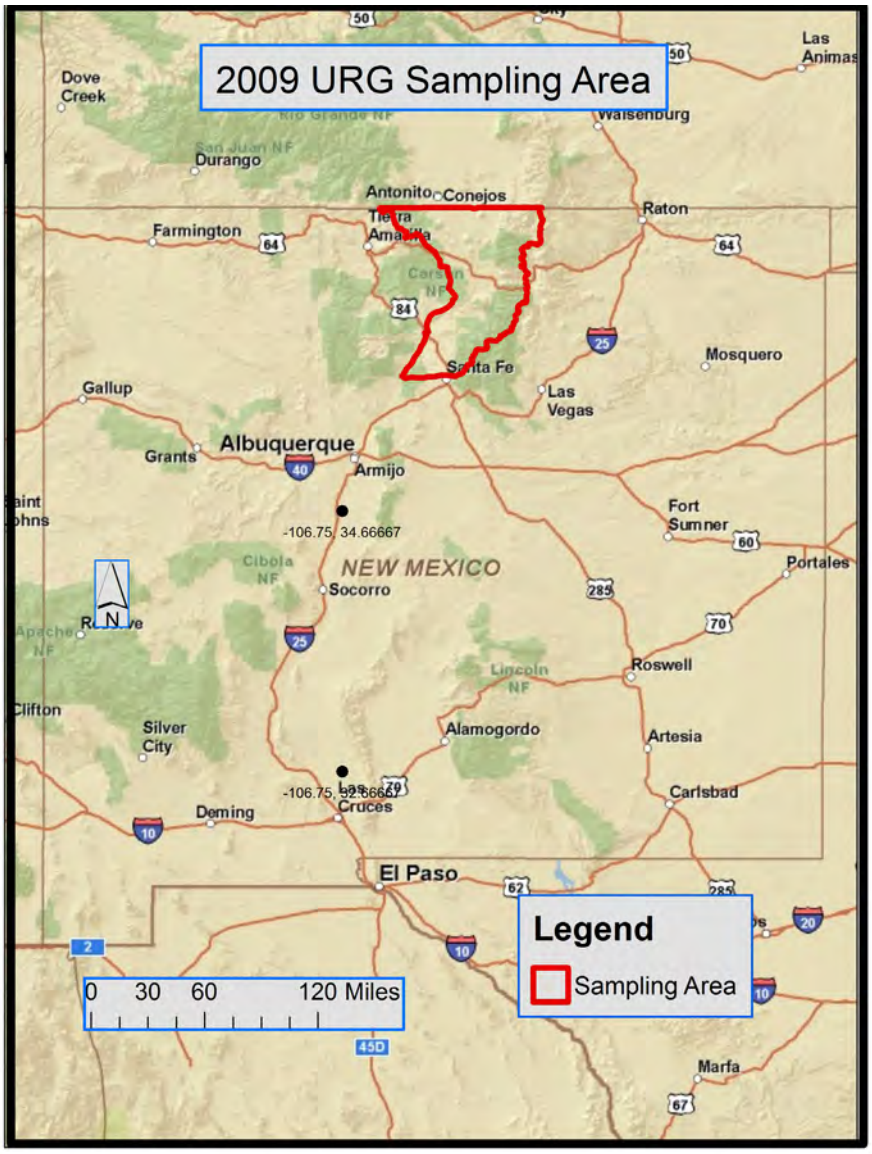

Figure 1. Upper Rio Grande watershed location within Northern New Mexico, USA.

The primary purpose of this survey was to collect chemical, physical, and biological data to evaluate water quality within the watershed. The data collected are assessed against New Mexico Water Quality Standards (WQS; NMWQCC 2011) and impaired waters are summarized in the WQCC-Approved 2012-2014 Integrated List portion of the biennial *State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report* (NMED/SWQB 2012). It is important to note that both the assessment protocols and water quality standards are revised periodically to incorporate new information and refinements. Any assessment conclusions presented in this report are based on water quality standards and assessment protocols that existed at the time the report was developed. The U.S. Environmental Protection Agency (USEPA) uses the most recent state-developed assessment protocols and the most recent USEPA-approved water quality standards when deciding whether or not to approve impairment determinations on the biennial *New Mexico Integrated List of Impaired Waters*. Therefore, the impairment conclusions in the most recent Integrated List will supersede assessment conclusions in this survey report if they should differ.

Water chemistry, physical habitat, and biological sampling occurred at stations which were selected based on previous survey findings, proximity to potential sources, and input from various interested parties outside of NMED–SWQB. Chemical analyses included total nutrients, total and dissolved metals, major anions and cations, radionuclides, organics, and microbiological collections. In addition, data loggers were deployed at select stations to collect temperature, pH, dissolved oxygen, conductivity, and turbidity data to monitor diurnal trends. Biological surveys (macroinvertebrates, periphyton, fish community) and physical habitat surveys were also conducted at select sites.

Water quality in the Upper Rio Grande watershed was found to exceed a number of water quality criteria.

- **Total Aluminum:** Bitter Creek.

  Note: A total aluminum standard has been adopted by the WQCC, but has not been approved by EPA. The WQCC-adopted total aluminum standard determined the impairment status for the WQCC-Approved 2012-2014 Integrated List (NMED/SWQB 2012).

- **Ammonia:** Unnamed Arroyo below Taos Wastewater Treatment Plant (WWTP).
- ***E. coli*:** Rio Fernando, Rio Grande, Rio Quemado, Rio San Antonio, Rio Santa Barbara, Unnamed Arroyo below Taos WWTP, and Santa Cruz River.
- **Nutrient/Eutrophication Biological Indicators:** Embudo Creek, Red River, Rio Fernando de Taos, Rio Grande del Rancho, Rio Pueblo, Rio Pueblo de Taos, and Unnamed Arroyo below Taos WWTP.
- **Specific Conductance:** Rio Grande del Rancho and Rio Fernando de Taos.
- **Temperature:** Embudo Creek, Rio Grande, Rio Pueblo de Taos, Rio Santa Barbra, Rio Grande del Rancho, Rio Fernando de Taos, Rio San Antonio, Rio de los Pinos, Cañada Tĩo Grande, and Rio Hondo.
- **Sediment/Siltation:** Rio Fernando de Taos, Pioneer Creek, and Cordova Creek.
- **Turbidity:** Rio Grande and Bitter Creek.

1.0 INTRODUCTION

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the upper Rio Grande watershed between March and October, 2009. The survey area included 75 sampling sites in the Rio Grande watershed upstream from Cochiti Reservoir to the Colorado border. Some of the major tributaries included in this study are Embudo Creek, the Red River, Rio Hondo, Rio Pueblo de Taos, Rio Costilla, and the Santa Cruz River. General watershed characteristics are summarized in Table 1. SWQB staff presented the monitoring plan at two public meetings, one on February 2, 2009 in Española, NM and the other on February 3, 2009 in Taos, NM. The Rio Chama, tributaries that drain Los Alamos and the Pajarito Plateau, and several streams in the Valle Vidal Unit of the Carson National Forest were not sampled during this survey due to previous and on-going monitoring in the area.

Table 1. General characteristics of watersheds in the Upper Rio Grande.

Watershed	Area		Watershed Lower Elevation		Watershed Upper Elevation	
	Square Kilometers	*Square Miles*	Meters	*Feet*	Meters	*Feet*
Embudo	828	*320*	1,768	*5,800*	3,970	*13,024*
Los Pinos	259	*100*	2,432*	*7,980**	3,322*	*10,900**
Red River	489	*189*	2,042	*6,700*	4,011	*13,161*
Rio Costilla	648	*250*	2,361*	*7,747**	3,836	*12,585*
Rio Grande (abv Cochiti Reservoir)	9,477	*3,659*	1,615	*5,300*	4,011*	*13,161**
Rio Hondo	183	*71*	1,972	*6,470*	4,011	*13,161*
Rio Pueblo de Taos	1,085	*419*	1,868	*6,130*	4,011	*13,161*
Rio San Antonio	319	*123*	2,432	*7,980*	3,200	*10,500*
Rio Tesuque (abv Tesque Pueblo)	202	*78*	2,067	*6,780*	3,630	*11,910*
Santa Cruz (abv Santa Clara Pueblo)	474	*183*	1,740	*5,709*	3,993	*13,100*

* Elevations and areas calculated for the portions of the watershed within the State of New Mexico only.

Water chemistry, physical habitat, and biota were studied to characterize the streams and water quality. Water quality monitoring enables an assessment against New Mexico WQS (NMWQCC 2011) to determine if the waterbodies in the survey are meeting their designated uses. River and streams are divided into individual assessment units (AU) based on differing geological and hydrological properties. Each AU is assessed individually with data from one or more monitoring sites per AU.

Water quality monitoring was conducted over three seasons to enable an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream from the sites. Samples collected during unstable conditions, such as monsoon storm events, are only used for assessment against the acute criteria (Photos 1 and 2). Biological and physical habitat sampling occurred under low flow conditions at select stations during the biological index period in late summer and fall.

Photo 1. Photo of high turbidity, in response to monsoon thunderstorm, observed on the Red River above Chevron Questa Mine site looking upstream (9/16/2009).

Photo 2. Photo looking uphill from Highway 38 at sediment source about 1 mile downstream of Red River WWTP (9/16/2009).

The geology of the Upper Rio Grande watershed consists of a complex distribution of Precambrian metamorphic rocks, Paleozoic sedimentary rocks and Tertiary volcanics (Figure 2). The Upper Rio Grande bisects two distinct geologic areas. The area west of the Rio Grande mainly consists of late Quaternary to Tertiary basalts formed as a result of tectonic events associated with the Rio Grande Rift. The Tertiary basalt flows are interbedded with sands and gravels, which were deposited during periods of erosion between volcanic events. The Rio Grande has incised a deep north-south canyon through these basalt flows from the Colorado border to Velarde, NM. Immediately east of the Rio Grande recent alluvial deposits cover these basalt deposits. The source of this alluvial material is the Sangre de Cristo Mountains which parallel the river. The Sangre de Cristo Mountains mainly consist of Precambrian metamorphic rocks (amphibolites, granitic gneiss, and mica schist) and granitic stocks. Dikes of rhyolite, monzonite porphyry, latite and andesite are also present. Not as common, but still notable, are the scattered deposits of Pennsylvanian sediments including conglomerates, sandstones, shales and limestones. This portion of the Sangre de Cristo range is highly mineralized and heavily mined as a result.

Land ownership in the Upper Rio Grande basin, within the study area, is 46% private, 18% Bureau of Land Management (BLM), 12% U.S. Forest Service (USFS), 12% State, and 11% Native lands (Figure 3; Table 2). Land use in the upper Rio Grande watershed is composed of a variety of purposes including cattle range, mining, and forest products (Figure 4; Table 3). Additionally, the area is heavily utilized by the public for fishing, hunting, camping, off-road vehicles, river rafting, and skiing. Approximately 38,600 commercial passengers floated sections of the upper Rio Grande in 2008 (BLM pers. com.).

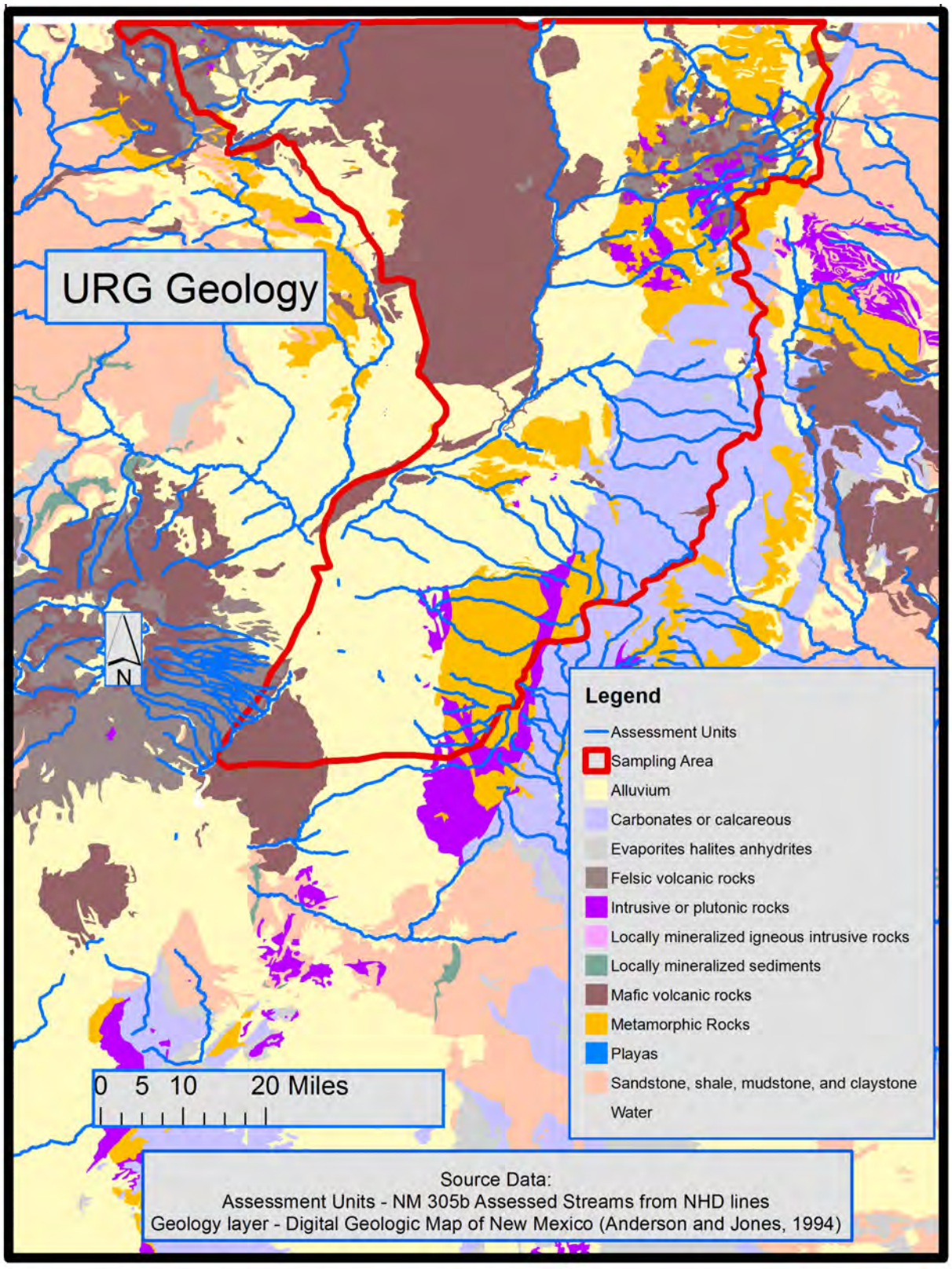

Figure 2. Geology of the Upper Rio Grande watershed.

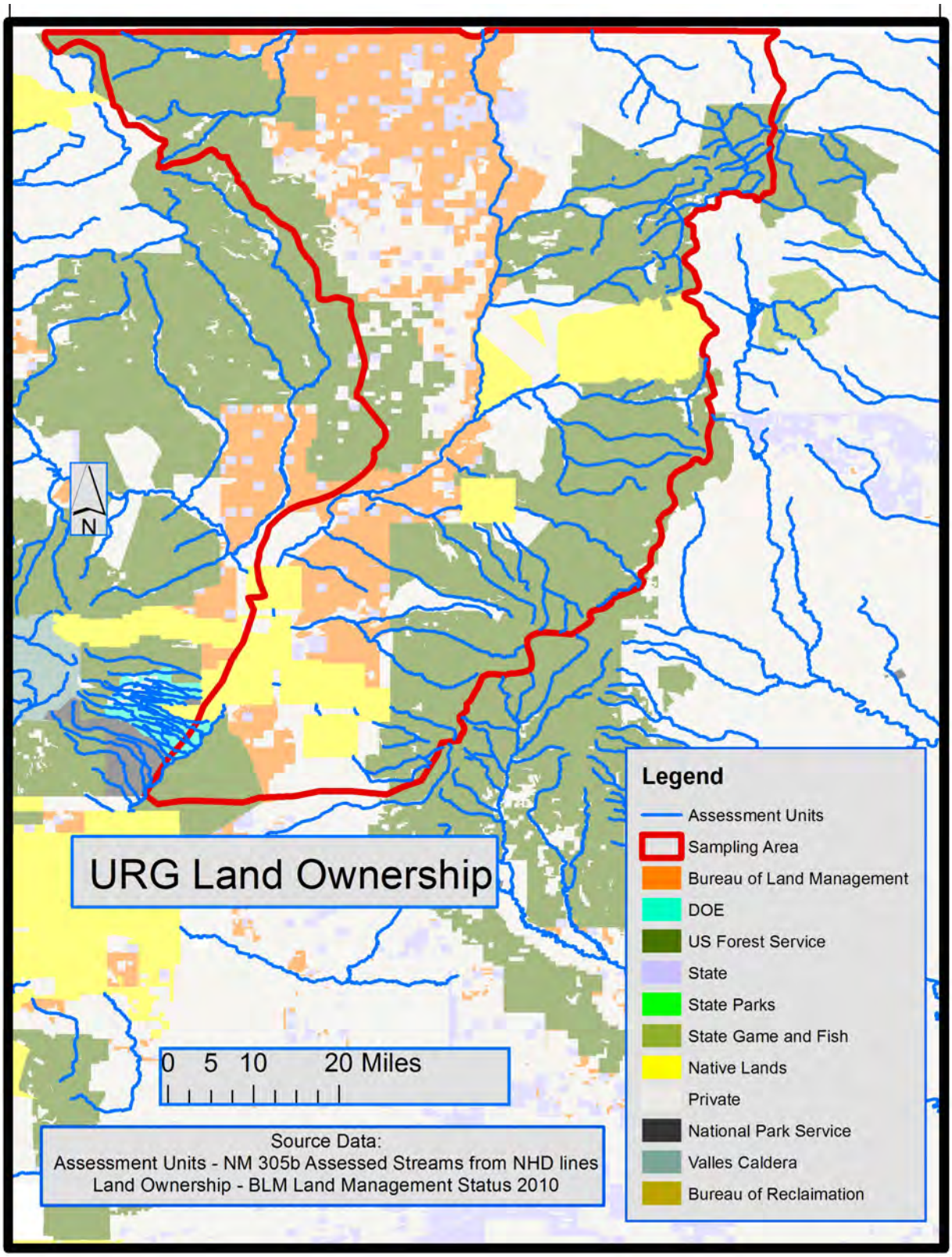

Figure 3. Land ownership in the Upper Rio Grande watershed.

Table 2. New Mexico land ownership for the Upper Rio Grande watershed (*BLM Land Management Status 2010*).

Watershed	% Land Ownership						
	BLM	Forest Service	Pueblo	Private	State	Dept. of Energy	National Park Service
Embudo	7.83	72.4	8.22	10.07	1.48	0	0
Los Pinos	2.89	90.18	0	4.85	2.08	0	0
Red River	4.14	82.16	0.07	13.51	0.13	0	0
Rio Costilla	5.5	23.79	0	70.64	0.07	0	0
Rio Grande (abv Cochiti Reservoir)	17.4	40.1	11.05	24.56	3.96	1.46	1.44
Rio Hondo	0.18	65.01	1.27	33.54	0	0	0
Rio Pueblo de Taos	0.45	44.95	32.72	21.88	0	0	0
Rio San Antonio	13.2	78.03	0	6.97	1.8	0	0
Rio Tesuque (abv Tesque Pueblo)	0.01	29.99	39.22	29.95	0.89	0	0
Santa Cruz (abv Santa Clara Pueblo)	19.49	59.58	0.66	19.72	0.56	0	0

Table 3. New Mexico land use in the Upper Rio Grande watershed (*National Landcover Dataset New Mexico version 09-10-2000*).

Watershed	% Land Use					
	Water	Built-up	Barren	Forest	Rangeland	Agriculture
Embudo	0	0.12	0.47	79.13	18.33	1.95
Los Pinos	0.01	0	0.02	44.93	54.08	0.92
Red River	0.05	0.42	2.82	77.96	18.27	0.48
Rio Costilla	0.17	0.03	0.03	56.81	42.06	0.88
Rio Grande (abv Cochiti Reservoir)	0.15	0.53	0.36	41.84	56.17	0.95
Rio Hondo	0.02	0.05	0.13	68.76	29.91	1.13
Rio Pueblo de Taos	0.01	0.86	0.12	73.43	24.15	1.42
Rio San Antonio	0.07	0	0.06	27.24	72.62	0.01
Rio Tesuque (abv Tesque Pueblo)	0	0.69	0.99	33.43	64.69	0.19
Santa Cruz (abv Santa Clara Pueblo)	0.08	1.4	0.68	63.77	32.73	1.33

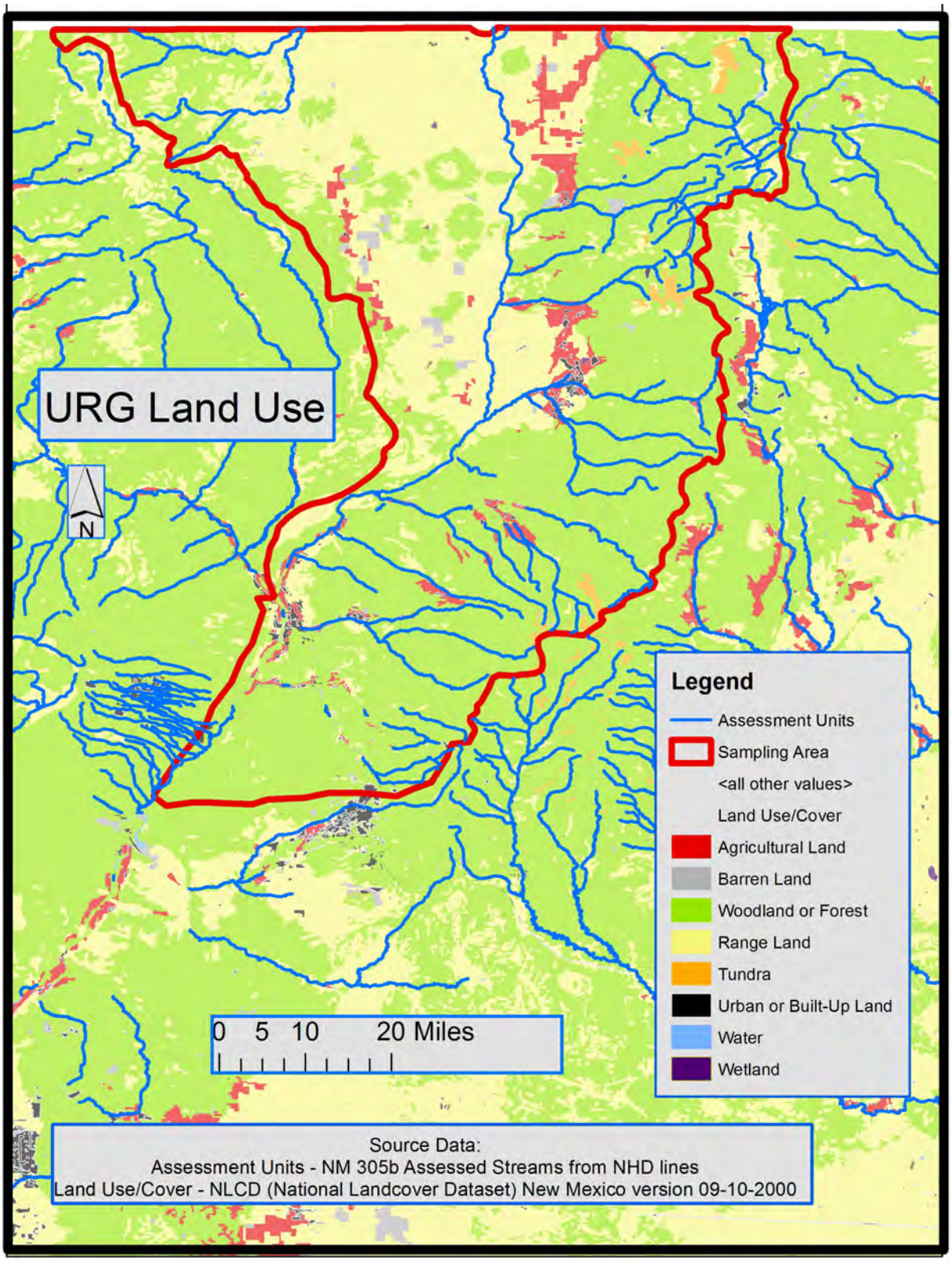

Figure 4. Land use/cover in the Upper Rio Grande watershed.

2.0 WATER QUALITY STANDARDS

State and tribal water quality standards constitute the baseline of water quality standards (WQS) in effect for Clean Water Act purposes. Waters within the Upper Rio Grande survey area flow across a number of state and pueblo jurisdictional boundaries (Figure 3; Table 2); however only State of New Mexico waters were sampled as part of this survey. USEPA approved water quality standards were used to determine if waterbodies throughout the watershed are supporting their designated uses. The applicable WQS for all assessment units in this Upper Rio Grande Watershed are set forth in sections 20.6.4.114, 20.6.4.121, 20.6.4.122, and 20.6.4.123 of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMWQCC 2011).

20.6.4.114 RIO GRANDE BASIN - The main stem of the Rio Grande from the Cochiti pueblo boundary upstream to Rio Pueblo de Taos excluding waters on San Ildefonso, Santa Clara and Ohkay Owingeh pueblos, Embudo creek from its mouth on the Rio Grande upstream to the Picuris Pueblo boundary, the Santa Cruz river from the Santa Clara pueblo boundary upstream to the Santa Cruz dam, the Rio Tesuque except waters on the Tesuque and Pojoaque pueblos, and the Pojoaque river from the San Ildefonso pueblo boundary upstream to the Pojoaque pueblo boundary. Some Rio Grande waters in this segment are under the joint jurisdiction of the state and San Ildefonso pueblo.

A. Designated Uses: irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, primary contact and warmwater aquatic life; and public water supply on the main stem Rio Grande.

B. Criteria:

(1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: 6T3 temperature 22°C (71.6°F) and maximum temperature 25°C (78.8°F). In addition, the following criteria based on a 12-month rolling average are applicable to the public water supply use for monitoring and public disclosure purposes only:

Radionuclide	pCi/L
Americium-241	1.9
Cesium-137	6.4
Plutonium-238	1.5
Plutonium-239/240	1.5
Strontium-90	3.5
Tritium	4,000

(2) At mean monthly flows above 100 cfs, the monthly average concentration for: TDS 500 mg/L or less, sulfate 150 mg/L or less and chloride 25 mg/L or less. [20.6.4.114 NMAC - Rp 20 NMAC 6.1.2111, 10-12-00; A, 05-23-05; A, 12-01-10]

20.6.4.121 RIO GRANDE BASIN - Perennial tributaries to the Rio Grande in Bandelier national monument and their headwaters in Sandoval county and all perennial reaches of tributaries to the Rio Grande in Santa Fe county unless included in other segments and excluding waters on tribal lands.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on Little Tesuque creek, the Rio en Medio, the Santa Fe river and Cerrillos reservoir.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less. [20.6.4.121 NMAC - Rp 20 NMAC 6.1.2118, 10-12-00; A. 05-23-05; A, 12-01-10] [**NOTE:** The segment covered by this section was divided effective 05-23-05. The standards for the additional segments are under 20.6.4.126, 20.6.4.127 and 20.6.4.128 NMAC.]

20.6.4.122 RIO GRANDE BASIN - The main stem of the Rio Grande from Rio Pueblo de Taos upstream to the New Mexico-Colorado line, the Red river from its mouth on the Rio Grande upstream to the mouth of Placer creek, and the Rio Pueblo de Taos from its mouth on the Rio Grande upstream to the mouth of the Rio Grande del Rancho. Some Rio Grande and Rio Pueblo de Taos waters in this segment are under the joint jurisdiction of the state and Taos pueblo.

A. Designated Uses: coldwater aquatic life, fish culture, irrigation, livestock watering, wildlife habitat and primary contact.
B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less. [20.6.4.122 NMAC - Rp 20 NMAC 6.1.2119, 10-12-00; A, 05-23-05; A, 12-01-10]

20.6.4.123 RIO GRANDE BASIN - Perennial reaches of the Red river upstream of the mouth of Placer creek, all perennial reaches of tributaries to the Red river, and all other perennial reaches of tributaries to the Rio Grande in Taos and Rio Arriba counties unless included in other segments and excluding waters on Santa Clara, Ohkay Owingeh, Picuris and Taos pueblos.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the Rio Pueblo and Rio Fernando de Taos.
B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 400 µS/cm or less (500 µS/cm or less for the Rio Fernando de Taos); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less; and phosphorus (unfiltered sample) less than 0.1 mg/L for the Red river. [20.6.4.123 NMAC - Rp 20 NMAC 6.1.2120, 10-12-00; A, 05-23-05; A, 12-01-10] [**NOTE:** The segment covered by this section was divided effective 05-23-05. The standards for the additional segment are under 20.6.4.129 NMAC.]

Subsection J of Section 20.6.4.900 NMAC, as referenced above, provides a list of analytes and associated concentration criteria for different designated uses, for which SWQB tests to determine if stream segments are achieving their designated uses.

Table 4 details the impairment listings for the Upper Rio Grande watershed included in the *WQCC-Approved 2012-2014 State of New Mexico Clean Water Act §303(d)/§305(b) Integrated Report* (NMED/SWQB 2012) and existing Total Maximum Daily Loads (TMDLs). The Integrated List is a catalog of assessment units (AUs) throughout the state with a summary of their current status – assessed/not assessed and impaired/not impaired. Once a stream AU is identified as impaired, a TMDL planning document is developed for that segment with guidelines for stream restoration. AU names and WQS have changed over the years and the history of these individual changes is tracked in the Record of Decision document associated with the WQCC-Approved 2012-2014 Integrated Report available on the SWQB website at: http://www.nmenv.state.nm.us/swqb/303d-305b.

Table 4. Summary of TMDLs and impairments from the *WQCC-Approved 2012-2014 Integrated List*.

AU Name	CAUSE NAME	STATUS	IR Category* (by AU)	CYCLE FIRST LISTED
Bitter Creek (Red River to headwaters)	Aluminum	TMDL Completed	5/5A	1998
Bitter Creek (Red River to headwaters)	Turbidity	303(d) list	5/5A	2012
Cañada Tío Grande (Río San Antonio to headwaters)	Oxygen, Dissolved; Temperature, water	303(d) list	5/5C	2012
Comanche Creek (Costilla Creek to headwaters)	Temperature, water	TMDL Completed	4A	1998
Cordova Creek (Costilla Creek to headwaters)	Sedimentation/Siltation	TMDL Completed	4A	2004
Costilla Creek (CO border to Diversion abv Costilla)	Low flow alterations	TMDL not developed for this cause	4C	N/A
Costilla Creek (Rio Grande to CO border)	Low flow alterations	TMDL not developed for this cause	4C	N/A
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)	Nutrient/Eutrophication Biological Indicators	303(d) list	5/5C	2012
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	Sedimentation/Siltation	TMDL Completed	5/5A	1998
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	Temperature, water	303(d) list	5/5A	2012
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	Turbidity	TMDL Completed	5/5A	1998
Little Tesuque Creek (Rio Tesuque to headwaters)	Aluminum	TMDL Completed	4A	1998
Pioneer Creek (Red River to headwaters)	Sedimentation/Siltation	303(d) list	5/5A	2012
Pioneer Creek (Red River to headwaters)	Turbidity	TMDL Completed	5/5A	2004
Red River (Placer Creek to headwaters)	Nutrient/Eutrophication Biological Indicators	303(d) list	5/5A	2012
Rio de los Pinos (New Mexico reaches)	Temperature, water	TMDL Completed	4A	2004
Rio Fernando de Taos (R Pueblo de Taos to USFS bnd at canyon)	*E. coli*	303(d) list	5/5A	2008
Rio Fernando de Taos (R Pueblo de Taos to USFS bnd at canyon)	Nutrient/Eutrophication Biological Indicators; Sedimentation/Siltation	303(d) list	5/5A	2012

AU Name	CAUSE NAME	STATUS	IR Category* (by AU)	CYCLE FIRST LISTED
Rio Fernando de Taos (R Pueblo de Taos to USFS bnd at canyon)	Specific Conductance; Temperature, water	TMDL Completed	5/5A	1998
Rio Fernando de Taos (Tienditas Creek to headwaters)	*E. coli*	303(d) list	5/5A	2008
Rio Fernando de Taos (UFSF bnd at canyon to Tienditas Creek)	*E. coli*	303(d) list	5/5A	2012
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	*E. coli*; Gross Alpha – Adjusted; PCBs	303(d) list	5/5A	2012
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	PCBs in Fish Tissue	303(d) list	5/5A	2006
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	Turbidity	303(d) list	5/5A	2004
Rio Grande (Embudo Creek to Rio Pueblo de Taos)	Turbidity	303(d) list	5/5C	2012
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)	PCBs in Fish Tissue	303(d) list	5/5C	2006
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)	Turbidity	TMDL Completed	5/5C	1998
Rio Grande (Red River to CO border)	pH	303(d) list	5/5A	2004
Rio Grande (Red River to CO border)	Temperature, water	TMDL Completed	5/5A	2004
Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)	PCBs in Fish Tissue	303(d) list	5/5C	2010
Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)	Turbidity	TMDL Completed	5/5C	1998
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)	Nutrient/Eutrophication Biological Indicators; Temperature, water	303(d) list	5/5A	2012
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)	Specific Conductance	TMDL Completed	5/5A	2004
Rio Hondo (Rio Grande to USFS bnd)	Temperature, water	TMDL Completed	4A	2002
Rio Pueblo (Picuris Pueblo bnd to headwaters)	Nutrient/Eutrophication Biological Indicators	303(d) list	5/5A	2012
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	Nutrient/Eutrophication Biological Indicators	303(d) list	5/5A	2012
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	Temperature, water	TMDL Completed	5/5A	2004

AU Name	CAUSE NAME	STATUS	IR Category* (by AU)	CYCLE FIRST LISTED
Rio Pueblo de Taos (R Grande del Rancho to Taos Pueblo bnd)	*E. coli*	303(d) list	5/5A	2012
Rio Pueblo de Taos (R Grande del Rancho to Taos Pueblo bnd)	Temperature, water	TMDL Completed	5/5A	2004
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	Nutrient/Eutrophication Biological Indicators	303(d) list	5/5C	2012
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	Temperature, water	TMDL Completed	5/5C	2004
Rio Quemado (Santa Cruz River to Rio Arriba Cnty bnd)	*E. coli*	303(d) list	5/5A	2012
Rio San Antonio (CO border to Montoya Canyon)	Oxygen, Dissolved; Temperature, water	303(d) list	5/5C	2012
Rio San Antonio (Montoya Canyon to headwaters)	*E. coli*; Oxygen, Dissolved	303(d) list	5/5C	2012
Rio San Antonio (Montoya Canyon to headwaters)	Temperature, water	TMDL Completed	5/5C	2004
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)	Benthic-Macroinvertebrate Bioassessments (Streams)	303(d) list	5/5A	1998
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)	Temperature, water	303(d) list	5/5A	2012
Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)	*E. coli*; Temperature, water	303(d) list	5/5A	2012

*IR – Integrated Report category. See Appendix A for definitions.

3.0 METHODS

All water quality data within this project were collected in accordance with the procedures set forth in the *SWQB Quality Assurance Project Plan* (NMED/SWQB 2009) and the *SWQB Standard Operating Procedures for Data Collection* (NMED/SWQB 2007). The data collected as part of this study were later combined with all other readily available or submitted data that meet state quality assurance/quality control requirements to form the basis of designated use attainment determinations. These data were assessed in accordance with protocols established in the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report [Assessment Protocols]* (NMED/SWQB 2011).

Biological and habitat sampling procedures were detailed in the Standard Operating Procedures (NMED/SWQB 2007). Macroinvertebrate and periphyton samples were collected from riffle

habitats best representing the stream reach being surveyed. The physical habitat survey procedures measured substrate present with a modified Wolman pebble count, canopy cover, stream bank stability, three measured cross sections, and qualitative habitat and geomorphic observations. Fish communities were sampled with a backpack shocker in a representative stream reach.

4.0 SAMPLING SUMMARY

Maps of the study area are provided in Figures 5 – 8. The station numbers and USEPA Storage and Retrieval database (STORET) identification codes are provided in Table 5. Stations are often located at AU breaks to include all inputs from that area before entering a new AU. Waste water treatment plants (WWTP) were sampled to account for in-stream pollutant loading from the permitted facility.

Table 5. Upper Rio Grande sampling stations

Map ID #	Station Name	Station ID
1	Beaver Creek	27Beaver004.6
2	Bitter Creek	28Bitter000.1
3	Bobcat Creek	28Bobcat000.3
4	Cabresto Creek @ NM 38	28Cabres000.9
5	Cabresto Creek @ USGS gage	28Cabres005.4
6	Cañada Tío Grande abv Río San Antonio	27CTGran000.7
7	Columbine Creek at Columbine Camp Ground	28Columb000.2
8	Comanche below upper exclosure	28Comanc007.7
9	Comanche Creek above Costilla Creek	28Comanc000.1
10	Cordova Creek 300m upstream from Day Lodge	28Cordov006.2
11	Cordova Creek above Costilla Creek	28Cordov001.5
12	Costilla Cr abv Comanche Cr	28RCosti032.5
13	Costilla Creek above Costilla at Hwy 196 bridge	28RCosti005.7
14	Costilla Creek at USFS Vermejo Park boundary	28RCosti038.5
15	Embudo Creek above Cañoncito	28Embudo010.1
16	Embudo Creek at Hwy 68 bridge	28Embudo000.8
17	Española WWTP effluent	NM0029351
18	Latir Creek at Costilla Creek	28LatirC000.1
19	Little Tesuque Creek at FS boundry	28LTesuq004.5
20	Pioneer Creek about 400 yards abv Red River	28Pionee000.7
21	Placer Creek, about 400 yds above Red River	28Placer000.2
22	Red River @ bridge abv Questa WWTF	28RedRiv009.8
23	Red River @ Goose Creek	28RedRiv034.8
24	Red River @ Molycorp boundary	28RedRiv024.4
25	Red River @ USGS gage	28RedRiv014.0
26	Red River above Fish Hatchery and diversion	28RedRiv005.9
27	Red River at Junebug abv Red River WWTP	28RedRiv028.5

Map ID #	Station Name	Station ID
28	Red River at Zwergle	28RedRiv035.5
29	Red River below Fish Hatchery near USGS	28RedRiv005.3
30	Red River blw Questa WWTF	28RedRiv009.2
31	Red River downstream of Moly abe Columbine	28RedRiv019.6
32	Red River fish hatchery effluent	28RRHatchery
33	Red River WWTP effluent	NM0024899
34	Red River, Middle Fork	28MFkRed001.0
35	Rio Chupadero above summer homes	28RChupa015.2
36	Rio de los Pinos at USGS gage	27RPinos002.6
37	Rio Fernando de Taos @ Fred Baca Park	28RFerna003.2
38	Rio Fernando de Taos abv Rio Pueblo de Taos	28RFerna000.3
39	Rio Fernando de Taos at Hwy 64 bridge	28RFerna031.7
40	Rio Frijoles above Rio Medio	28RFrijo000.1
41	Rio Grande above Embudo Creek	28RGrand628.0
42	Rio Grande above Española at Valdez Bridge	28RGrand565.5
43	Rio Grande above the Rio Pueblo de Taos	28RGrand651.2
44	Rio Grande abv Red River	28RGrand678.5
45	Rio Grande at Buckman Road	30RGrand541.7
46	Rio Grande at NM CO border at USGS in CO	28RGrand734.5
47	Rio Grande at Otowi Bridge	28RGrand547.2
48	Rio Grande below Rio Hondo USGS	28RGrand665.0
49	Rio Grande blw Taos Junc Bridge USGS gage	28RGrand647.9
50	Rio Grande del Rancho @ gage near Talpa	28RGRanc013.1
51	Rio Grande del Rancho abv Rio Pueblo de Taos	28RGRanc000.2
52	Rio Grande near Los Luceros	28RGrand579.7
53	Rio Grande Spring	28RGrandeSpr
54	Rio Hondo 1.5 miles above Valdez at USGS	28RHondo014.8
55	Rio Hondo 2.4 miles blw WWTP	28RHondo022.4
56	Rio Hondo 50 feet above WWTP	28RHondo027.3
57	Rio Hondo at Rio Grande confluence	28RHondo000.1
58	Rio Medio above Santa Cruz River	28RMedio000.1
59	Rio Pueblo .8 miles above Hwy 518/75 at USGS	28Pueblo013.4
60	Rio Pueblo de Taos 20m below Taos WWTP	28RPuebT008.1
61	Rio Pueblo de Taos 400m above Rio Grande	28RPuebT000.1
62	Rio Pueblo de Taos above Rio Fernando	28RPuebT015.8
63	Rio Pueblo de Taos near Los Cordovas	28RPuebT013.2
64	Rio Quemado near Chimayo	28RQuema003.1
65	Rio San Antonio at FR 87 bridge	27RSanAn025.3
66	Rio San Antonio at NM CO border in Ortiz	27RSanAn000.4
67	Rio Santa Barbara abv Embudo Creek	28RSanBa000.2
68	Rio Santa Barbara at Hodges Campground	28RSanBa013.2

Map ID #	Station Name	Station ID
69	Rio Santa Barbara @ Santa Barbara Campground	28RSanBa017.9
70	Rio Tesuque @ Tesuque Village Road	28RTesuq018.5
71	Sanchez Creek above Costilla Creek	28Sanche000.1
72	Santa Cruz River at town of Quarteles	28SanCru004.2
73	Unnamed Arroyo above Rio Pueblo de Taos	28Unnamed000.1
74	Tesuque Creek at gage near Santa Fe	28Tesuqu023.4
75	Twining WWTP effluent	NM0022101

NOTES: WWTF/P = Wastewater Treatment Facility/Plant;
FR = Forest Road;
USFS = U.S. Forest Service; and
USGS = U.S. Geological Survey

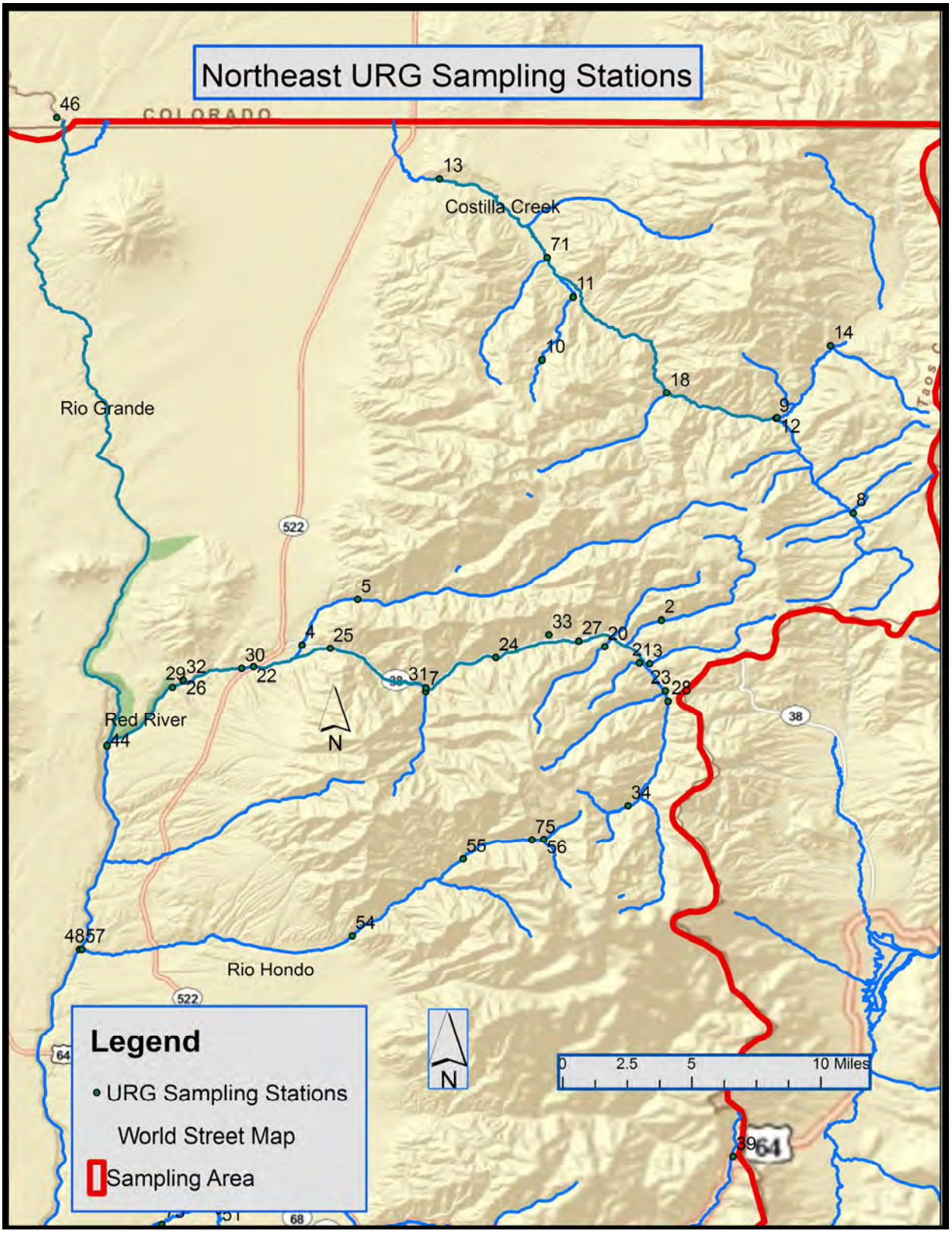

Figure 5. Northeast sampling stations.

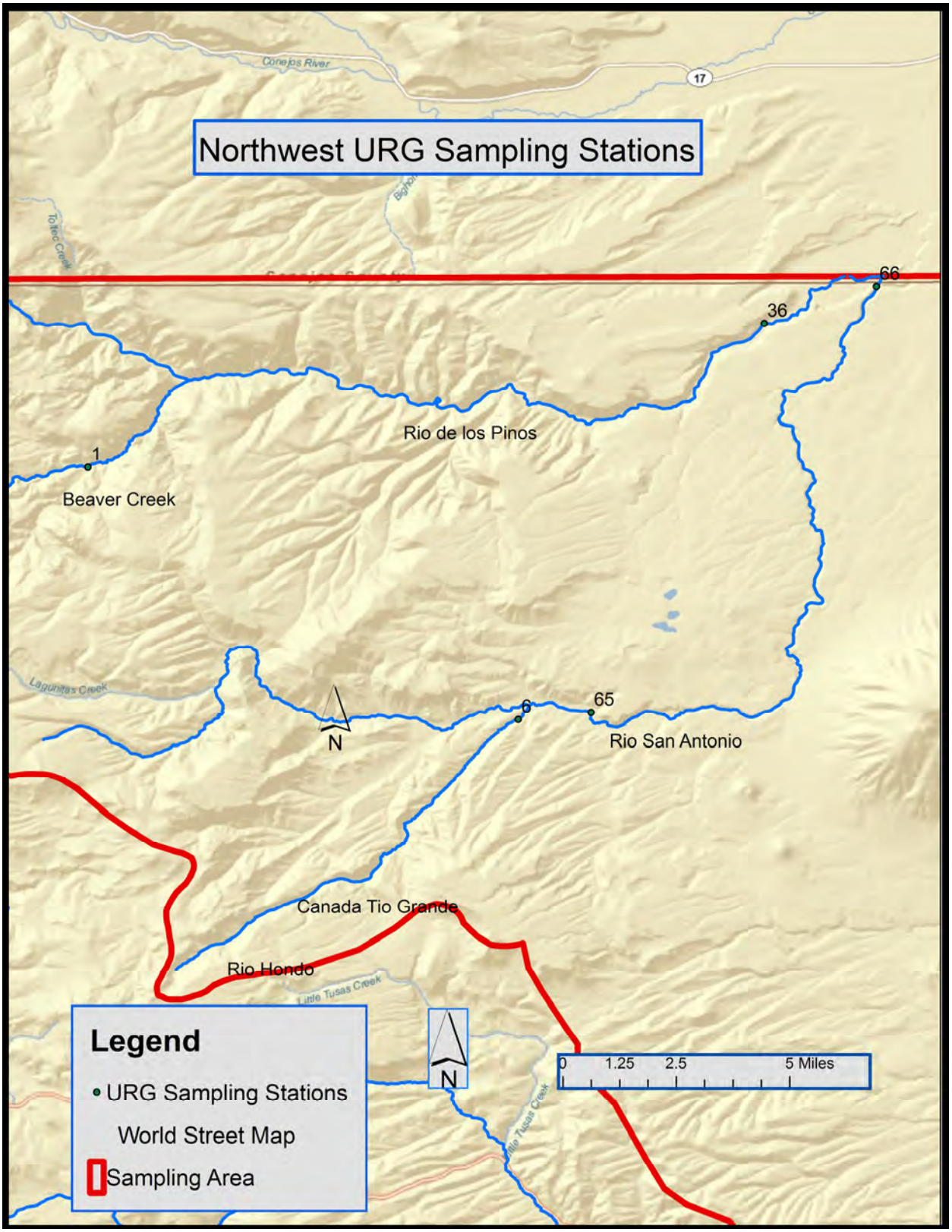

Figure 6. Northwest sampling stations.

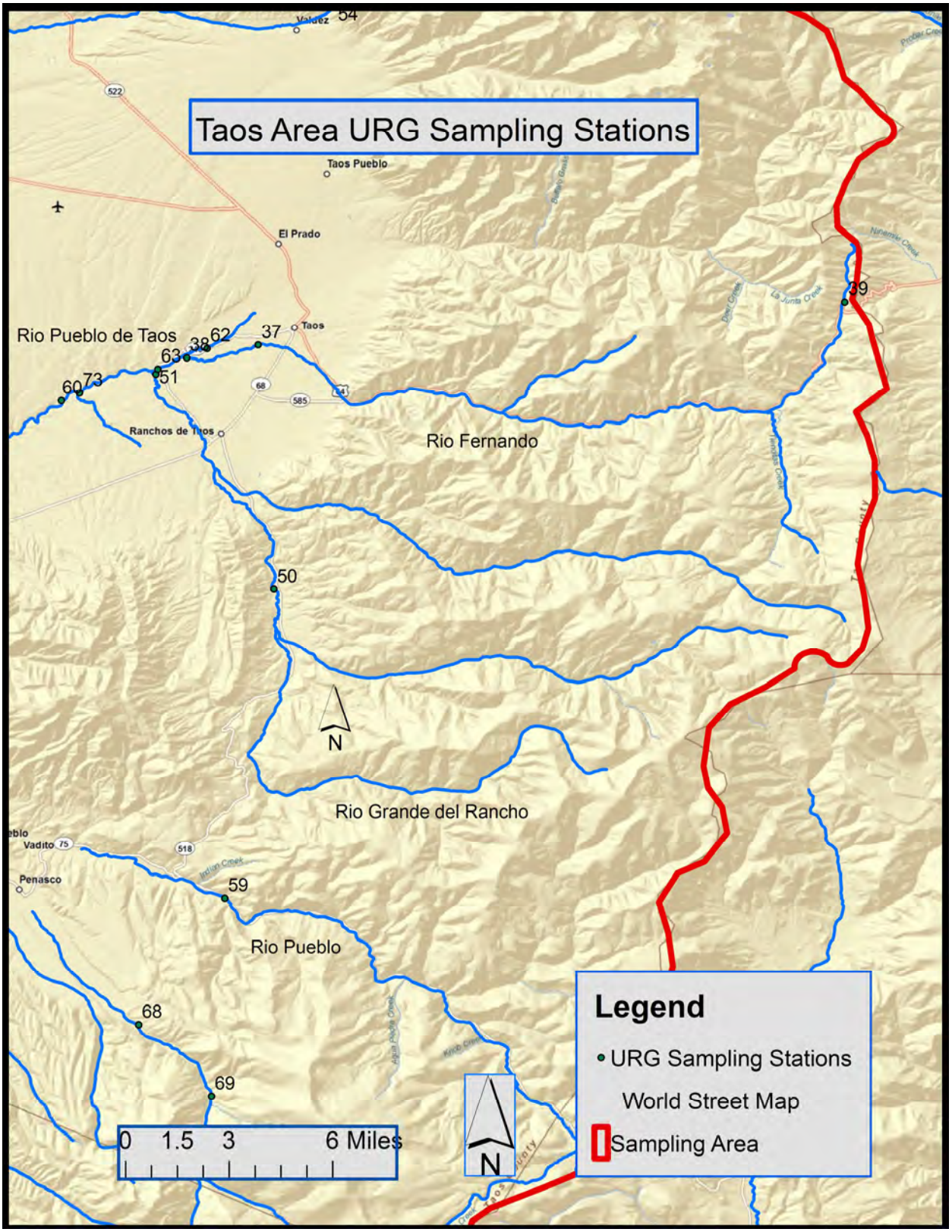

Figure 7. Taos area sampling stations.

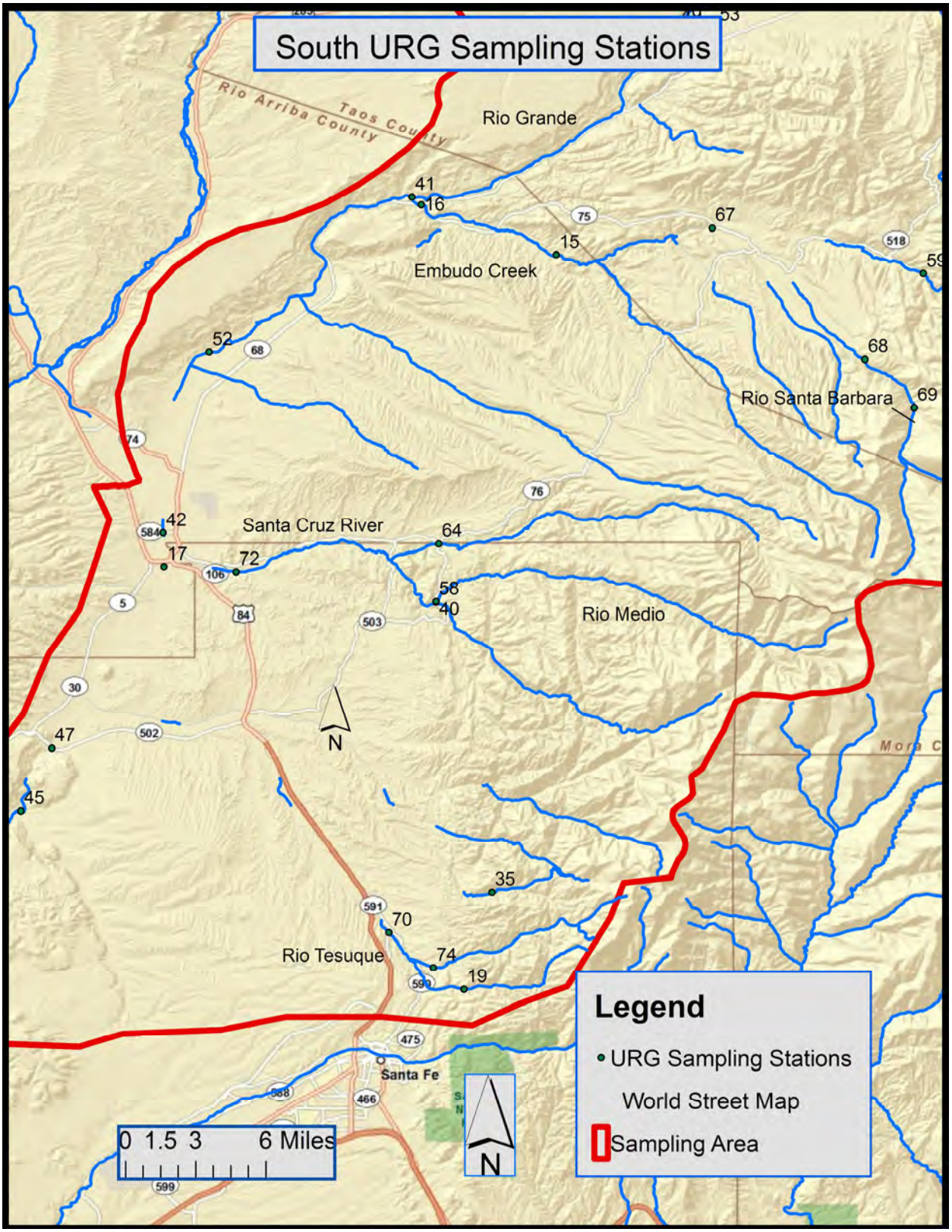

Figure 8. Southern sampling stations.

Water chemistry grab sampling was conducted monthly or bimonthly to capture different portions of the hydrograph ranging from spring snowmelt, monsoon storm events, and base flow. Table 6 summarizes data collected in each assessment unit and at each station. The number of times each parameter (or suite of parameters) was sampled is indicated (in the case of stream discharge, some of the data are retrieved from USGS gages). Field data, which includes temperature, specific conductance, pH, DO, and turbidity, were collected during each site visit.

Table 6. Number of sampling occurrences; *Upper Rio Grande Watershed Survey, 2009.*

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Beaver Creek (Rio de los Pinos to headwaters)																	
Beaver Creek below Diablo Creek	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Bitter Creek (Red River to headwaters)																	
Bitter Creek above town of Red River	-	4	4	4	-	4	4	-	-	1	4	-	1	1	1	1	-
Bobcat Creek (Red River to headwaters)																	
Bobcat Creek at NM Hwy 578	-	4	4	4	-	4	4	-	-	-	4	-	-	-	-	-	-
Cabresto Creek (Red River to headwaters)																	
Cabresto Creek at NM 38	4	4	8	4	-	4	4	-	-	-	4	1	1	-	-	-	-
Cabresto Creek at USGS gage	-	4	4	4	-	4	4	-	-	-	-	1	1	1	1	1	1
Cañada Tío Grande (Río San Antonio to headwaters)																	
Cañada Tío Grande above Río San Antonio	-	4	4	4	4	-	4	-	-	1	4	1	1	1	1	1	1
Columbine Creek (Red River to headwaters)																	
Columbine Creek at Columbine Camp Ground	-	4	4	4	-	4	4	-	-	-	4	-	-	-	-	-	-
Comanche Creek (Costilla Creek to headwaters)																	
Comanche below upper exclosure	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	1	-
Comanche Creek above Costilla Creek	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	1	-
Cordova Creek(Costilla Creek to headwaters)																	
Cordova Creek 300m upstream from Day Lodge	-	4	4	4	4	-	4	-	-	-	4	1	-	1	1	1	-
Cordova Creek above Costilla Creek	-	4	4	4	4	-	4	-	-	-	4	1	1	1	1	1	-
Costilla Creek (Comanche Creek to Costilla Dam)																	
Costilla Cr above Comanche Cr	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Costilla Creek (Diversion abv Costilla to Comanche Creek)																	
Costilla Creek above Costilla at Hwy 196 bridge	4	4	8	4	4	-	4	2	2	2	-	1	1	1	1	1	1

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)																	
Embudo Creek above Cañoncito	4	4	8	4	4	-	5	-	-	1	8	1	1^	1	1	1	-
Embudo Creek (Rio Grande to Canada de Ojo Sarco)																	
Embudo Creek at Hwy 68 bridge	4	4	8	4	4	-	5	2	2	2	-	1	1^	-	-	-	-
Latir Creek (Costilla Creek to headwaters)																	
Latir Creek at Costilla Creek	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	-	-
Little Tesuque Creek (Rio Tesuque to headwaters)																	
Little Tesuque Creek at FS boundry	-	4	4	4	2	2	4	-	-	-	4	-	-	-	-	-	-
Middle Fork Red River (Red River to headwaters)																	
Red River, Middle Fork	-	4	4	4	2	2	4	-	-	-	4	1	-	-	-	-	-
Pioneer Creek (Red River to headwaters)																	
Pioneer Creek about 400 yards above Red River	-	4	4	4	1	3	4	-	-	-	4	1	1	1	1	1	1
Placer Creek (Red River to headwaters)																	
Placer Creek, about 400 yards above Red River	-	4	4	4	4	-	4	-	-	-	4	-	-	-	-	-	-
Red River (Placer Creek to headwaters)																	
Red River at Goose Creek	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
Red River at Zwergle	4	4	8	4	-	4	7	-	-	-	1	-	-	-	-	1	-
Red River (Rio Grande to Placer Creek)																	
Red River at bridge abv Questa WWTF	4	4	8	4	-	4	8	-	-	-	-	-	-	-	-	-	-
Red River at Molycorp boundary	4	4	8	4	-	4	7	-	-	1	-	-	-	-	-	-	-
Red River at USGS gage	4	4	8	4	-	4	4	-	-	1	-	-	-	-	-	-	-
Red River above Fish Hatchery and diversion	4	4	8	4	-	4	4	-	-	-	-	-	-	-	-	-	-
Red River at Junebug abv Red River WWTP	4	4	8	4	-	4	8	-	-	-	8	-	-	-	-	-	-
Red River below Fish Hatchery near USGS	4	4	8	4	-	4	4	2	2	2	-	1	1	1	1	1	-

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Red River below Questa WWTF	4	4	8	4	-	4	8	-	-	-	-	-	-	-	-	-	-
Red River downstream of Moly abe Columbine	-	4	4	4	-	4	4	-	-	1	-	-	-	-	-	-	-
Red River fish hatchery effluent	2	6	8	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Red River WWTP effluent	1	7	8	-	-	4	8	-	-	-	-	-	-	-	-	-	-
Rio Chupadero (USFS bnd to headwaters)																	
Rio Chupadero above summer homes	-	4	4	4	4	-	2	-	-	-	-	-	-	-	-	-	-
Rio de los Pinos (New Mexico reaches)																	
Rio de los Pinos at USGS gage	4	4	8	4	4	-	7	2	-	2	-	1	1	1	1	1	-
Rio Fernando de Taos (Rio Pueblo de Taos to Tienditas Creek)																	
Rio Fernando de Taos at Fred Baca Park	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1
Rio Fernando de Taos above Rio Pueblo de Taos	-	4	4	4	4	-	4	-	-	-	4	1	1	1	1	1	1
Rio Fernando de Taos (Tienditas Creek to headwaters)																	
Rio Fernando de Taos at Hwy 64 bridge	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	1	1
Rio Frijoles (Rio Medio to Pecos Wilderness)																	
Rio Frijoles above Rio Medio	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	-	-
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)																	
Rio Grande at Buckman Road	-	-	-	-	-	-	8	-	-	-	-	1*	-	1	1	1	-
Rio Grande (Embudo Creek to Rio Pueblo de Taos)																	
Rio Grande above Embudo Creek	4	4	8	4	4	-	8	2	2	2	-	1*	1	1	1	1	-
Rio Grande below Taos Junction bridge USGS gage	-	1*	1*	1*	-	-	1*	-	5	-	-	1*	-	-	-	-	-
Rio Grande Spring	-	-	-	-	-	-	6	-	2	-	-	-	-	-	-	-	-

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)																	
Española WWTP effluent	-	-	1	-	-	-	8	-	-	-	-	-	-	-	-	-	-
Rio Grande above Española at Valdez Bridge	-	4	4	4	4	-	4	-	-	-	-	-	-	-	-	-	-
Rio Grande (Red River to CO border)																	
Rio Grande above Red River	4	4	8	4	4	-	8	2	2	2	-	1	1	-	-	-	-
Rio Grande at NM-CO border at USGS in CO	-	4	4	4	4	-	4	-	-	1	-	-	-	-	-	-	-
Rio Grande (Rio Pueblo de Taos to Red River)																	
Rio Grande above the Rio Pueblo de Taos	4	4	8	4	4	-	8	2	2	2	-	1*	1	-	-	-	-
Rio Grande below Rio Hondo USGS	-	4	4	4	4	-	4	-	-	1	-	1*	-	-	-	-	-
Rio Grande (San Ildefonso Pueblo)																	
Rio Grande at Otowi Bridge	-	1*	1*	1*	-	-	1*	-	5	-	-	1*	-	-	-	-	-
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)																	
Rio Grande near Los Luceros	4	4	8	4	4	-	8	2	2	2	-	1*	1	1	1	1	-
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)																	
Rio Grande del Rancho at gage near Talpa	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	-	-
Rio Grande del Rancho above Rio Pueblo de Taos	4	4	8	4	4	-	4	-	-	1	8	1	1^	-	-	1	-
Rio Hondo (Rio Grande to USFS bnd)																	
Rio Hondo at Rio Grande confluence	4	4	8	4	4	-	4	2	2	2	8	1	1^	1	1	1	1
Rio Hondo (South Fork Rio Hondo to Lake Fork Creek)																	
Rio Hondo 50 feet above WWTP	2	5	7	5	5	-	7	-	-	1	7	-	-	-	-	-	-
Rio Hondo 2.4 miles below WWTP	4	4	8	4	4	-	8	-	-	-	8	1	1	-	-	1	-
Twining WWTP effluent	1	7	8	-	-	-	8	-	-	-	-	-	-	-	-	-	-

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Rio Hondo (USFS bnd to South Fork Rio Hondo)																	
Rio Hondo 1.5 miles above Valdez at USGS	4	4	8	4	4	-	4	-	-	-	-	-	-	-	-	-	-
Rio Medio (Rio Frijoles to headwaters)																	
Rio Medio above Santa Cruz River	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	-	-
Rio Pueblo (Picuris Pueblo bnd to headwaters)																	
Rio Pueblo .8 miles above Hwy 518/75 at USGS	-	4	4	4	4	-	4	-	-	-	4	1	1	1	1	1	1
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)																	
Rio Pueblo de Taos 20m below Taos WWTP	4	4	8	4	4	-	7	-	-	-	8	1	1	-	-	-	-
Taos WWTP	1	7	8	-	-	-	7	-	-	-	8	-	-	-	-	-	-
Rio Pueblo de Taos (R Grande del Rancho to Taos pueblo bnd)																	
Rio Pueblo de Taos near Los Cordovas	4	8	8	8	8	-	8	-	-	-	8	1	-	-	-	-	-
Rio Pueblo de Taos above Rio Fernando	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rio Pueblo de Taos (Rio Grande to Arryo del Alamo)																	
Rio Pueblo de Taos 400m above Rio Grande	4	4	8	4	4	-	4	2	2	2	8	1	-	-	-	-	-
Rio Quemado (Santa Cruz River to Rio Arriba Cnty bnd)																	
Rio Quemado near Chimayo	-	4	4	4	4	-	4	-	-	-	4	1	-	-	-	-	-
Rio San Antonio (CO border to Montoya Canyon)																	
Rio San Antonio at NM CO border in Ortiz	-	4	4	4	4	-	4	2	2	-	4	1	1	1	1	1	-
Rio San Antonio (Montoya Canyon to headwaters)																	
Rio San Antonio at FR 87 bridge	-	4	4	4	4	-	4	-	-	1	4	1	1	1	1	1	1
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)																	
Rio Santa Barbara above Embudo Creek	4	4	8	4	4	-	6	-	2	1	8	1	-	-	1	-	-

Assessment Unit/Station Name	Total Suspended Solids/ Total Dissolved Solids (TSS/TDS)	TSS/TDS + Hardness	Total Nutrients	Dissolved Metals	Total Metals	Total Metals (Al, Se, and Hg)	*E. coli*	Volatile and Semivolatile Organics	Radionuclides	Cyanide, total	Flow	Thermograph	Sonde Deployment	Habitat (EMAP)	Macroinvertebrates	Periphyton	Fish Community
Rio Santa Barbara (USFS bnd to confl of E and W forks)																	
Rio Santa Barbara at Hodges Campground	-	4	4	4	4	-	4	-	-	-	4	-	-	-	-	-	-
Rio Santa Barbara at Santa Barbara Campground	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Rio Tesuque (Tesuque Pueblo to Tesuque Creek)																	
Rio Tesuque at Tesuque Village Road	-	4	4	4	3	1	4	2	2	1	4	-	-	-	-	-	-
Sanchez Canyon (Costilla Creek to headwaters)																	
Sanchez Creek above Costilla Creek	-	4	4	4	4	-	4	-	-	-	4	-	-	-	-	-	-
Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)																	
Santa Cruz River at town of Quarteles	4	4	8	4	4	-	5	2	2	2	8	1	-	-	-	-	-
Tesuque Creek(Rio Tesuque to confl of forks)																	
Tesuque Creek at gage near Santa Fe	-	4	4	4	4	-	4	-	-	-	-	1	-	-	-	-	-
Ute Creek																	
Ute Creek above Costilla Creek at Hwy 196																	

1^ = DO probe failure
1* = USGS samples

5.0 WATER QUALITY ASSESSMENT

For many water quality analytes, the State of New Mexico maintains numeric water quality standards (see Section 2.0 above). Data are assessed for designated use attainment status for both numeric and narrative water quality standards by application of the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report* [Assessment Protocols] (NMED/SWQB 2011).

5.1 Water Quality Impairments for Numeric Criteria

5.1.1 Grab Data

Grab data refers to samples or measurements collected from individual visits to survey stations and is distinct from data obtained with continuous monitoring devices over an extended period of time. Water samples were analyzed for major ions, nutrients, total and dissolved metals, bacteria, radionuclides, and anthropogenic organic compounds. Variables such as temperature, dissolved oxygen (DO), pH, turbidity, and specific conductance were measured in the field. Exceedences of the WQS criteria identified during this survey using grab data are documented in **Table 7**. Results indicate designated use impairments due to aluminum, *E. coli*, nutrients, specific conductance, temperature, and turbidity. A complete dataset can be obtained through EPA's STORET website or by calling the SWQB.

Table 7. Number of samples that exceeded water quality criteria per total number of samples collected during *Upper Rio Grande Survey 2009*.

Assessment Unit/Station Name *- Dash indicates sample was not detected or not collected. See Table 6 for sample collection summary.*	Aluminum[1]	Cadmium[1]	Copper[1]	Nickel[1]	Zinc[1]	Total Aluminum[2]	Total Ammonia	*E. coli*	Specific Conductance
Beaver Creek (Rio de los Pinos to headwaters)									
Beaver Creek below Diablo Creek	-	-	-	-	-	-	-	-	-
Bitter Creek (Red River to headwaters)									
Bitter Creek above town of Red River	**2/4**	-	-	-	-	**2/4**	-	-	-
Bobcat Creek (Red River to headwaters)									
Bobcat Creek at NM Hwy 578	1/4	-	-	-	-	1/4	-	-	-
Cabresto Creek (Red River to headwaters)									
Cabresto Creek at NM 38	1/4	-	-	-	-	1/4	-	-	-
Cabresto Creek at USGS gage	-	-	-	-	-	-	-	-	-
Cañada Tío Grande (Río San Antonio to headwaters)									
Cañada Tío Grande above Río San Antonio	**2/4**	-	-	-	-	-	-	-	-
Columbine Creek (Red River to headwaters)									
Columbine Creek at Columbine campground	1/4	-	-	-	-	-	-	-	-

Assessment Unit/Station Name *- Dash indicates sample was not detected or not collected. See Table 6 for sample collection summary.*	Aluminum[1]	Cadmium[1]	Copper[1]	Nickel[1]	Zinc[1]	Total Aluminum[2]	Total Ammonia	*E. coli*	Specific Conductance
Cordova Creek (Costilla Creek to headwaters)									
Cordova Creek 300m upstream from Day Lodge	-	-	-	-	-	-	-	-	-
Cordova Creek above Costilla Creek	1/4	-	-	-	-	-	-	-	-
Costilla Creek (Diversion abv Costilla to Comanche Crk)									
Costilla Creek above Costilla at Hwy 196 bridge	1/4	-	-	-	-	-	-	-	-
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)									
Embudo Creek above Cañoncito	1/4	-	-	-	-	-	-	-	-
Embudo Creek (Rio Grande to Canada de Ojo Sarco)									
Embudo Creek at Hwy 68 bridge	1/4	-	-	-	-	-	-	-	-
Latir Creek (Costilla Creek to headwaters)									
Latir Creek at Costilla Creek	**2/4**	-	-	-	-	-	-	-	-
Little Tesuque Creek (Rio Tesuque to headwaters)									
Little Tesuque Creek at FS boundry	**2/4**	-	-	-	1/4	-	-	-	-
Middle Fork Red River (Red River to headwaters)									
Red River, Middle Fork	-	-	-	-	-	-	-	-	-
Pioneer Creek (Red River to headwaters)									
Pioneer Creek about 400 yards above Red River	1/4	-	-	-	-	1/4	-	-	-
Placer Creek (Red River to headwaters)									
Placer Creek, about 400 yds above Red River	1/4	-	-	-	-	-	-	-	-
Red River (Placer Creek to headwaters)									
Red River at Zwergle	1/4	-	-	-	-	-	-	-	-
Red River (Rio Grande to Placer Creek)									
Red River at bridge abv Questa WWTF	**3/4**	-	-	-	-	1/4	-	-	-
Red River at Molycorp boundary	**4/4**	1/4	1/4	1/4	-	**1/3**	-	1/8	1/8
Red River at USGS gage	**4/4**	-	-	-	-	-	-	-	-
Red River above Fish Hatchery and diversion	**4/4**	-	-	-	-	1/4	-	-	-
Red River at Junebug abv Red River WWTP	**2/3**	-	-	-	-	1/3	-	1/8	-
Red River below Fish Hatchery near USGS	**2/4**	-	-	-	-	1/4	-	-	-
Red River below Questa WWTF	**2/4**	-	-	-	-	-	-	-	-
Red River downstream of Moly abe Columbine	**3/4**	-	-	-	-	-	-	1/4	-
Rio Chupadero (USFS bnd to headwaters)									
Rio Chupadero above summer homes	-	-	-	-	-	-	-	-	-
Rio de los Pinos (New Mexico reaches)									
Rio de los Pinos at USGS gage	**2/5**	-	-	-	-	-	-	-	-

Assessment Unit/Station Name *- Dash indicates sample was not detected or not collected. See Table 6 for sample collection summary.*	Aluminum[1]	Cadmium[1]	Copper[1]	Nickel[1]	Zinc[1]	Total Aluminum[2]	Total Ammonia	*E. coli*	Specific Conductance
Rio Fernando de Taos (Rio Pueblo de Taos to Tienditas Creek)									
Rio Fernando de Taos at Fred Baca Park	-	-	-	-	-	-	-	1/3	**4/4**
Rio Fernando de Taos above Rio Pueblo de Taos	-	-	-	-	-	-	-	-	-
Rio Fernando de Taos (Tienditas Creek to headwaters)									
Rio Fernando de Taos at Hwy 64 bridge	1/4	-	-	-	-	-	-	**2/4**	-
Rio Frijoles (Rio Medio to Pecos Wilderness)									
Rio Frijoles above Rio Medio	**2/4**	-	-	-	-	-	-	-	-
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)									
Rio Grande at Buckman Road	-	-	-	-	-	-	-	**3/7**	-
Rio Grande (Embudo Creek to Rio Pueblo de Taos)									
Rio Grande above Embudo Creek	-	-	-	-	-	-	-	-	-
Rio Grande below Taos Junction bridge USGS gage	-	-	-	-	-	-	-	-	-
Rio Grande Spring	-	-	-	-	-	-	-	-	-
Rio Grande (Santa Clara Pueblo boundary to Ohkay Owingeh boundary)									
Rio Grande above Española at Valdez Bridge	1/4	-	-	-	-	-	-	-	-
Rio Grande (Red River to CO border)									
Rio Grande above Red River	1/4	-	-	-	-	-	-	-	-
Rio Grande at NM CO border at USGS in CO	1/4	-	-	-	-	-	-	-	-
Rio Grande (Rio Pueblo de Taos to Red River)									
Rio Grande above the Rio Pueblo de Taos	-	-	-	-	-	-	-	-	-
Rio Grande below Rio Hondo USGS	1/4	-	-	-	-	-	-	-	-
Rio Grande (San Ildefonso Pueblo)									
Rio Grande at Otowi Bridge	-	-	-	-	-	-	-	-	-
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)									
Rio Grande near Los Luceros	-	-	-	-	-	-	-	1/7	-
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)									
Rio Grande del Rancho at gage near Talpa	-	-	-	-	-	-	-	-	**4/5**
Rio Grande del Rancho above Rio Pueblo de Taos	-	-	-	-	-	-	-	1/5	**8/8**
Rio Hondo (Rio Grande to USFS bnd)									
Rio Hondo at Rio Grande confluence	1/4	-	-	-	-	-	-	-	-
Rio Hondo (S. Fork Rio Hondo to Lake Fork Crk)									
Rio Hondo 50 feet above WWTP	1/3	-	-	-	-	-	-	-	-
Rio Hondo 2.4 miles below WWTP	-	-	-	-	-	-	-	-	-

Assessment Unit/Station Name *- Dash indicates sample was not detected or not collected. See Table 6 for sample collection summary.*	Aluminum[1]	Cadmium[1]	Copper[1]	Nickel[1]	Zinc[1]	Total Aluminum[2]	Total Ammonia	*E. coli*	Specific Conductance
Rio Hondo (USFS bnd to S. Fork Rio Hondo)									
Rio Hondo 1.5 miles above Valdez at USGS	1/4	-	-	-	-	-	-	-	-
Rio Medio (Rio Frijoles to headwaters)									
Rio Medio above Santa Cruz River	**2/4**	-	-	-	-	-	-	-	-
Rio Pueblo (Picuris Pueblo bnd to headwaters)									
Rio Pueblo .8 miles above Hwy 518/75 at USGS	-	-	-	-	-	-	-	-	-
Rio Pueblo de Taos (Arroyo del Alamo to Rio Grande del Rancho)									
Rio Pueblo de Taos 20m below Taos WWTP	-	-	-	-	-	-	-	-	-
Unnamed Arroyo (Rio Pueblo de Taos to Taos WWTP)	-	-	-	-	-	-	**6/8**	**4/7**	-
Rio Pueblo de Taos (Rio Grande del Rancho to Taos Pueblo boundary)									
Rio Pueblo de Taos near Los Cordovas	1/4	-	-	-	-	-	-	-	-
Rio Pueblo de Taos above Rio Fernando	-	-	-	-	-	-	-	-	-
Rio Pueblo de Taos (Rio Grande to Arryo del Alamo)									
Rio Pueblo de Taos 400m above Rio Grande	-	-	-	-	-	-	-	-	-
Rio Quemado (Santa Cruz River to Rio Arriba Cnty bnd)									
Rio Quemado near Chimayo	**2/4**	-	-	-	-	-	-	**2/4**	1/4
Rio San Antonio (CO border to Montoya Canyon)									
Rio San Antonio at NM-CO border in Ortiz	1/4	-	-	-	-	-	-	-	-
Rio San Antonio (Montoya Canyon to headwaters)									
Rio San Antonio at FR 87 bridge	1/4	-	-	-	-	-	-	**3/4**	-
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)									
Rio Santa Barbara above Embudo Creek	-	-	-	-	-	-	-	**3/7**	-
Rio Santa Barbara (USFS bnd to confl of E and W forks)									
Rio Santa Barbara at Hodges Campground	-	-	-	-	-	-	-	-	-
Rio Tesuque (Tesuque Pueblo to Tesuque Creek)									
Rio Tesuque at Tesuque Village Road	-	-	-	-	-	-	-	-	-
Sanchez Canyon (Costilla Creek to headwaters)									
Sanchez Creek above Costilla Creek	1/4	-	-	-	-	-	-	-	-
Santa Cruz River (Santa Clara Pueblo boundary to Santa Cruz Dam)									
Santa Cruz River at town of Quarteles	**3/4**	-	-	-	-	-	-	**3/5**	-

Assessment Unit/Station Name *- Dash indicates sample was not detected or not collected. See Table 6 for sample collection summary.*	Aluminum[1]	Cadmium[1]	Copper[1]	Nickel[1]	Zinc[1]	Total Aluminum[2]	Total Ammonia	*E. coli*	Specific Conductance
Tesuque Creek(Rio Tesuque to confl of forks)									
Tesuque Creek at gage near Santa Fe	-	-	-	-	-	-	-	-	-
Ute Creek (Costilla Creek to headwaters)									
Ute Creek above Costilla Creek at Hwy 196	-	-	-	-	-	-	-	1/4	-

NOTES:

[1] Metals are dissolved unless otherwise indicated.

[2] A total aluminum standard has been adopted by the WQCC, but has not been approved by EPA. The WQCC-adopted total aluminum standard determined the impairment status for the *WQCC-Approved 2012-2014 Integrated List* (NMED/SWQB 2012).

Exceedences are expressed as the ratio of the number of exceedences divided by the total number of samples for that parameter at that station. **BOLDED** ratios indicate designated use impairments.

5.1.2 Data from Electronic Monitoring Devices

Temperature data loggers (thermographs) were deployed at selected stations within the study area. Multi-parameter sondes (YSI) were also deployed at selected stations to examine diel fluctuations in pH and dissolved oxygen (DO). The thermographs and sondes were programmed to record once per hour over their respective collection intervals.

Large datasets generated from data loggers (e.g., sondes and thermographs) are assessed according to protocols developed specifically for such datasets (NMED/SWQB 2011). Temperature, DO, and pH criteria are typically associated with aquatic life designated uses (20.6.4.900 NMAC); however occasionally there are segment-specific criteria that differ from the use-specific criteria. Assessment conclusions based on thermograph and sonde data are summarized below (Tables 8 – 9).

Table 8. Thermograph assessment conclusions.

Station	Aquatic Life Use	Temperature Criterion (°C)	Temperature Assessment
Cabresto Creek at NM Hwy 38	HQCWAL	20	FS
Cabresto Creek at USGS gage	HQCWAL	20	FS
Cañada Tío Grande above Río San Antonio	HQCWAL	20	**NS**
Comanche Creek above Costilla Creek	HQCWAL	20	**NS**

Station	Aquatic Life Use	Temperature Criterion (°C)	Temperature Assessment
Comanche Creek below upper exclosure	HQCWAL	20	**NS**
Cordova Creek at Ski Rio	HQCWAL	20	FS
Cordova Creek above Costilla Creek	CWAL	20	FS
Cordova Creek above Costilla Creek	HQCWAL	20	FS
Costilla Cr above Comanche Cr	HQCWAL	20	FS
Costilla Creek above Costilla at Hwy 196 bridge	HQCWAL	20	FS
Embudo Creek above Cañoncito	MCWAL	22	FS
Embudo Creek at Hwy 68 bridge near Dixon at USGS gage	MCWAL	22	**NS**
Latir Creek at Costilla Creek	HQCWAL	20	FS
Middle Fork Red River	HQCWAL	20	FS
Pioneer Creek above Red River	HQCWAL	20	FS
Red River below Fish Hatchery	CWAL	20	FS
Red River below Goose Creek	HQCWAL	20	FS
Rio de los Pinos at USGS gage	HQCWAL	20	**NS**
Rio Fernando de Taos at Fred Baca Park	HQCWAL	20	FS
Rio Fernando de Taos above Rio Pueblo de Taos	HQCWAL	20	**NS**
Rio Fernando de Taos at Hwy 64 bridge	HQCWAL	20	FS
Rio Frijoles above Rio Medio	MCWAL	22	FS
Rio Grande above Red River	CWAL	20	**NS**
Rio Grande del Rancho at gage near Talpa	HQCWAL	20	**NS**
Rio Grande del Rancho above Rio Pueblo de Taos	HQCWAL	20	**NS**
Rio Hondo 2.4 mi. below WWTP	HQCWAL	20	FS
Rio Hondo at Rio Grande confluence	HQCWAL	20	**NS**
Rio Medio above Santa Cruz River	MCWAL	22	FS
Rio Pueblo .8 miles above Hwy 518/75 at USGS gage 08277470	HQCWAL	20	no data

Station	Aquatic Life Use	Temperature Criterion (°C)	Temperature Assessment
Rio Pueblo de Taos above Rio Grande	CWAL	20	**NS**
Rio Pueblo de Taos above Rio Grande del Rancho	HQCWAL	20	**NS**
Rio Pueblo de Taos below Taos WWTP effluent channel	CWAL	20	**NS**
Rio Quemado near Chimayo	MCWAL	22	FS
Rio San Antonio at FR 87 bridge	HQCWAL	20	**NS**
Rio San Antonio at NM-CO border in Ortiz	HQCWAL	20	**NS**
Rio Santa Barbara above Embudo Cr	HQCWAL	20	**NS**
Rio Santa Barbara at Santa Barbara Campground	HQCWAL	20	FS
Santa Cruz River at Cuarteles	MCWAL	22	no data
Tesuque Creek at gage 08302500 near Santa Fe	MCWAL	22	FS

NOTES:
HQCWAL = high quality coldwater aquatic life
CWAL = coldwater aquatic life
MCWAL = marginal coldwater aquatic life
FS = Fully supporting its designated uses
NS = Not supporting its designated uses

Table 9. Sonde assessment conclusions.

Station	Aquatic Life Use	DO Criterion	DO Assessment	pH Criterion	pH Assessment
Embudo Creek at Hwy 68 bridge near Dixon at USGS gage	MCWAL	< 6 mg/L	no data	6.6-9.0	FS
Embudo Creek above Cañoncito	MCWAL	< 6 mg/L	no data	6.6-9.0	FS
Rio Grande near Los Luceros	MCWAL	< 6 mg/L	FS	6.6-9.0	FS
Rio Grande above Embudo Cr	MCWAL	< 6 mg/L	FS	6.6-9.0	FS
Rio Grande above Red River	CWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Grande above Rio Pueblo de Taos	CWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Pueblo de Taos below Taos WWTP effluent channel	CWAL	< 6 mg/L	FS	6.6-8.8	FS
Red River below Fish Hatchery	CWAL	< 6 mg/L	FS	6.6-8.8	FS
Cordova Creek above Costilla Creek	CWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Pueblo .8 miles above Hwy 518/75 at USGS gage	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Pueblo de Taos above Rio Grande del Rancho	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Grande del Rancho above Rio Pueblo de Taos	HQCWAL	< 6 mg/L	no data	6.6-8.8	FS
Rio Fernando de Taos above Rio Pueblo de Taos	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio Fernando de Taos at Fred Baca Park	HQCWAL	< 6 mg/L	**NS**	6.6-8.8	FS
Red River below Goose Creek	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Cabresto Creek at NM Hwy 38	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Pioneer Creek abv Red River	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Costilla Creek above Costilla at Hwy 196 bridge	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Cordova Creek above Costilla Creek	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Rio San Antonio at NM-CO border in Ortiz	HQCWAL	< 6 mg/L	**NS**	6.6-8.8	FS
Rio San Antonio at FR 87 bridge	HQCWAL	< 6 mg/L	**NS**	6.6-8.8	FS
Rio de los Pinos at USGS gage	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Cañada Tío Grande above Río San Antonio	HQCWAL	< 6 mg/L	**NS**	6.6-8.8	FS

Station	Aquatic Life Use	DO Criterion	DO Assessment	pH Criterion	pH Assessment
Rio Hondo at Rio Grande confluence	HQCWAL	< 6 mg/L	no data	6.6-8.8	FS
Rio Hondo 2.4 mi. below WWTP	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS
Bitter Creek	HQCWAL	< 6 mg/L	FS	6.6-8.8	FS

NOTES: HQCWAL = high quality coldwater aquatic life
CWAL = coldwater aquatic life
MCWAL = marginal coldwater aquatic life
FS = Fully supporting its designated uses
NS = Not supporting its designated uses

5.2 Water Quality Impairments for Narrative Criteria

5.2.1 Sedimentation/Siltation Assessment

The sedimentation/siltation assessment protocol was substantially revised prior to the development of the 2012-2014 Integrated List. This revision was based on the completion of an analysis by TetraTech, Inc., USEPA Region 6, and SWQB that generally followed the recommended steps in USEPA's Framework for developing suspended and bedded sediment (SABS) water quality criteria (USEPA 2006). This effort included the identification of sediment characteristics that are expected under the range of environmental settings in New Mexico, especially in undisturbed or best available reference streams. The goal of this characterization was to enable SWQB to identify situations where sedimentation/siltation expectations are not met, using sediment indicators that show responsiveness to disturbance. Examining the relationships between biological measures and sediment indicators helped to identify where disturbance caused sediment imbalance and biologically-relevant habitat degradation. The results of these analyses led to quantitative, sedimentation threshold recommendations for New Mexico perennial streams. See NMED/SWQB 2011 for details.

Substrate characteristics may be considered impacted at a site if they are: 1) not similar to expectations for undisturbed sites in the same environmental setting, or 2) detectably affecting the biota. In the first case, substrate may be finer, coarser, more unstable, or more stable than expected under broadly-recognized, undisturbed conditions (reference or best available conditions) for that particular environmental setting. This, in itself, can be an indication that streambed substrates are impacted by human disturbance. Biotic responses to disturbed substrates can be variable, but sub-optimal biotic conditions are often associated with unbalanced sediment.

Bedded sediments cannot be treated as introduced pollutants such as pesticides because they are not uniquely generated through human input or disturbance. Rather, bedded sediments are components of natural systems that are present even in pristine settings and to which stream organisms have evolved and adapted. Therefore, the detection of a sediment imbalance is more difficult than detecting an absolute concentration or percentage that represents a clear biological impact (Jessup et al. 2010).

Sedimentation/Siltation Assessment

Habitat surveys were conducted at twenty-four study sites to collect data for sedimentation/siltation impairment determinations. Table 10 describes the ecoregion, associated sediment site class, watershed size, and elevation of each station where habitat data were collected.

Table 10. Watershed characteristics of study sites.

Station Name	Level IV Ecoregion	Elevation (m)	Watershed Area (mi^2)	Sediment Site Class
Bitter Creek above town of Red River	21c	2758	10.6	Mountains
Cabresto Creek at USGS gage	21h	2400	36	Mountains
Canada Tio Grande above Rio San Antonio	21d	2710	10.3	Foothills
Comanche below upper exclosure	21j	2812	34	Mountains
Comanche Creek above Costilla Creek	21b	2722	42.2	Mountains
Cordova Creek 300m upstream from Day Lodge	21g	2886	1.3	Mountains
Cordova Creek above Costilla Creek above Hwy 196	21d	2544	5.6	Foothills
Costilla Creek above Costilla at Hwy 196 bridge	22b	2416	196	Foothills
Embudo Creek above Cañoncito	22h	1903	267	Xeric
Pioneer Creek about 400 yards above the Red River	21c	2670	5.2	Mountains
Red River below Fish Hatchery near USGS	22f	2140	185	Foothills
Rio de los Pinos at USGS gage	22a	2452	167	Foothills
Rio Fernando de Taos at Fred Baca Park	22f	2096	60.8	Foothills
Rio Fernando de Taos above Rio Pueblo de Taos	22f	2061	71.8	Foothills
Rio Grande del Rancho above Rio Pueblo de Taos	22f	2052		Foothills
Rio Hondo at Rio Grande confluence	22f	1984	70.9	Foothills
Rio Pueblo .8 miles above Hwy 518/75 at USGS gage	21f	2380	101	Mountains
Rio Pueblo de Taos 20m below Taos effluent channel	22f	2032	380	Foothills
Rio Pueblo de Taos above Rio Grande	22f	1870	418	Foothills
Rio Pueblo de Taos above Rio Grande del Rancho near Los Cordovas	22f	2052	199	Foothills
Rio San Antonio at FR 87 bridge	21d	2686	61	Foothills
Rio San Antonio at NM-CO border in Ortiz	22a	2434	63.1	Foothills
Rio Santa Barbara at Roybal Road	21d	2238		Foothills
Santa Cruz River at town of Quarteles	22h	1740	177	Xeric

To determine if there is excessive sedimentation/siltation in the study stream reach, two levels of assessment are performed in sequential order (NMED/SWQB 2011, Appendix C). The first level considers the simpler indicator of biological impairment, and then refines the assessment with the second indicator of geomorphic impairment as needed when the first level threshold is exceeded. The % sand & fines (%SaFN) indicator (based on a reach-wide pebble count) is used in the Level One assessment because it is easily measured and strongly related with biological

metrics. Particles two mm and smaller are referred to as "% sand & fines" in USEPA documentation, and are equivalent to New Mexico's definition of "fines" in 20.6.4.13 NMAC Subsection A. The percent sand & fines is calculated by adding the % sand and % silt-clay fractions

If the %SaFN indicates excessive fine sediment in the streambed (i.e., the %SaFN is greater than the sediment site class threshold), a Level Two survey is performed to calculate the log relative bed stability_ no bedrock (LRBS_NOR) value in order to determine if the excessive fine sediment is expected based on geomorphic characteristics. This sediment indicator is a calculation that considers site-specific hydraulic potential for moving bed sediments, so that the observed amount of fine sediments are only considered impaired when the streambed is more easily mobilized and transported than expected. The LRBS_NOR measure is appropriate as a second-tier indicator because it is scaled to hydro-geomorphic factors of the individual sites, as well as to the broader site classes, thus allowing evaluation of the potential of the specific site in terms of retaining or flushing fine sediments. When used as a second-tier sediment indicator, LRBS_NOR helps explain whether high % SaFN is expected for a given site or is the result of disturbed conditions (Jessup et al. 2010).

Level One and Level Two (as needed) sedimentation survey data and results are reported in Table 11 below. Three sites were found to be not supporting or impaired with respect to sedimentation/siltation. Twenty-one sites were found to be fully supporting.

Table 11. Sedimentation/Siltation assessment results.

Station Name	LEVEL ONE %SaFN threshold	Measured %SaFN	LEVEL ONE Sediment Assessment	Mean bankfull width (m) = XBkf_W	Mean bankfull height (m) = XBkf_H	Mean thalweg depth (cm) = XDEPTH	Reach SLOPE (%) = XSLOPE	LRBS_NOR (without bedrock)	LEVEL TWO LRBS_NOR threshold	LEVEL TWO Sediment Assessment
Bitter Creek above town of Red River	<20%	0.0	FS	3.9	0.28	12.2	4.5	--	--	--
Cabresto Creek at USGS gage	<37%	14.3	FS	5.3	0.32	30.9	2.2	--	--	--
Canada Tio Grande above Rio San Antonio	<37%	36.2	FS	3.6	0.25	16.6	0.8	--	--	--
Comanche below upper exclosure	<20%	20.0	**NS**	3.2	0.48	21.7	1.0	-0.89	> -1.1	FS
Comanche Creek above Costilla Creek	<20%	21.0	**NS**	4.1	0.45	21.0	1.2	-0.73	> -1.1	FS
Cordova Creek 300m upstream from Day Lodge	<20%	21.0	**NS**	4.1	0.66	8.5	5.9	-1.45	> -1.1	**NS**
Cordova Creek above Costilla Creek above Hwy 196	<37%	27.6	FS	3.1	0.62	9.2	3.9	--	--	--
Costilla Creek above Costilla at Hwy 196 bridge	<37%	25.0	FS	9.0	0.51	36.3	2.0	--	--	--
Embudo Creek above Cañoncito	<74%	15.1	FS	12.5	0.43	62.0	3.9	--	--	--
Pioneer Creek about 400 yards above the Red River	<20%	54.3	**NS**	4.4	0.23	24.5	0.5	-1.61	> -1.1	**NS**
Red River below Fish Hatchery near USGS	<37%	17.3	FS	9.4	0.29	47.8	1.4	--	--	--
Rio de los Pinos at USGS gage	<37%	15.2	FS	18.0	0.37	40.1	0.9	--	--	--
Rio Fernando de Taos at Fred Baca Park	<37%	57.3	**NS**	4.5	0.35	20.2	0.3	-1.19*	>-1.3	FS
Rio Fernando de Taos above Rio Pueblo de Taos	<37%	68.8	**NS**	5.5	0.36	26.5	0.7	-2.2*	>-1.3	**NS**
Rio Grande del Rancho above Rio Pueblo de Taos	<37%	24.8	FS	--	--	--	--	--	--	--
Rio Hondo at Rio Grande confluence	<37%	16.2	FS	6.8	0.35	30.8	2.3	--	--	--
Rio Pueblo .8 miles above Hwy 518/75 at USGS gage 08277470	<20%	12.4	FS	10.8	0.65	39.7	1.7	--	--	--
Rio Pueblo de Taos 20m below Taos effluent channel	<37%	49.0	**NS**	11.3	0.32	45.3	1.0	-1.15	>-1.3	FS
Rio Pueblo de Taos above Rio Grande	<37%	25.0	FS	--	--	--	--	--	--	--
Rio Pueblo de Taos above Rio Grande del Rancho, near Los Cordovas	<37%	20.0	FS	--	--	--	--	--	--	--
Rio San Antonio at FR 87 bridge	<37%	43.0	**NS**	7.3	0.35	23.8	0.5	-0.63	> -1.3	FS
Rio San Antonio at NM-CO border in Ortiz	<20%	23.8	**NS**	9.4	0.36	25.0	0.8	-0.48	> -1.1	FS
Rio Santa Barbara at Roybal Road	<37%	13.3	FS	--	--	--	--	--	--	--
Santa Cruz River at town of Quarteles	<74%	34.3	FS	--	--	--	--	--	--	--

NOTES: **NS = Not Supporting**; FS = Fully Supporting; -- = not available or applicable; * = LRBS with bedrock from EPA SWIMS (*Surface Water Information Management System*) website. No bedrock was recorded at this site, so LRBS calculated with or without bedrock are equivalent.

5.2.2 Periphyton Community and Nutrient Assessment

Periphyton Sampling

Periphyton is collected in biological surveys for a community composition analysis and for the quantification of chlorophyll *a* for the second level of nutrient assessments. A Level 1 nutrient screen is performed at each survey station to determine if excess nutrients may be an issue for the reach. If necessary, a series of data is collected for the Level 2 nutrient survey to determine impairment status. The periphyton community composition is a biological indicator that can express system stress in ways that the macroinvertebrate community may not reveal. The use of periphyton community composition data is still in early stages of development in New Mexico and does not provide conclusive information on stream condition at this time.

Nutrient Level 2 Assessment

Level 2 nutrient surveys were conducted at sites that were previously listed as impaired due to plant nutrients or where the Level 1 nutrient assessment indicated the possibility of nutrient impairment. For more information on this process refer to the *Nutrient Assessment Protocol for Wadeable, Perennial Streams* (NMED/SWQB 2011). The Level 2 nutrient survey consists of data collection on a number of indicators including total phosphorus, total nitrogen, dissolved oxygen, pH, and periphyton chlorophyll *a* concentration in order to perform a weight-of-evidence based impairment determination. Chlorophyll *a* is a quantitative measure of algal biomass which is the direct or indirect cause of most problems associated with nutrient impairment. The indicators are compared to the applicable criteria or threshold values to generate an exceedence ratio, or the number of exceedences divided by the total number of times the parameter was measured (Table 12). For total phosphorus, total nitrogen, and chlorophyll *a*, the threshold values are dependent on the ecoregion and designated aquatic life use. Level 2 nutrient surveys were conducted in twelve assessment units. Eight of these AUs were determined impaired for nutrients as noted in Table 12.

Table 12. Level 2 Nutrient assessment data for Upper Rio Grande watershed.

Assessment Unit	Ecoregion – Aquatic Life Use	DO & pH – long term datasets	DO %Sat. – grab (# and % of exceedences)	DO conc – grab (# and % of exceedences)	pH – grab (# and % of exceedences)	Total Nitrogen (# and % of exceedences)	Total Phosphorus (# and % of exceedences)	Chlorophyll *a* exceedence?	Nutrient Assessment
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)	22h - MCWAL & WWAL	pH supports; DO probe malfunction	0/8 = 0%	0/8 = 0%	0/8 = 0%	**3/8 = 37.5%**	1/8 = 12.5%	**yes**	**NS**
Red River (Placer Creek to headwaters)	21h - HQCWAL	Supports HQCWAL	0/8 = 0%	0/8 = 0%	1/8 = 12.5%	**4/8 = 50%**	**3/8 = 37.5%**	**yes**	**NS**

Assessment Unit	Ecoregion – Aquatic Life Use	DO & pH – long term datasets	DO %Sat. – grab (# and % of exceedences)	DO conc – grab (# and % of exceedences)	pH – grab (# and % of exceedences)	Total Nitrogen (# and % of exceedences)	Total Phosphorus (# and % of exceedences)	Chlorophyll *a* exceedence?	Nutrient Assessment
Rio Fernando de Taos (Rio Pueblo de Taos to Tienditas Creek)	22f - HQCWAL	Supports HQCWAL	0/9 = 0%	1/9 = 11%	0/9 = 0%	**3/4 = 75%**	**2/4 = 50%**	**yes**	**NS**
Rio Fernando de Taos (Tienditas Creek to headwaters)	21f - HQCWAL	NA	0/5 = 0%	0/5 = 0%	0/5 = 0%	**3/4 = 75%**	**3/4 = 75%**	no	FS
Rio Grande del Rancho (Rio Pueblo de Taos to Hwy 518)	22f; 21d – HQCWAL	pH supports; DO probe malfunction	**2/13 = 15.4%**	0/13 = 0%	0/8 = 0%	**5/13 = 38.5%**	**2/12 = 16.7%**	**yes**	**NS**
Rio Hondo (South Fork Rio Hondo to Lake Fork Creek)	21b – HQCWAL	Supports HQCWAL	0/14 = 0%	0/14 = 0%	0/14 = 0%	**8/14 = 57.1%**	**4/14 = 28.6%**	no	FS
Rio Pueblo (Picuris Pueblo bnd to headwaters)	21f - HQCWAL	Supports HQCWAL	0/4 = 0%	0/4 = 0%	0/4 = 0%	**2/4 = 50%**	**2/4 = 50%**	**yes**	**NS**
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	22f – CWAL	Non-Support CWAL	**3/8 = 37.5%**	0/8 = 0%	0/8 = 0%	**10/12 = 83.3%**	**9/12 = 75%**	**yes**	**NS**
Rio Pueblo de Taos (R Grande del Rancho to Taos pueblo bnd)	22f - HQCWAL	Supports HQCWAL	0/15 = 0%	0/15 = 0%	0/15 = 0%	**6/9 = 66.7%**	1/9 = 11.1%	no	FS
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	22f – CWAL	NA	0/8 = 0%	0/8 = 0%	**2/8 = 25%**	**6/9 = 66.7%**	**8/9 = 88.9%**	no	**NS**
Santa Cruz River (Santa Clara Pueblo bnd to Santa Cruz Dam)	22h - MCWAL & WWAL	Supports - MCWAL & WWAL	0/8 = 0%	0/8 = 0%	0/8 = 0%	**5/9 = 55.6%**	**4/9 = 44.4%**	no	FS
Unnamed Arroyo (Rio Pueblo de Taos to Taos WWTP)	22f – WWAL	NA	**4/9 = 44.4%**	0/9 = 0%	1/9 = 11.1%	**10/10 = 100%**	**10/10 = 100%**	**yes**	**NS**

NOTES: **Bolded Cells** indicate parameters that exceed the thresholds and/or exceedence ratios.
HQCWAL = High Quality Coldwater Aquatic Life;
CWAL = Coldwater Aquatic Life;
MCWAL = Marginal Coldwater Aquatic Life;
WWAL = Warmwater Aquatic Life
NS = Not Supporting;
FS = Fully Supporting; and
NA = sonde data are not available

5.2.3 Fish Community Data

Fish community data are collected for one or more of the following reasons:

- Development and/or refinement of water quality standards, particularly for designated aquatic life uses and/or temperature criteria;
- Development of fish-based biocriteria and/or bioassessment procedures; or
- To document and characterize a given water's fish community for comparison with future or past records.

The characteristics and habits of fish species (Table 13) can be correlated with physical habitat to provide information about how changes may be impacting the fish community.

Fish collection occurred between August 25 and October 23, 2009 at eight stations. Table 14 provides the results of fish collection in the upper Rio Grande watershed.

Table 13. Characteristics of fish species found in the upper Rio Grande watershed.

Species	Common Name	Native	Temperature	Gravel Spawner	Feeding Guild	Water Quality Tolerance
Catostomus catostomus	longnose sucker	Non-native	Cold	Yes	Invertivore	Intermediate
Catostomus commersoni	white sucker	Non-native	Cool	Yes	Omnivore	Tolerant
Catostomus (Pantosteus) plebeius	Rio Grande sucker	Native	Cool	Yes	Omnivore	Intermediate
Gila pandora	Rio Grande chub	Native	Cool	Yes	Invertivore	Intermediate
Oncorhynchus clarki virginalis	Rio Grande cutthroat trout	Native	Cold	Yes	Invertivore	Sensitive
Oncorhynchus mykiss	rainbow trout	Non-native	Cold	Yes	Invertivore	Sensitive
Oncorhynchus mykiss x clarki	cutbow	Non-native	Cold	Yes	Invertivore	Sensitive
Pimephales promelas	fathead minnow	Native	Warm	No	Omnivore	Tolerant
Rhinichthys cataractae	longnose dace	Native	Cool	Yes	Invertivore	Intermediate
Salmo trutta	brown trout	Non-native	Cold	Yes	Invertivore	Sensitive

Table 14. Fish community data from sites in the Upper Rio Grande watershed.

		Station:	28Cabres005.4	27CTGran000.7	28RCosti005.7	28Pionee000.7	28RFerna003.2	28RFerna000.3	28RHondo000.1	27RSanAn025.3
Scientific name	**Common name**	**Temperature**								
Catostomus catostomus	longnose sucker	Cold	-	-	23	-	-	-	-	-
Catostomus commersoni	white sucker	Cool	-	152	4	-	47	32	-	141
Catostomus (Pantosteus) plebeius	Rio Grande sucker	Cool	-	-	-	-	-	2	-	-
Gila pandora	Rio Grande chub	Cool	-	8	-	-	6	37	-	53
Oncorhynchus clarki virginalis	Rio Grande cutthroat trout	Cold	-	1	-	-	-	-	-	5
Oncorhynchus mykiss	rainbow trout	Cold	3	-	11	-	-	-	19	-
Oncorhynchus mykiss x clarki	cutbow	Cold	-	-	15	-	-	-	-	-
Pimephales promelas	fathead minnow	Warm	-	1	-	-	13	22	-	1
Rhinichthys cataractae	longnose dace	Cool	-	2	3	-	-	24	14	104
Salmo trutta	brown trout	Cold	82	1	-	11	1	35	155	19
Salvelinus fontinalis	brook trout	Cold	-	-	-	1	-	-	-	-
		# of Individuals	85	165	56	12	67	152	188	323
		Total # of Taxa	2	6	5	2	4	6	3	6
		% Native	0	7	5	0	28	56	7	50
		% Non-native	100	93	95	100	72	44	93	50
		% Coldwater	100	1	88	100	2	23	93	7
		% Coolwater	0	98	12	0	79	63	7	92
		%Warmwater	0	1	0	0	19	14	0	<1

5.2.4 Macroinvertebrate Community

Macroinvertebrate Sampling

SWQB uses data on the macroinvertebrate communities present in a stream reach to identify changes that indicate stress on the community. Depending on the ecoregion of the study site, this is done by utilizing either the Rapid Bioassessment Protocol (RBP) (Plafkin et. al 1989, Barbour et. al 1999) or Mountain Stream Condition Index (M-SCI) (Jacobi et al., 2006) as described in SWQB's main assessment protocol (NMED/SWQB 2011). The RBP or M-SCI score is a percentage comparison of the sum of selected metric scores derived from the macroinvertebrate communities and used to compare the study site to the selected reference site or reference condition in order to determine the degree of impairment. For example, when the macroinvertebrate community at a study site in ecoregion 21 or 23 has an M-SCI score less than 56.70% of the reference condition, it can be concluded that there is stress on that community and it would be deemed impaired (i.e. non-support) (Table 15).

Table 15. Biological integrity evaluations for the Upper Rio Grande and tributaries.

Station Name	Ecoregion	Elevation (m)	Watershed Area (mi^2)	Reference site group	RBP % of reference site	M-SCI Score	Biological Assessment
Costilla Creek above Costilla at Hwy 196 bridge (***Reference site 1***)	22b	2416	196	**1**	**100%**	--	FS
Embudo Creek above Cañoncito	22h	1903	267	1	88%	--	FS
Rio de los Pinos at USGS gage	22a	2452	167	1	--	73.4	FS
Red River below Fish Hatchery near USGS	22f	2140	185	1	--	60.5	FS
Rio San Antonio at NM-CO border in Ortiz	22a	2434	63.1	1	--	62.4	FS
Rio Pueblo de Taos above Rio Grande del Rancho near Los Cordovas (***Reference site 2***)	22f	2052	199	**2**	**100%**	--	FS
Rio Pueblo de Taos 20m below Taos effluent channel	22f	2032	380	2	91%	--	FS
Rio Grande del Rancho above Rio Pueblo de Taos	22f	2052	138	2	86%	--	FS
Rio Fernando de Taos above Rio Pueblo de Taos	22f	2061	71.8	2	68%	--	**NS**

Station Name	Ecoregion	Elevation (m)	Watershed Area (mi^2)	Reference site group	RBP % of reference site	M-SCI Score	Biological Assessment
Rio Fernando de Taos at Fred Baca Park	22f	2096	60.8	2	59%	--	**NS**
Rio Hondo at Rio Grande confluence (***Reference site 3***)	22f	1984	70.9	**3**	**100%**	--	FS
Rio Pueblo de Taos above Rio Grande	22f	1870	418	3	74%	--	**NS**
Cordova Creek 300m upstream from Day Lodge	21g	2886	1.3	--	--	87.8	FS
Cabresto Creek at USGS gage	21b	2400	36	--	--	77.5	FS
Bitter Creek above town of Red River	21c	2758	10.6	--	--	77.1	FS
Rio Pueblo .8 miles above Hwy 518/75 at USGS gage	21f	2380	101	--	--	76	FS
Cordova Creek above Costilla Creek above Hwy 196	21d	2544	5.6	--	--	72.7	FS
Comanche Creek above Costilla Creek	21b	2722	42.2	--	--	71.5	FS
Comanche below upper exclosure	21j	2812	34	--	--	69.8	FS
Canada Tio Grande above Rio San Antonio	21d	2710	10.3	--	--	64.3	FS
Pioneer Creek about 400 yards above the Red River	21c	2670	5.2	--	--	60.2	FS
Rio San Antonio at FR 87 bridge	21d	2686	61	--	--	57.5	FS

NOTES: **NS** = **Not Supporting**; and
FS = Fully Supporting.

6.0 CONCLUSIONS

There were 41 stream listings before the start of the 2009 water quality survey. The 2009 survey confirmed 29 impairment listings and added 28 listings increasing the number of listed streams from 41 to 57 (Table 16). In addition, 12 streams were removed, or "de-listed", from the WQCC-Approved 2012–2014 Integrated List (Table 17) because they were found to be meeting standards (NMED/SWQB 2012). Fish tissue was not studied during this survey, therefore, any previous listings were not confirmed nor rejected and stand as previously sampled. Nutrients, temperature, and *E. coli* saw the most dramatic increases in number of impairments (Figure 9).

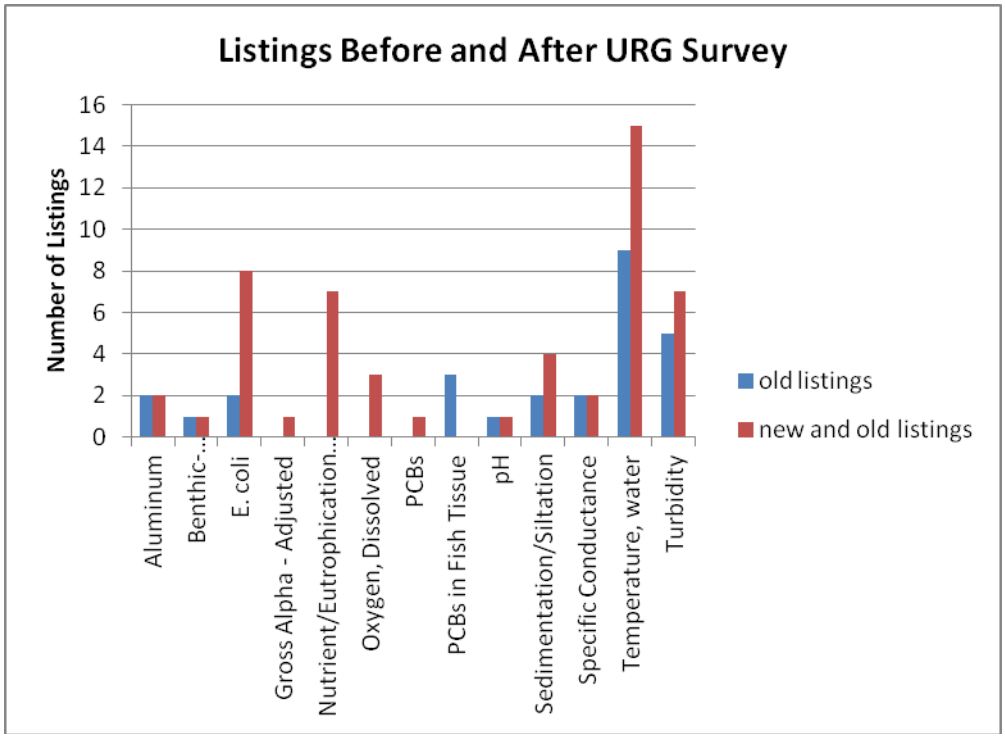

Figure 9. Water quality impairment listings before and after 2009 Upper Rio Grande survey**.**

Table 16. List of new and confirmed impairments from *WQCC-Approved 2012-2014 Integrated List*. New listings are in **BOLD**.

AU Name	CAUSE NAME	CYCLE FIRST LISTED
Bitter Creek (Red River to headwaters)	Aluminum	1998
Bitter Creek (Red River to headwaters)	**Turbidity**	**2012**
Cañada Tío Grande (Río San Antonio to headwaters)	**Oxygen, Dissolved**	**2012**

AU Name	CAUSE NAME	CYCLE FIRST LISTED
Cañada Tío Grande (Río San Antonio to headwaters)	**Temperature, water**	**2012**
Comanche Creek (Costilla Creek to headwaters)	Temperature, water	1998
Cordova Creek (Costilla Creek to headwaters)	Sedimentation/Siltation	2004
Costilla Creek (CO border to Diversion abv Costilla)	Low flow alterations	
Costilla Creek (Rio Grande to CO border)	Low flow alterations	
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	Sedimentation/Siltation	1998
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	**Temperature, water**	**2012**
Embudo Creek (Rio Grande to Canada de Ojo Sarco)	Turbidity	1998
Little Tesuque Creek (Rio Tesuque to headwaters)	Aluminum	1998
Pioneer Creek (Red River to headwaters)	**Sedimentation/Siltation**	**2012**
Pioneer Creek (Red River to headwaters)	Turbidity	2004
Red River (Placer Creek to headwaters)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Rio de los Pinos (New Mexico reaches)	Temperature, water	2004
Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)	*E. coli*	2008
Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)	**Sedimentation/Siltation**	**2012**
Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)	Specific Conductance	1998
Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)	Temperature, water	1998
Rio Fernando de Taos (Tienditas Creek to headwaters)	*E. coli*	2008

AU Name	CAUSE NAME	CYCLE FIRST LISTED
Rio Fernando de Taos (UFSF bnd at canyon to Tienditas Creek)	***E. coli***	**2012**
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	***E. coli***	**2012**
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	**Gross Alpha - Adjusted**	**2012**
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	PCBs	2012
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	PCBs in Fish Tissue	2006
Rio Grande (Cochiti Reservoir to San Ildefonso bnd)	Turbidity	2004
Rio Grande (Embudo Creek to Rio Pueblo de Taos)	**Turbidity**	**2012**
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)	PCBs in Fish Tissue	2006
Rio Grande (Ohkay Owingeh bnd to Embudo Creek)	Turbidity	1998
Rio Grande (Red River to CO border)	pH	2004
Rio Grande (Red River to CO border)	Temperature, water	2004
Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)	PCBs in Fish Tissue	2010
Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)	Turbidity	1998
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)	Specific Conductance	2004
Rio Grande del Rancho (Rio Pueblo de Taos to HWY 518)	**Temperature, water**	**2012**
Rio Hondo (Rio Grande to USFS bnd)	Temperature, water	2002
Rio Pueblo (Picuris Pueblo bnd to headwaters)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	**Nutrient/Eutrophication Biological Indicators**	**2012**

AU Name	CAUSE NAME	CYCLE FIRST LISTED
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	Temperature, water	2004
Rio Pueblo de Taos (R Grande del Rancho to Taos Pueblo bnd)	***E. coli***	**2012**
Rio Pueblo de Taos (R Grande del Rancho to Taos Pueblo bnd)	Temperature, water	2004
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	**Nutrient/Eutrophication Biological Indicators**	**2012**
Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)	Temperature, water	2004
Rio Quemado (Santa Cruz River to Rio Arriba Cnty bnd)	***E. coli***	**2012**
Rio San Antonio (CO border to Montoya Canyon)	**Oxygen, Dissolved**	**2012**
Rio San Antonio (CO border to Montoya Canyon)	**Temperature, water**	**2012**
Rio San Antonio (Montoya Canyon to headwaters)	***E. coli***	**2012**
Rio San Antonio (Montoya Canyon to headwaters)	**Oxygen, Dissolved**	**2012**
Rio San Antonio (Montoya Canyon to headwaters)	Temperature, water	2004
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)	Benthic-Macroinvertebrate Bioassessments (Streams)	1998
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)	**Temperature, water**	**2012**
Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)	***E. coli***	**2012**
Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)	**Temperature, water**	**2012**

Table 17. Impairments removed from the *WQCC-Approved 2012-2014 Integrated List*.

AU Name	Impairments removed from the WQCC-Approved 2012-2014 Integrated List	CYCLE FIRST LISTED
Bitter Creek (Red River to headwaters)	Sedimentation/Siltation	1998
Costilla Creek (Diversion abv Costilla to Comanche Creek)	Temperature, water	2004
Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)	Benthic-Macroinvertebrate Bioassessments (Streams)	1998
Placer Creek (Red River to headwaters)	Aluminum	2004
Red River (Placer Creek to headwaters)	Aluminum	1998
Red River (Rio Grande to Placer Creek)	Aluminum	1998
Rio Chupadero (USFS bnd to headwaters)	Aluminum	1998
Rio Pueblo (Picuris Pueblo bnd to headwaters)	Benthic-Macroinvertebrate Bioassessments (Streams)	1998
Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)	Sedimentation/Siltation	2004
Rio Pueblo de Taos (R Grande del Rancho to Taos Pueblo bnd)	Specific Conductance	2004
Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)	Turbidity	1998
Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)	Sedimentation/Siltation	1998

Data collected from permitted discharges are used to determine point source contributions but are not directly used in assessments. These data are included in Tables 18 – 20 for public information.

Table 18. Point source sampling results for select parameters.

Point Source	Sample Date	Ammonia mg/L	Bacteria (*E. coli*) cfu/100mL	Total Kjehldal Nitrogen mg/L	Total Phosphorus mg/L
Red River Fish Hatchery effluent	3/18/2009	0.178	-	0.410	0.039
	4/15/2009	0.226	-	0.160	0.044
	5/12/2009	0.197	-	0.170	0.048
	6/10/2009	0.270	-	0.270	0.035
	7/7/2009	0.197	-	0.500	0.063
	8/12/2009	0.217	-	0.230	0.025
	9/16/2009	0.100	-	0.250	0.059
	10/7/2009	0.165	-	0.230	0.055

Point Source	Sample Date	Ammonia mg/L	Bacteria (*E. coli*) cfu/100mL	Total Kjehldal Nitrogen mg/L	Total Phosphorus mg/L
Twining WWTP effluent at Taos Ski Valley	3/19/2009	9.510	235.9	11.000	0.197
	4/16/2009	0.638	1.0	2.100	0.039
	5/13/2009	0.100	1.0	0.440	0.232
	6/11/2009	0.100	1.0	0.730	0.433
	7/9/2009	0.150	1.0	0.870	0.214
	8/13/2009	0.100	1.0	0.330	0.225
	9/17/2009	0.100	3.1	0.600	0.217
Red River WWTP effluent	3/18/2009	5.400	63.1	7.100	0.619
	4/15/2009	0.158	3.1	0.740	0.499
	5/12/2009	0.395	17.1	0.970	0.257
	6/10/2009	0.380	218.7	1.700	0.371
	7/8/2009	0.614	57.3	2.540	0.563
	8/12/2009	1.020	25.6	3.200	1.030
	9/16/2009	0.487	13.5	1.800	0.537
	10/7/2009	0.670	52.9	1.750	0.313
Española WWTP effluent	3/26/2009	0.100	10.8	0.980	3.470
	4/21/2009		187.2	-	-
	5/21/2009		517.2	-	-
	6/16/2009		2419.6	-	-
	7/16/2009		93.4	-	-
	8/19/2009		37.3	-	-
	9/23/2009		34.1	-	-
	10/15/2009		7.5	-	-

Rio Grande (Klauer) Spring was sampled due to public concern for use as a domestic water supply. Samples for radionuclides and *E. coli* were collected. Three out of six samples detected *E. coli* in the water, but at levels below surface water primary contact standards. Radionuclides were also detected both times sampled, but at levels below the domestic water supply criteria. Surface water primary contact standards are not the same as drinking water standards and the results of this study should not be used to determine the safety of this water source for drinking water.

Table 19. *E. coli* results from Rio Grande Spring.

Sampling Date	*E. coli* (cfu/100mL)	Primary Contact Criterion* (cfu/100mL)
3/24/2009	0	410
4/21/2009	<1	410
5/20/2009	<1	410
7/15/2009	59.1	410
8/18/2009	21.8	410
9/24/2009	18.9	410

NOTES: cfu/100 mL = colony forming units per 100 milliliters
Primary contact criterion is the single sample criterion (as opposed to the monthly geometric mean criterion)

Table 20. Radionuclide results from Rio Grande Spring.

Sampling Date	Analyte	pCi/L
4/21/2009	Gross alpha (Am-241 ref.)	4.2[a]
	Gross alpha (U-nat ref.)	5.1
	Gross beta (Cs-137 ref.)	4.6
	Gross beta (Sr/Y-90 ref.)	4.4
	Radium-226	0.01[b]
	Uranium-234/235/238	5 µg/L
8/18/2009	Gross alpha (Am-241 ref.)	2.7[a]
	Gross alpha (U-nat ref.)	3.1
	Gross beta (Cs-137 ref.)	4.3
	Gross beta (Sr/Y-90 ref.)	4.2

NOTES:
a. Domestic water supply criterion for adjusted gross alpha (i.e., Gross alpha (Am-241 ref.) minus Uranium-234/235/238) is 15pCi/L.
b. Domestic water supply criterion for Radium 226+228 is 5 pCi/L.

Data collected in the Upper Rio Grande watershed and mentioned in this report are not included due to the large volume. To acquire specific data, contact the SWQB or search EPA's WQX/ STORET databases.

Total Maximum Daily Load (TMDL) documents will be prepared or updated by the SWQB to address the above noted impairments. Additional water quality data will be collected by the SWQB during the standard rotational period for intensive stream surveys. As a result, targets will be re-examined and potentially revised. When water quality standards have been achieved, the reach will be moved to the appropriate category on the *Integrated Clean Water Act §303(d)/§305(b) List of Assessed Waters*.

7.0 REFERENCES

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APPENDIX A IR (INTEGRATED REPORT) CATEGORIES

Overall water quality standards attainment categories for each assessment unit as determined by combining individual designated use support decisions. The unique assessment categories for New Mexico are described as follows:

IR Category 1	Attaining the water quality standards for all designated and existing uses. AUs are listed in this category if there are data and information that meet all requirements of the assessment and listing methodology and support a determination that the water quality criteria are attained.
IR Category 2	Attaining some of the designated or existing uses based on numeric and narrative parameters that were tested, and no reliable monitored data is available to determine if the remaining uses are attained or threatened. AUs are listed in this category if there are data and information that meet requirements of the assessment and listing methodology to support a determination that some, but not all, uses are attained based on numeric and narrative water quality criteria that were tested. Attainment status of the remaining uses is unknown because there is no reliable monitored data with which to make a determination.
IR Category 3	No reliable monitored data and/or information to determine if any designated or existing use is attained. AUs are listed in this category where data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology.
IR Category 4A	Impaired for one or more designated uses, but does not require development of a TMDL because TMDL has been completed. AUs are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of an AU, the AU remains in Category 5A (see below) until all TMDLs for each pollutant have been completed and approved by USEPA.
IR Category 4B	Impaired for one or more designated uses, but does not require development of a TMDL because other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future. Consistent with the regulation under 40 CFR 130.7(b)(i),(ii), and (iii), AUs are listed in this subcategory where other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard (WQS) applicable to such waters.
IR Category 4C	Impaired for one or more designated uses, but does not require development of a TMDL because impairment is not caused by a pollutant. AUs are listed in this subcategory if a pollutant does not cause

	the impairment. For example, USEPA considers flow alteration to be "pollution" vs. a "pollutant."
IR Category 4N	Impairment is caused solely due to natural conditions. AUs are listed in this subcategory if the impairment is due solely to natural conditions. These waters are still protected by antidegradation provisions, and decisions regarding discharges or activities in the watershed that could increase the pollutant of concern must consider these waters to be "impaired." To be placed in this category, SWQB must have evidence that anthropogenic activities are not contributing to the impairment.
IR Category 5/5A	Impaired for one or more designated or existing uses and a TMDL is underway or scheduled. AUs are listed in this category if the AU is impaired for one or more designated uses by a pollutant. Where more than one pollutant is associated with the impairment of a single AU, the AU remains in Category 5A until TMDLs for all pollutants have been completed and approved by USEPA.
IR Category 5/5B	Impaired for one or more designated or existing uses and a review of the water quality standard will be conducted. AUs are listed in this category when it is possible that water quality standards are not being met because one or more current designated use is inappropriate. After a review of the water quality standard is conducted, a Use Attainability Analysis (UAA) will be developed and submitted to USEPA for consideration, or the AU will be moved to Category 5A and a TMDL will be scheduled.
IR Category5/5C	Impaired for one or more designated or existing uses and Additional data will be collected before a TMDL is scheduled. AUs are listed in this category if there is not enough data to determine the pollutant of concern or there is not adequate data to develop a TMDL. For example, AUs with biological impairment will be listed in this category until further research can determine the particular pollutant(s) of concern. When the pollutant(s) are determined, the AU will be moved to Category 5A and a TMDL will be scheduled. If it is determined that the current designated uses are inappropriate, it will be moved to Category 5B and a UAA will be developed. If it is determined that "pollution" is causing the impairment (vs. a "pollutant"), the AU will be moved to Category 4C.