DRAFT MIDDLE RIO GRANDE TOTAL MAXIMUM DAILY LOAD (TMDL) FOR FECAL COLIFORM IN STORM WATER

New Mexico Environment Department
Surface Water Quality Bureau
September 2000

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Summary Table

New Mexico Standards Segment	Rio Grande, 2105 Rio Grande, 2105.5
Waterbody Identifier	Rio Grande MRG3-30000
Parameters of Concern	Fecal coliform
Uses Affected	Limited Warm Water Fishery
State Priority	1
Threatened or Endangered Species	Silvery Minnow
Geographic Location	Rio Grande River Basin
Scope/size of watershed	3,204 mi^2
Land type	Arizona/New Mexico Plateau
Land use/cover	59% Rangeland 23% Forest 7% Agricultural 6% Urban 3% Barren 1% Wetlands <1% Water
Identified Point Sources City of Albuquerque NPDES Multi-Sector 4 ~ Permit Pending	Bernalillo WWTF (NM0023485) Rio Rancho #2 (NM0027987) Rio Rancho #3 (NM0029602) General Electric (NM0000159) Albuquerque WWTF (NM0022250) Siemans (NM0029394) PNM (Reeves Station) (NM0000124) Sandia Peak Ski Area (NM0027863) Delta Environmental/Diamond Shamrock (NM0029807) Wylie Corporation (NM0029009) Rio Grande Portlant Cement Corp (NM0000116) Corrales Chevron (NM0029696) Duke City Distributing (DRT Consultants) (NM0029688) Rio Grande Resources, Inc. (NM0028100) Stormwater
Watershed Ownership	66% Private 13% Bureau of Land Management 10% Tribal 9% United States Forest Service 2% United States Military

Stormwater TMDLs for:	**LA + WLA + MOS = TMDL**
Fecal Coliform	**Bernalillo WWTF** $1.766 \times 10^{12} + 3.030 \times 10^{9} + 0 = 1.769 \times 10^{12}$
	Rio Rancho #3 WWTF $1.762 \times 10^{12} + 7.424 \times 10^{9} + 0 = 1.769 \times 10^{12}$
	Rio Rancho #2 WWTF $1.762 \times 10^{12} + 7.424 \times 10^{9} + 0 = 1.769 \times 10^{12}$
	City of Albuquerque WWTF $1.497 \times 10^{12} + 2.727 \times 10^{11} + 0 = 1.769 \times 10^{12}$
Discharge is to Sandia Pueblo Tribal Waters, with no mixing zone or dilution.	**North Floodway Diversion** **$0 + 6.438 \times 10^{11} + 0 = 6.438 \times 10^{11}$**
	La Cueva Arroyo $6.438 \times 10^{11} + 268.94 + 0 = 6.438 \times 10^{11}$
	Pino Arroyo $6.437 \times 10^{11} + 26{,}928.03 + 0 = 6.437 \times 10^{11}$
	Grant Line Arroyo $6.438 \times 10^{11} + 905.30 + 0 = 6.438 \times 10^{11}$
	Academy Acres Drain $6.438 \times 10^{11} + 2{,}837.12 + 0 = 6.438 \times 10^{11}$
	Tramway Floodway $1.16 \times 10^{12} + 29{,}356.06 + 0 = 1.16 \times 10^{12}$
	North Fork Hahn Arroyo $6.438 \times 10^{11} + 931.81 + 0 = 6.438 \times 10^{11}$
	South Fork Hahn Arroyo $6.437 \times 10^{11} + 41{,}617.42 + 0 = 6.437 \times 10^{11}$
	Hahn Arroyo $6.438 \times 10^{11} + 291.66 + 0 = 6.438\ 10^{11}$
	Embudo Arroyo $6.438 \times 10^{11} + 291.66 + 0 = 6.438\ 10^{11}$
	North Camino Arroyo $6.438 \times 10^{11} + 560.61 + 0 = 6.438 \times 10^{11}$
	Arroyo 19a $8.88 \times 10^{12} + 719.69 + 0 = 8.88 \times 10^{12}$
	Campus Wash $8.87 \times 10^{12} + 1{,}175{,}113.64 + 0 = 8.87 \times 10^{12}$
	Ladera Arroyo $8.88 \times 10^{12} + 37{,}689.39 + 0 = 8.88 \times 10^{12}$
	San Jose Drain $1.16 \times 10^{12} + 10{,}681.81 + = 1.16 \times 10^{12}$
	Taylor Ranch Drain $8.88 \times 10^{12} + 13{,}939.39 + 0 = 8.88 \times 10^{12}$
	Corrales Main Canal Outfall $8.88 \times 10^{12} + 223{,}750 + 0 = 8.88 \times 10^{12}$
	Corrales Riverside Drain $8.79 \times 10^{12} + 769{,}128.78 + 0 = 8.79 \times 10^{12}$
	Albuquerque Riverside Drain $1.159 \times 10^{12} + 335{,}378.78 + 0 = 1.159 \times 10^{12}$
	Tijeras Arroyo $1.159 \times 10^{12} + 119{,}924.24 + 0 = 1.159 \times 10^{12}$
	South Diversion Channel $1.159 \times 10^{12} + 144{,}431.81 + 0 = 1.159 \times 10^{12}$
	Atrisco Drain near Isleta $1.159 \times 10^{12} + 175{,}037.87 + 0 = 1.159 \times 10^{12}$

List of Abbreviations

BMP	Best Management Practice
CFS	Cubic Feet per Second
CWA	Clean Water Act
CWAP	Clean Water Action Plan
CWF	Cold Water Fishery
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
FCU	Fecal Colony Unit
LWWF	Limited Warm Water Fishery
LA	Load Allocation
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MOS	Margin of Safety
NMED	New Mexico Environment Department
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Sources
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
UWA	Unified Watershed Assessment
WLA	Waste Load Allocation
WQLS	Water Quality Limited Segment
WQCC	New Mexico Water Quality Control Commission
WQS	Water Quality Standards
WWTF	Waste Water Treatment Facility

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop TMDL management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety and natural background conditions.

The middle Rio Grande, for the purposes of this document, is defined as the Rio Grande from the northern boundary of Isleta Pueblo to the southern boundary of Santa Ana Pueblo. The New Mexico 1998-2000 §303(d) report, *"State of New Mexico §303(d) List for Assessed Stream and River Reaches,"* lists this segment as being water quality limited for the following pollutants: fecal coliform, total ammonia and chlorine. Subsequent sampling conducted in three seasons in 1999 resulted in a re-evaluation of these listings. Based on this sampling, the listings were modified to include only fecal coliform. The 2000-2002 §303(d) reflects these changes. This Total Maximum Daily Load (TMDL) document addresses only fecal coliform specifically in stormwater. The land use/land cover for the middle Rio Grande is 59% Rangeland, 23% Forest, 7% Agricultural, 6% Urban, 3% Barren, 1% Wetlands and <1% Water **(Figure 1)**.

State of New Mexico Standards for Interstate and Intrastate Surface Waters (New Mexico Water Quality Control Commission, 20.6.1 NMAC, February 23, 2000 [Standards]) identify and designate this part of the Rio Grande as a limited warmwater fishery with other designated uses of irrigation, livestock watering, wildlife habitat and secondary contact. The Standards specify specific constituent criteria levels to be maintained so that the water body can support these designated uses. TMDL targets specified in this document are based on these water quality standards criteria. TMDL numeric targets are calculated so as to provide protection of designated uses. Load capacities are estimated as a function of these water quality targets and the assimilative capacity of the middle Rio Grande. Load allocations presented in this TMDL are based on the load capacities developed using these targets. Targets, loading analyses, and load allocations are presented for fecal coliform. These load analyses show that the estimated load capacities are currently exceeded, and therefore require reductions

Included in this document is a general plan outlining activities which, when implemented in the middle Rio Grande stormwater drainage area, would result in a reduction of fecal coliform bacteria inputs in the river. The New Mexico Environment Department, Surface Water Quality Bureau, local municipalities, USEPA Region 6 and Tribal Governments along this reach will assist in the development of these and other stormwater abatement controls in order to reduce the pollutant loads to the system. Implementation of recommendations in this document will be done with full participation of all interested and affected parties

Background Information

Eight ambient water quality monitoring stations and four effluent discharges were sampled in 1999. Results of this effort are listed in **Appendix B**. These data were used to characterize water quality of the stream reach. Station locations were selected to evaluate impacts of the wastewater discharge to the system and storm water inputs into the river **(Figure 2)**. This monitoring effort documented several exceedances of New Mexico water quality standards for fecal coliform. All exceedances for fecal coliform in the river were observed after summer rain events. Historically, as far back as 1979, the New Mexico Environment Department, then known as the New Mexico Health and Environment Department, has studied this issue. In a report titled**, *"Pollutant Loads in Stormwater Runoff from Albuquerque, New Mexico"***, David F. Tague and Anthony Drypolcher document fecal coliform exceedances in stormwater **(Appendix D)**. The following is an excerpt from the 1979 report:

"Fecal Coliform loading from stormwater runoff, approximately 49 times greater than that attributable to the WWTF, is probably the principal cause of fecal coliform counts ranging between 10,000 and 100,000 colonies/100ml routinely observed in the river during June through September. Fecal coliform/fecal streptococci ratios indicate feces of domestic animals are an important source of fecal bacteria contained in runoff from the watershed (Geldreich et al. 1968; Geldreich 1971; Geldreich 1976). The fecal coliform standard for this reach that specifies a logarithmic mean of less than 1,000 fecal coliforms/100ml on a monthly basis was adopted prior to an understanding of the effect of urban runoff. Seasonal water quality standards that allow for a decline in bacterial quality during the summer thunderstorm season (discussed under Work Element 5.1 of New Mexico's Statewide Water Quality Management Plan) seem reasonable in view of these data. We believe that impounding and disinfecting runoff waters to reduce bacteria densities to levels compatible with the existing stream standards is not a reasonable alternative".[1]

In a 1988 report titled, "***Intensive Water Quality Survey of The Rio Grande from Angostura to U.S. 85 Bridge, Sandoval and Bernalillo Counties, New Mexico***, Steven T. Pierce, Surveillance and Standards Section, Surface Water Quality Bureau, New Mexico Environmental Improvement Division, noted that:

"Violations of the single-sample numeric standard for fecal coliform bacteria occurred at stations 1, 3, 5 and 7 but only after the runoff event. The fecal coliform count at station 7 was greater than 600,000 per 100ml. This appears to be the result of runoff waters from a major thunderstorm entering the Rio Grande above station 7 from the North Floodway Channel near Alameda, which drains runoff from over 60 percent of the land in Albuquerque. At peak runoff, the flow from the North floodway channel near Alameda was approximately six times the flow of the Rio Grande at the central Avenue bridge.

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1 New Mexico Health and Environment Department, Water Pollution Control Section, Surveillance Unit, ***Pollutant loads in Stormwater Runoff from Albuquerque, New Mexico***, June 1979, p. 14.

Three separate series of fecal coliform samples were collected during the survey, but only samples collected after the runoff event from the four stations listed above violated the numeric standards. Average counts at stations 1, 3, 5, and 7 before the runoff event were 133, <74, <95 and <370, well within the single sample standard of 2,000 per 100ml".[2]

In a recent study conducted by Camp Dresser & McKee, Inc., in association with Janet Yagoda Shagam, Ph.D. and commissioned by the City of Albuquerque Wastewater Division, findings indicate that there are elevated levels of fecal coliform both above and below Albuquerque's Southside Wastewater Reclamation Plant (SWRP).

In addition to the 1999 NMED/SWQB study, historical stormwater flow data provided by the United States Geological Survey (USGS) from discreet conveyances and the City of Albuquerque's stormwater sampling program **(Appendix C)** will be used in the development of this TMDL.

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2 Steven T. Pierce, ***Intensive Water Quality Survey of the Rio Grande from Angostura to U.S. 85 Bridge, Sandoval and Bernalillo Counties, New Mexico, July 25-28, 1988***, Surveillance and Standards Section, Surface Water Quality Bureau, New Mexico Environmental Improvement Division, January 1989, p. 25.

Figure 1.

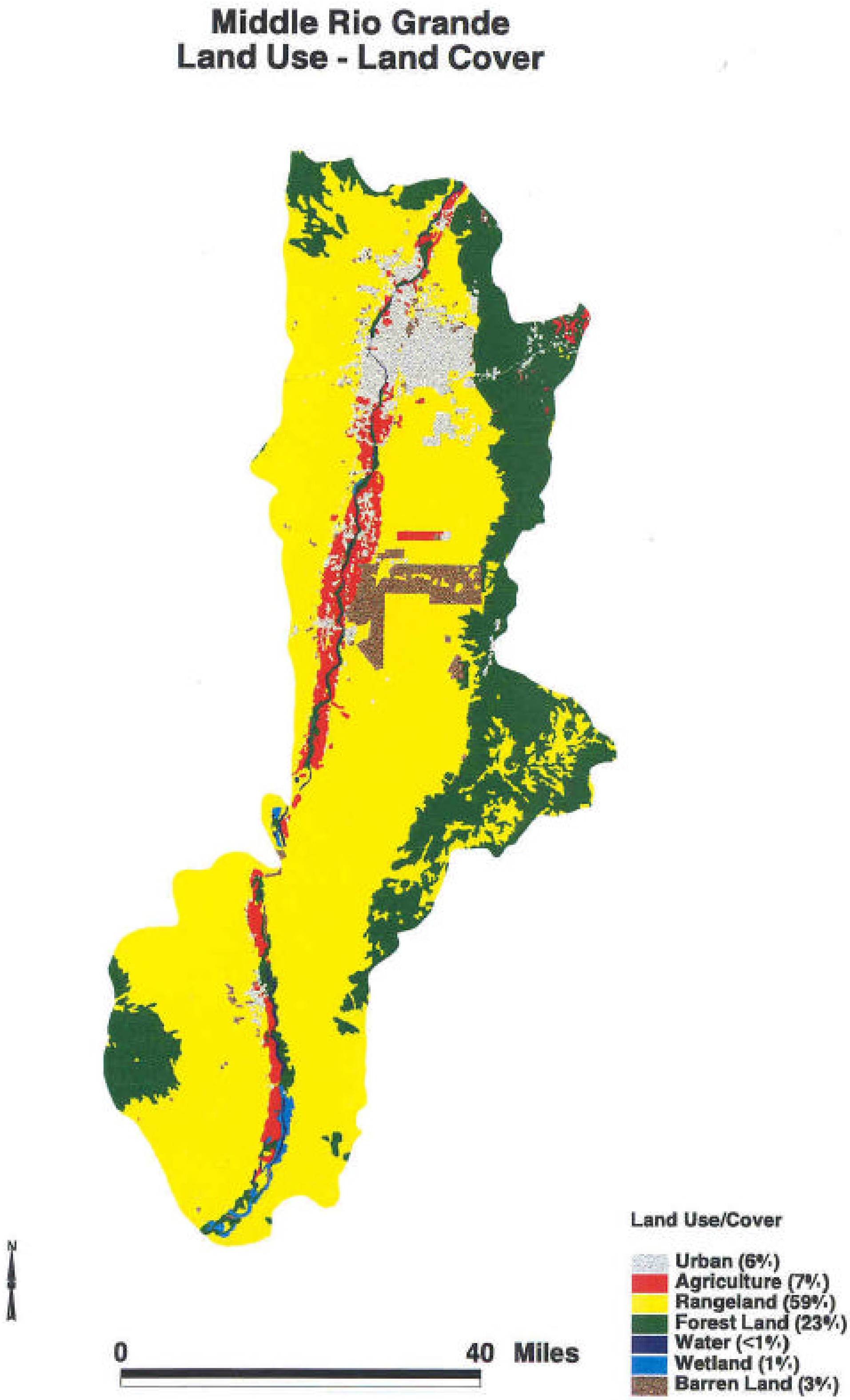
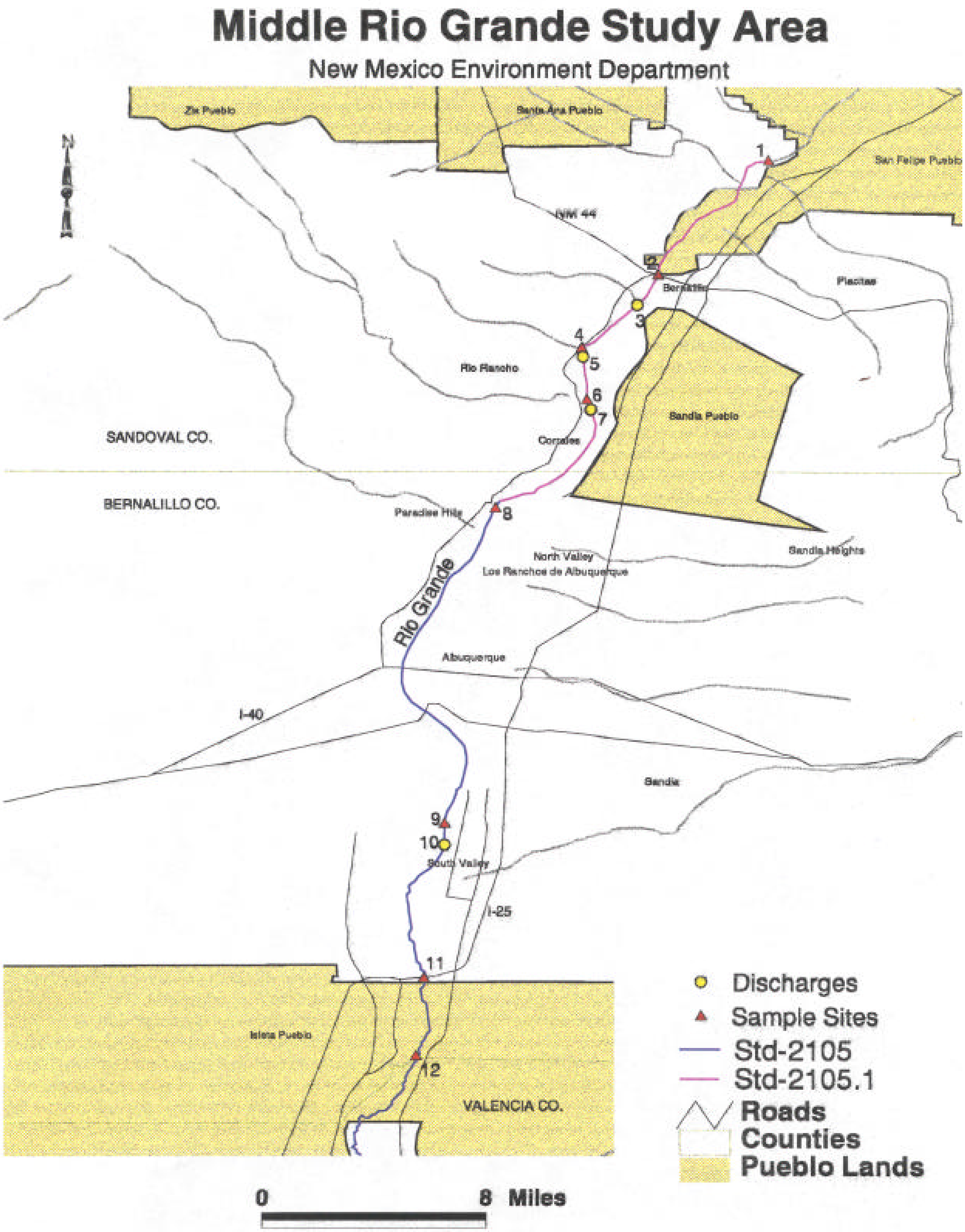

Middle Rio Grande
Land Use - Land Cover
N
0
40 Miles
Land Use/Cover
Urban (6%)
Agriculture (7%)
Rangeland (59%)
Forest Land (23%)
Water (<1%)
Wetland (1%)
Barren Land (3%)

Figure 2.   1999 Middle Rio Grande Sampling Stations



Applicable Standards and Designated Uses

The middle Rio Grande is classified in the Standards as a limited warmwater fishery (LWWF) and broken into two standard segments. Segment specific standards for fecal coliform are found under standards segment 2105 and 2105.1 **(Figure 3)**.

Segment 2105 is defined as follows: The main stem of the Rio Grande from the headwaters of Elephant Butte Reservoir upstream to Alameda Bridge (Corrales Bridge), the Jemez River from the Jemez Pueblo boundary upstream to the Rio Guadalupe, and intermittent flow below the perennial reaches of Rio Puerco and Jemez River which enters the main stem of the Rio Grande.

Designated uses: irrigation, limited warmwater fishery, livestock watering, wildlife habitat and secondary contact.

Fecal coliform standards: The monthly geometric mean of fecal coliform bacteria shall not exceed 1,000/100ml; no single sample shall exceed 2,000/100ml.

Segment 2105.1 is defined as follows: The main stem of the Rio Grande from Alameda Bridge (Corrales Bridge) upstream to the Angostura Diversion Works.

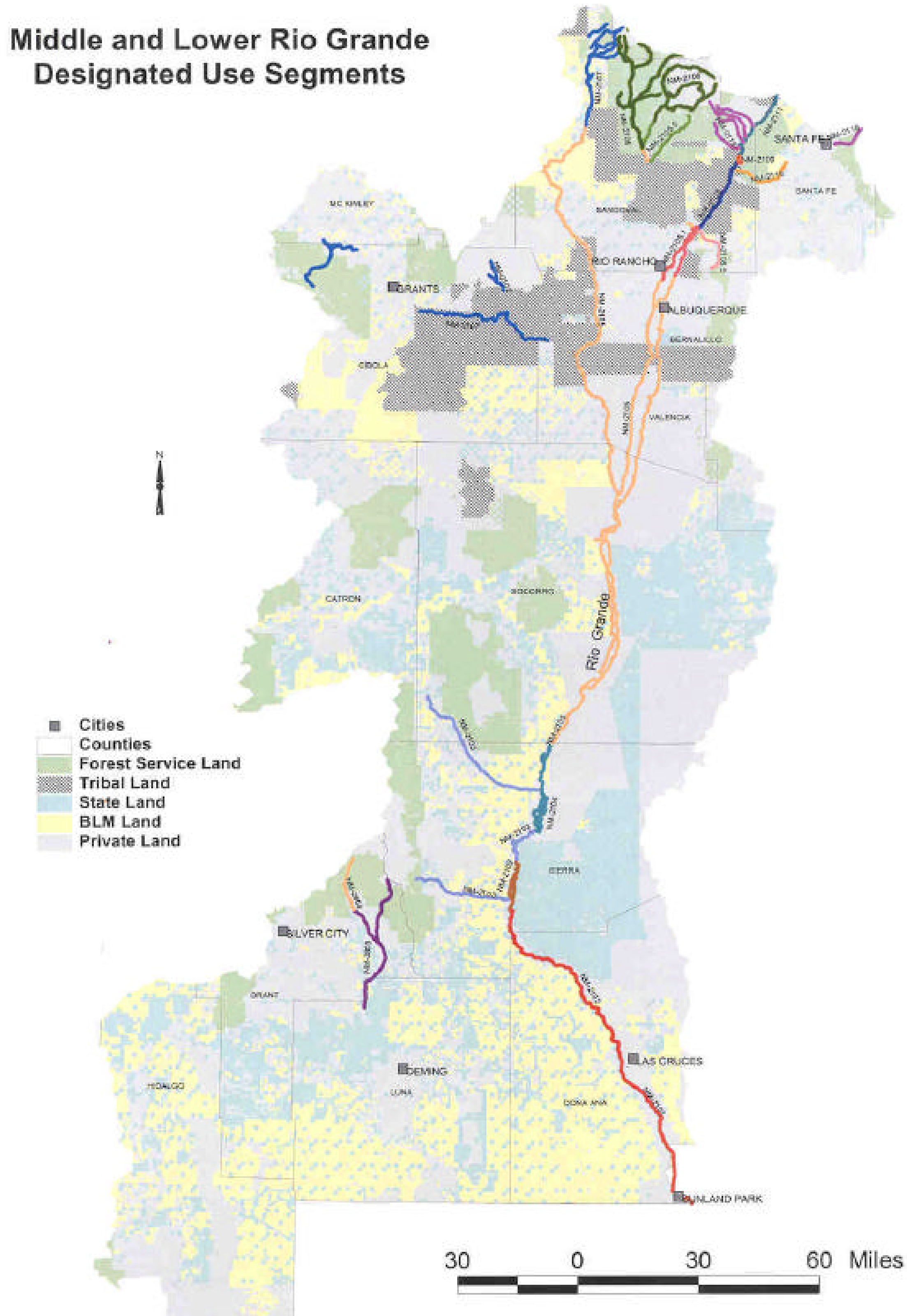
Designated uses: irrigation, limited warmwater fishery, livestock watering, wildlife habitat and secondary contact.

Fecal coliform standards: The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100ml; no single sample shall exceed 400/100ml.

Identification of Sources

The middle Rio Grande is listed on the 2000-2002 State of New Mexico §303(d) list with fecal coliform as a pollutant of concern. Presence of fecal coliform bacteria is an indicator of the possible presence of bacteria or other microbial pathogens that may limit beneficial uses and present human health concerns. There are three significant sources of fecal coliform bacteria in the middle Rio Grande. This reach of the Rio Grande contains National Pollutant Discharge Elimination System (NPDES) permitted dischargers to the river with spills and end of pipe violations of permits having been historically documented. There are nonpoint sources of fecal coliform bacteria from livestock rearing, livestock operations and other domestic animals that enter side canals and can eventually make it to the river as well as limited seasonal inputs from wild birds which use the Rio Grande as a migratory flyway. The main contributor of fecal coliform and the focus of this document is stormwater. There are six discreet concrete transports of stormwater that enter the middle Rio Grande. During the annual monsoon rain season (May-September) high levels of fecal coliform are collected from neighborhoods including parks, and vacant lots then transported to the river unfiltered. These pulse events directly lead to elevated levels of fecal coliform in the surface water.

Figure 3.



Middle and Lower Rio Grande
Designated Use Segments
Cities
Counties
Forest Service Land
Tribal Land
State Land
BLM Land
Private Land
Rio Grande
GRANTS
RIO RANCHO
ALBUQUERQUE
SANTA FE
SILVER CITY
DEMING
LAS CRUCES
30 0 30 60 Miles

Fecal coliform sampling in the middle Rio Grande is extensive. The most recent NMED/SWQB data was collected during the summer of 1999 by the Surveillance and Standards Section. **Table 1** summarizes this information.

Table 1. Results of the 1999 fecal coliform sampling in the middle Rio Grande.

Site **(Yellow denotes standard exceedence)**	**Date**	**Time**	**Fecal Coliform Col/100ml Membrane filter**	**Fecal Coliform Col/100ml Most Probable Number (MPN)**
Rio Grande Below Angostura Diversion Works	990628	1010	20	
Rio Grande Above Highway 44 Bridge	990628	1025	34	
Rio Grande at Bernalillo WWTF discharge	990628	1035	23	
Rio Grande Above Rio Rancho WWTF #3	990628	1055	37	
Rio Rancho WWTF #3 discharge	990628	1100	12B	
Rio Grande Above Rio Rancho WWTF #2	990628	1125	49	
Rio Rancho WWTF #2 discharge	**990628**	**1130**	**5300**	
Rio Grande Above Alameda Bridge	**990628**	**1200**	**2400**	
Rio Grande Above Alameda Bridge	990628	1200	50 QA REP	
Rio Grande Above Rio Bravo Bridge	990628	1230	180B	
Albuquerque WWTF discharge	990628	1245	19B	
Rio Grande Above I-25 Bridge	990628	1300	540	
Rio Grande Above Isleta Diversion	990628	1315	400B	
Rio Grande Below Angostura Diversion Works	990706	0800		300
Rio Grande Above Highway 44 Bridge	**990706**	**0820**		**900**
Rio Grande at Bernalillo WWTF discharge	990706	0835	1K	
Rio Grande Above Rio Rancho WWTF #3	**990706**	**0855**		**1600L**
Rio Rancho WWTF #3 discharge	990706	0905	15J	
Rio Grande Above Rio Rancho WWTF #2	**990706**	**0925**		**500**
Rio Rancho WWTF #2 discharge	**990706**	**0935**	**3500**	
Rio Grande Above Alameda Bridge	990706	0955	1000	
Rio Grande Above Rio Bravo Bridge	**990706**	**1030**	**2400B**	
Albuquerque WWTF discharge	990706	1045	11B	
Rio Grande Above I-25 Bridge	**990706**	**1100**	**2100B**	
Rio Grande Above Isleta Diversion	990706	1115	1800B	
Rio Grande Above Isleta Diversion	990706	1115	1600B QA REP	
Rio Grande Below Angostura Diversion Works	990712	0855	110B	
Rio Grande Above Highway 44 Bridge	990712	0920	160B	
Rio Grande at Bernalillo WWTF discharge	990712	0935	10KB	
Rio Grande Above Rio Rancho WWTF #3	990712	0955	200	
Rio Rancho WWTF #3 discharge	**990712**	**1000**	**2100**	
Rio Grande Above Rio Rancho WWTF #2	990712	1030	330	
Rio Rancho WWTF #2 discharge	**990712**	**1035**	**7300B**	
Rio Grande Above Alameda Bridge	990712	1055	250	
Rio Grande Above Alameda Bridge	990712	1055	280 QA REP	
Rio Grande Above Rio Bravo Bridge	990712	1200	170B	
Albuquerque WWTF discharge	990712	1215	30B	
Rio Grande Above I-25 Bridge	990712	1235	170B	
Rio Grande Above Isleta Diversion	990712	1245	290	
Rio Grande Below Angostura Diversion Works	990719	0830		300
Rio Grande Above Highway 44 Bridge	990719	0850	340	

Rio Grande Above Highway 44 Bridge	990719	0850	360 QA REP	
Site **(Yellow denotes standard exceedence)**	**Date**	**Time**	**Fecal Coliform Col/100ml Membrane filter**	**Fecal Coliform Col/100ml MPN**
Rio Grande at Bernalillo WWTF discharge	990719	0905	10K	
Rio Grande Above Rio Rancho WWTF #3	**990719**	**0925**		**1600**
Rio Rancho WWTF #3 discharge	990719	0926	50B	
Rio Grande Above Rio Rancho WWTF #2	**990719**	**1000**		**2400**
Rio Rancho WWTF #2 discharge	**990719**	**1005**	**8500**	
Rio Grande Above Alameda Bridge	990719	1030		1300
Rio Grande Above Rio Bravo Bridge	**990719**	**1105**		**5000**
Albuquerque WWTF discharge	990719	1115	180	
Rio Grande Above I-25 Bridge	**990719**	**1130**		**16000**
Rio Grande Above Isleta Diversion	**990719**	**1145**		**5000**
Rio Grande Below Angostura Diversion Works	990726	0850	80B	
Rio Grande Above Highway 44 Bridge	**990726**	**0910**	**400**	
Rio Grande at Bernalillo WWTF discharge	990726	0920	10KB	
Rio Grande Above Rio Rancho WWTF #3	990726	0945	110B	
Rio Rancho WWTF #3 discharge	990726	0946	50B	
Rio Grande Above Rio Rancho WWTF #2	990726	1010	90B	
Rio Rancho WWTF #2 discharge	**990726**	**1015**	**20000**	
Rio Rancho WWTF #2 discharge	990726	1015	16000B QA REP	
Rio Grande Above Alameda Bridge	990726	1040	350	
Rio Grande Above Rio Bravo Bridge	990726	1120		500
Albuquerque WWTF discharge	990726	1130	30B	
Rio Grande Above I-25 Bridge	990726	1150		500
Rio Grande Above Isleta Diversion	990726	1200	240	
Rio Grande Above Rio Rancho WWTF #2	990729	1000	82B	
Rio Rancho WWTF #2 discharge	**990729**	**1005**	**3000**	
Rio Grande Above Alameda Bridge	990729	1035	81B	
Rio Grande Above Rio Bravo Bridge	990729	1115	70B	
Albuquerque WWTF discharge	990729	1145	3B	
Rio Grande Above I-25 Bridge	990729	1200	150B	
Rio Grande Above Isleta Diversion	990729	1215	140B	
Rio Grande Above Rio Rancho WWTF #2	**990802**	**0840**		**1600L**
Rio Rancho WWTF #2 discharge	**990802**	**0845**	**410**	
Rio Rancho WWTF #2 discharge	990802	0845	210 QA REP	
Rio Grande Above Alameda Bridge	990802	0910		1600L
Rio Grande Above Rio Bravo Bridge	990802	0945		1600L
Albuquerque WWTF discharge	990802	0955	3	
Rio Grande Above I-25 Bridge	990802	1010		1600L
Rio Grande Above Isleta Diversion	990802	1020		1600L

"L" Remark Code = Off scale high. Actual value not known, but known to be greater than value shown.
"B" Remark Code = Results based upon colony counts outside the acceptable range.
"K" Remark Code = Off scale low. Actual value not known, but known to be less than value shown.

Fecal Coliform Stormwater TMDLs

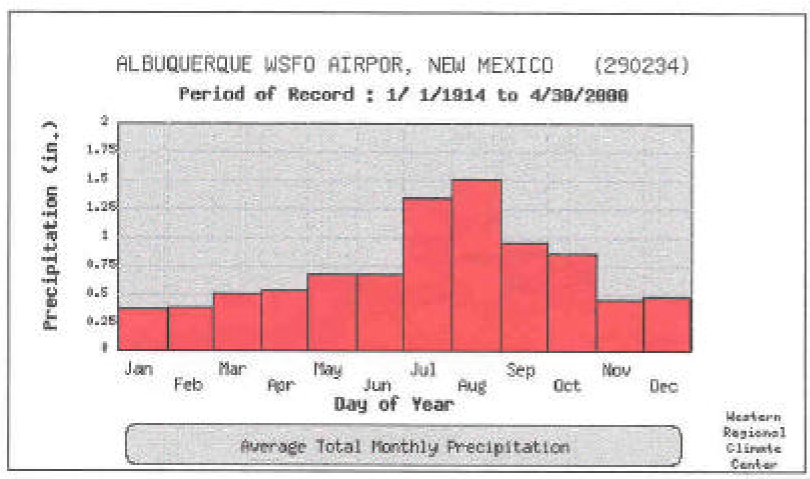
Precipitation

Historical (1914-July, 2000) monthly mean precipitation amounts (in inches) are provided in **Table 2** below.

Table 2

MONTH	May	June	July	August	September
MEAN	0.66	0.64	1.36	1.50	0.96
ANNUAL MEAN: 8.62					

POR - Monthly Average Total Precipitation



- Average precipitation recorded for the month.

Margin of Safety (MOS)

Significant conservative assumptions have been used in developing these loading limits. These include:

- use of the 4Q3 minimum peak flow for river loading assumptions,
- treating fecal coliform as a conservative pollutant, that is a pollutant that does not readily degrade in the environment,
- use of the design flow for calculation of WWTF contributions,
- use of the mean annual maximum flows and extremes for the period of record for stormwater inputs

No additional explicit margin of safety will be applied in calculation of this TMDL.

Future Growth

Future growth in the middle Rio Grande valley is also of concern when it comes to storm water and storm water impacts on surface water quality. Phase II of the federal Storm water Regulations requires municipalities to develop a storm water management program that addresses impacts from future growth and how those impacts will be handled Bernalillo County contains two of the largest and fastest growing cities in the State, Albuquerque and Rio Rancho. The following table shows the projections for the next twenty years in Bernalillo County **(Table 3)**:

Table 3
POPULATION PROJECTIONS FOR BERNALILLO COUNTY

YEAR	MALE	FEMALE	TOTAL	% INCREASE
2000	259,171	276,490	535,661	NA
2010	278,529	299,335	577,864	7.8
2015	287,830	309,311	597,141	3.3
2020	296,278	317,987	614,265	2.9

Average 20-Year Increase in Population: 4.7%

River Hydrology

The United States Geological Survey (USGS) Gage, **Rio Grande at Albuquerque (08330000)**, was used in this document to calculate the critical low flow condition or 4Q3, from 1992-1997 and for the months of May through September. The Hydrotec© computer program was used to calculate the 4Q3 value of 363 cubic feet per second (cfs). The USGS gage at Albuquerque is above the discharge of the Albuquerque WWTF therefore, an additional 111 cfs will added to the river below the WWTF discharge to bring the 4Q3 value to 474 cfs from the WWTF discharge down to the Isleta Diversion Dam. The additional cfs were derived using the following equation:

72 million gallons/day (Alb. WWTF Design Capacity) x 1.54723 (conversion factor) = 111 cfs

This gage has a water history starting in 1975 but a 1992 agreement between City of Albuquerque and Middle Rio Grande Conservancy District guaranteed a minimum flow in the Rio Grande between the Central Avenue Bridge and the Isleta Diversion Dam of at least 250 cfs for a period of 10 years starting January 1, 1992 and expiring December 31, 2001.

Storm Water Hydrology

The City of Albuquerque, Albuquerque Metropolitan Area Flood Control Authority (AMAFCA) in cooperation with the USGS have established seventeen storm water flow gaging sites and water quality sites throughout the middle Rio Grande area **(Appendix C)**.

Where data was available, the annual maximum flow condition was calculated. The Hydrotec© computer program was used to calculate these values in cfs.

Calculations of River Loading Capacity

Given that fecal coliform standards are expressed as colonies per unit volume, using 30-day geometric mean criterion of 1,000 fcu/100 ml for river segment 2105 and 200 fcu/100 ml for river segment 2105.1, river loading capacity can be calculated. This is accomplished through application of the following conversion calculations.

C as fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x Q in gallons / day = fcu/day

Where: C = State water quality standard criterion
Q = river flow in gallons

River Loading Capacity for Segment 2105

Applying the above conversion using the 1,000 fcu/100 ml criterion, adding an additional 111 cfs below the Albuquerque WWTF to account for their discharge, two loading capacities can be calculated. The first, waters below Alameda Bridge down to the Albuquerque WWTF (363 cfs) will be calculated as follows:

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 234,613,071 flow in gallons / day

The load may be expressed as:

The assimilative loading limit in the river is **8.88×10^{12} fcu/day** at the 4Q3 low flow.

The second, waters below the Albuquerque WWTF (474 cfs) and a protective standard of 100fcu/100ml will be calculated as follows:

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 306,354,258 flow in gallons / day

The load may be expressed as:

The assimilative loading limit in the river is **1.16×10^{12} fcu/day** at the 4Q3 low flow.

River Loading Capacity for Segment 2105.1

Applying the above conversion using the 200 fcu/100 ml criterion and using the previously determined river critical low flow (363 cfs) 234.6 million gallons per day the load may be expressed as:

200 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 234,613,071 flow in gallons / day

The assimilative loading limit in the river is **1.77 x 10^{12} fcu/day** at the 4Q3 low flow.

North Diversion Channel Loading Capacity

Applying the above conversion using the 100 fcu/100 ml criterion and using the previously determined North Diversion Channel mean annual maximum flow (263 cfs) 169.9 million gallons per day the load may be expressed as:

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 169,981,371 flow in gallons / day

The assimilative loading limit in the North Diversion Channel is **6.438 x 10^{11} fcu/day** at the mean annual maximum flow flow.

❖ Bernalillo WWTF (NM0023485)

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Design Capacity: .8 MGD

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 800,000 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **3.030 x 10^{9} fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.77 \times 10^{12} - 3.030 \times 10^{9}$$
$$\mathbf{LA = 1.766 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.766 \times 10^{12} + 3.030 \times 10^{9} + 0 = 1.769 \times 10^{12}}$$

❖ Rio Rancho WWTF #3 (NM0029602)

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Design Capacity: .35 MGD

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 350,000 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **1.325×10^9 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.77 \times 10^{12} - 1.325 \times 10^9$$

$$\mathbf{LA = 1.768 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.768 \times 10^{12} + 1.325 \times 10^9 + 0 = 1.769 \times 10^{12}}$$

❖ Rio Rancho WWTF #2 (NM0027987)

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Design Capacity: 1.96 MGD

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 1,960,000 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **7.424×10^9 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.77 \times 10^{12} - 7.424 \times 10^{9}$$
$$\mathbf{LA = 1.762 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.762 \times 10^{12} + 7.424 \times 10^{9} + 0 = 1.769 \times 10^{12}}$$

❖ Albuquerque WWTF (NM0022250)

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Design Capacity: 72 MGD

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 72,000,000 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **2.727×10^{11} fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.77 \times 10^{12} - 2.727 \times 10^{11}$$
$$\mathbf{LA = 1.497 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.497 \times 10^{12} + 2.727 \times 10^{11} + 0 = 1.769 \times 10^{12}}$$

❖ North Diversion Floodway Channel (Discharge is to Sandia Pueblo Tribal Waters)

NOTE: **No receiving water dilution or mixing zone is allowed under Tribal standards.**

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment.

The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Annual Maximum Flow: 263 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 169,981,371 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **6.438×10^{11} fcu/day.**

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$0 + 6.438 \times 10^{11} + 0 = 6.740 \times 10^{11}$$

❖ La Cueva Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Annual Maximum Flow: .110 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.071 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **268.94 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 268.94$$

$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 268.94 + 0 = 6.438 \times 10^{11}}$$

❖ Pino Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 11 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 7.109 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **26,928.03 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 26,928.03$$

$$\mathbf{LA = 6.437 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.437 \times 10^{11} + 26,928.03 + 0 = 6.437 \times 10^{11}}$$

❖ Grant Line Arroyo at Villa Del Oso

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: .37 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.239 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **905.30 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 905.30$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 905.30 + 0 = 6.438 \times 10^{11}}$$

❖ North Fork of the Hahn Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment.
The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: .38 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.246 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **931.81 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 931.81$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 931.81 + 0 = 6.438 \times 10^{11}}$$

❖ South Fork of the Hahn Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 17 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 10.987 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **41,617.42 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 41{,}617.42$$
$$\mathbf{LA = 6.437 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.437 \times 10^{11} + 41{,}617.42 + 0 = 6.437 \times 10^{11}}$$

❖ Hahn Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 93 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 60.107 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **227,678.03 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 227{,}678.03$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 227{,}678.03 + 0 = 6.438 \times 10^{11}}$$

❖ Embudo Arroyo

NOTE: Very limited flow data set.

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 0.12 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.077 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **291.66 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 291.66$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 291.66 + 0 = 6.438\ 10^{11}}$$

❖ Academy Acres Drain

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 1.16 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.749 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **2,837.12 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 2{,}837.12$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 2{,}837.12 + 0 = 6.438 \times 10^{11}}$$

❖ North Camino Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: **.23 cfs**

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.148 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **560.61 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 6.438 \times 10^{11} - 560.61$$
$$\mathbf{LA = 6.438 \times 10^{11}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{6.438 \times 10^{11} + 560.61 + 0 = 6.438 \times 10^{11}}$$

❖ Campus Wash

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: **48 cfs**

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 31.023 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **1,175,113.64 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 1{,}175{,}113.64$$
$$\mathbf{LA = 8.87 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.87 \times 10^{12} + 1{,}175{,}113.64 + 0 = 8.87 \times 10^{12}}$$

❖ Corrales Main Canal Outfall

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Daily Maximum Flow: **9.14 cfs**

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 5.907 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **223,750 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 223{,}750$$
$$\mathbf{LA = 8.88 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.88 \times 10^{12} + 223{,}750 + 0 = 8.88 \times 10^{12}}$$

❖ Corrales Riverside Drain near Corrales

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Daily Maximum Flow: 40.7 cfs

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 20.305 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **769,128.78 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 769{,}128.78$$
$$\mathbf{LA = 8.79 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.79 \times 10^{12} + 769{,}128.78 + 0 = 8.79 \times 10^{12}}$$

❖ Taylor Ranch Drain

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: .57 cfs

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.368 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **13,939.39 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 13{,}939.39$$
$$\mathbf{LA = 8.88 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.88 \times 10^{12} + 13{,}939.39 + 0 = 8.88 \times 10^{12}}$$

❖ Ladera Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 1.54 cfs

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.995 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **37,689.39 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 37{,}689.39$$
$$\mathbf{LA = 8.88 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.88 \times 10^{12} + 37{,}689.39 + 0 = 8.88 \times 10^{12}}$$

❖ Arroyo 19a at Albuquerque

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 1,000 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 2,000 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: .03 cfs

1,000 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 0.019 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **719.69 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 8.88 \times 10^{12} - 719.69$$
$$\mathbf{LA = 8.88 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{8.88 \times 10^{12} + 719.69 + 0 = 8.88 \times 10^{12}}$$

❖ Tijeras Arroyo

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 49 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 31.66 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **119,924.24 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 119{,}924.24$$
$$\mathbf{LA = 1.159 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.159 \times 10^{12} + 119{,}924.24 + 0 = 1.159 \times 10^{12}}$$

❖ Tramway Floodway Channel

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 12 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 7.75 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **29,356.06 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 29{,}356.06$$
$$\mathbf{LA = 1.16 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.16 \times 10^{12} + 29{,}356.06 + 0 = 1.16 \times 10^{12}}$$

❖ South Diversion Channel

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 59 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 38.13 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **144,431.81 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 144{,}431.81$$
$$\mathbf{LA = 1.159 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.159 \times 10^{12} + 144{,}431.81 + 0 = 1.159 \times 10^{12}}$$

❖ San Jose Drain

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 4.37 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 2.82 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **10,681.81 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 10{,}681.81$$
$$\mathbf{LA = 1.16 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.16 \times 10^{12} + 10{,}681.81 + \;= 1.16 \times 10^{12}}$$

❖ Albuquerque Riverside Drain near Isleta

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 137 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 88.54 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **335,378.78.78 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 335{,}378.78$$
$$\mathbf{LA = 1.159 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.159 \times 10^{12} + 335{,}378.78 + 0 = 1.159 \times 10^{12}}$$

❖ Atrisco Riverside Drain at Isleta

Waste Load Allocation

Under the conditions of the TMDL the permittee will be required to meet segment specific fecal coliform standards after final treatment. The limits will be 100 fcu/100 ml as a 30-day geometric mean and a single sample maximum of 200 fcu/100 ml. Applying these values to the formula above the waste load allocations may be determined as follows:

Mean Annual Maximum Flow: 71.5 cfs

100 fcu/100 ml x 1000ml/1 L x 1 L/ 0.264 gallons x 46.21 flow in gallons/day

Thus yielding a 30-day geometric mean waste load allocation of **175,037.87 fcu/day.**

Load Allocation

The nonpoint source load allocation is calculated by subtracting the waste load allocation from the final allowable capacity.

$$LA = 1.16 \times 10^{12} - 175{,}037.87$$
$$\mathbf{LA = 1.159 \times 10^{12}}$$

TMDL

Load Allocation, LA + Waste Load Allocation, WLA + Margin of Safety, MOS

$$\mathbf{1.159 \times 10^{12} + 175{,}037.87 + 0 = 1.159 \times 10^{12}}$$

Seasonal Variability

The critical season for this reach of the Rio Grande is the May through September time period. The traditional monsoon rainy season is captured in these months. It is possible that the criterion may be exceeded during a low flow condition when there are spills from point source dischargers and other unforeseen impacts to the river but for the most part the greatest fecal loads appear in the above mentioned months. Evaluation of seasonal variability for potential nonpoint sources is difficult due to limited available data. However, some general observations may be made about nonpoint source pollution. Domestic animal penning and rearing along drainage ditches, irrigation canals and in floodplains can be a direct conduit to the river during rainy periods in the summer months. This allows inference that seasonal inputs may account, in part, for the elevated fecal counts in this reach of the river.

Implementation Plan

Storm Water BMP Approaches and Cost Estimates

The cost and effectiveness of structural or treatment control BMPs is becoming the subject of increased interest as storm water dischargers face permit requirements that include “BMP ratcheting down” clauses and TMDL waste load allocations. Storm water’s high volume, intermittent nature and variable quality make treatment a tremendous challenge. Conventional structural BMPs can be a useful element in the management of storm water quality but they are not a panacea to achieve water quality standards.

Structural BMPs should be used when it is determined that they will be ‘cost effective’. A cost effective application is one that accomplishes the project goals for the least cost while also providing a benefit that exceeds the cost.

Most current conventional structural BMPs will not remove the dissolved fraction of a constituent-potential pollutant. In most instances it is the dissolved form of the constituent that can be responsible for beneficial use impairment in downstream receiving waters.

Consequently, the conventional structural BMP ‘tool kit’ available to the storm water manager cannot independently achieve the goal of compliance with water quality standards.

Storm water runoff water quality management programs must be a carefully crafted combination of non-structural and structural BMPs designed to address targeted constituents control requirements. Routine achievement of water quality standards will require more receiving water quality monitoring and evaluation to provide the basis for BMP development. Changes in urban planning and design will also be required to address peak flow and volume increases that occur with urbanization.

Structural BMPs

The primary structural BMPs currently in use in the southwest are:

Drain inlet inserts
Extended detention basins
Biofilters
Media filters
Infiltration

There are also other proprietary BMPs that use the principles of settling and filtration to remove chemical constituents and gross pollutants. Some of the benefits and pitfalls for each type of BMP are discussed below.

Drain Inlet Inserts

Drain inlet inserts are a proprietary BMP that is generally easily installed in a drain inlet or catch basin to treat storm water runoff. Three basic types of inlet inserts are available, the tray type, bag type and basket type. The tray type allows flow to pass through filter media residing in a tray located around the perimeter of the inlet.

Runoff enters the tray and leaves via weir flow under design conditions. High flows pass over the tray and into the inlet unimpeded.

The bag type of insert is constructed from a fabric and is placed in the drain inlet around the perimeter of the grate. Storm water runoff must pass through the ‘bag’ prior to discharging to the drain outlet pipe. Overflow holes are usually provided to pass larger flows without causing a backwater at the grate.

The basket type of inlet consists of a wire mesh that is placed around the perimeter of the inlet in an installation similar to the tray type device. The wire mesh operates similar to the bag type insert, screening larger materials from the runoff. Some basket type inserts also incorporate filter media similar to the tray type insert.

Drain inlet inserts have generally performed poorly in tests for several reasons. First, the detention or contact time with the insert ‘media’ is very short. Second, there is little storage area available for material that is removed from the flow. The device can act as temporary storage location, retaining solids as flow decreases, but then may allow re-suspension when flow (and velocity) subsequently increases. Lastly, inserts require a high degree of maintenance and must be monitored closely during rain events to ensure that the unit is not clogged or bypassing flow. Such a level of maintenance is not practical for most installations.

Bag and basket type drain inlet inserts can be effective in removing gross pollutants (trash), but must be well maintained.

For areas with a limited number of inlets where trash removal is the desired objective, inserts can be a useful BMP. Tray type inserts are generally not effective in trash or solids removal.

Extended Detention

Extended detention basins are a relatively popular BMP since the design is well documented from flood control engineering, and extended detention may be incorporated as an element into flood control detention basins. Extended detention employs a relatively longer drain time than conventional detention used for peak flow control. An average hydrograph detention time of 24 hours is desired. This can be achieved by using a full basin drain time of at least 48 hours, with no more than 50 percent of the water quality volume draining in the first 24 hours (Barrett, 1999). Sedimentation in the basin is the primary removal mechanism.

Extended detention basins can be relatively effective in removing solids (including gross pollutants) but are relatively ineffective in removing dissolved constituents and bacteria. The application of extended detention must include a review of the downstream receiving channel to ensure that problems are not created by their use through increased erosion of the channel.

Careful consideration should be given when installing extended detention basins upstream of an alluvial channel. The stability of an alluvial channel depends in large part on the quantity of bed material load that is transported by the stream, as well as the frequency and duration of the bankfull discharge. Extended detention basins are effective in removing the bed material load from natural channels. Channel stability problems and channel scour can result from the misapplication of this BMP. Extended detention is a useful BMP where particulate removal is a desired objective for the downstream receiving water. Extended detention requires moderate maintenance as compared to other BMPs.

Biofilters

Biofilters consist of dense vegetation designed to 'filter' runoff as it passes through the BMP. The detention or 'residence' time is generally insufficient for a significant portion of the runoff volume to be infiltrated, however, infiltration can be significant for storms smaller than the design storm for biofilters in soils with good infiltration characteristics. Biofilters can be effective in removing particulates from runoff.

Biofilters are an attractive BMP in that they can be incorporated into many projects with relatively little site modification. Conveyance structures that are normally paved can sometimes be replaced with vegetation. Buffer 'strips' can be provided where sheet flow leaves paved areas. Biofilter swales are generally designed with a flow velocity of less than 1 foot per second and are installed in a location with enough length to provide a residence time of at least 5 minutes (the length of the swale divided by the average flow velocity) (WEF/ASCE, 1998). Biofilter strips treat sheet flow and their width is a function of the contributing drainage area, but the strips should be at least 12 feet wide (Barrett, 1999).

Swales and strips must be designed to withstand flow rates that exceed the water quality design velocity to ensure they are not damaged during high flows, or cause upstream flooding.

Certain types of well-established vegetation can be sustained in flow velocities of up to about 8 feet per second with a more typical value being 4 to 5 feet per second. In the southwest, vegetation that does not require irrigation may be prudent to reduce water consumption. Biofilters can serve as a pretreatment device prior to infiltration or in situations where extended detention is desirable but insufficient area is available. Biofilters require a moderate maintenance schedule as compared to other BMPs.

Media Filters

There are a variety of media filters currently in use including sand, compost, sand peat and perlite/zeolite. Perlite/zeolite and compost filters are proprietary. The use of compost has declined since nutrients are released from this media. Sand filters enjoy the most widespread application. Slow sand filtration is a relatively old technology largely abandoned by the US water industry several decades ago in favor of rapid sand filtration. Sand filters are generally limited to low turbidity waters and operate through a combination of straining and adsorption. Sand filters are among the most efficient conventional treatment devices achieving good removal of particulates and modest removals of bacteria and dissolved metals.

Sand filters are designed with a sedimentation chamber to store all or part of the water quality volume, followed by the sand bed. The purpose of the sedimentation chamber is to remove the settleable solids that could otherwise rapidly clog the filter. The sand bed is designed for a filtration rate of about 3.5 ft/day (Barrett, 1999) but generally operates at the rate limited by the release from the sedimentation chamber. Various configurations are available including the Austin design, the Delaware design and the Washington D.C. design. Sand filters require relatively higher maintenance as compared to other BMPs.

Infiltration

Infiltration of storm water is a zero discharge solution infiltrating the entire design water quality volume to the surrounding soil. Infiltration is a popular BMP in areas that have relatively permeable soils.

Significant questions remain as to the potential impacts on groundwater quality from the infiltration of storm water (EPA NURP (1983) study concluded that most pollutants of importance in urban runoff are intercepted during the process of infiltration and quite effectively prevented from reaching the groundwater aquifers underlying recharge basins). Consequently, storm water infiltration devices should always include a groundwater monitoring element. Soils that are conducive to infiltration are also relatively poor in filtering and adsorbing contaminates that could otherwise enter an aquifer.

Infiltration devices have a poor performance record due to clogging. Current guidelines call for minimum soil permeability rates of about 0.52in/hr (Schueler and Claytor, 1998) for infiltration to be considered feasible. Generous safety factors should be used (by increasing surface area) and the depth to the groundwater table, seasonally adjusted, must be well documented (10 feet separation to the invert of the infiltration device is recommended).

If soil permeability does not allow the use of infiltration, retention and irrigation may be considered. The design water quality volume is stored and subsequently pumped through an irrigation system. Additional information on infiltration as a storm water BMP has been provided by Lee et al. (1998) and Taylor and Lee (1998).

Conventional Structural BMP Performance

The volume of available performance data (constituent removal) for conventional structural BMPs is rapidly increasing. Removals of commonly monitored constituents can be estimated with good accuracy using tools such as ASCE's BMP database (ASCE, 2000). **Table 4** provides estimated removals for selected categories of constituents for the BMPs discussed above. Note that the values are generalized and total (particulate and dissolved) for nutrients, pesticides and metals.

Table 4
Percentage Reduction in Storm Water Load by BMP

Runoff Control	Solids	Nutrients	Pesticides	Metals	Bacteria
Drain Inlet Insert	10	5	5	5	5
Extended Detention Basin	75	25	25	50	40
Vegetated Swales	70	30	30	50	0
Filter Strips	85	40	40	63	0
Media Filters	85	40	40	70	55

Source: Barrett, (1999)

Capital Cost

The capital cost of conventional BMP installation varies widely depending on site conditions. The primary factor is whether the BMP will be implemented as a part of new construction or is a retrofit project. Generalized costs for selected BMPs are provided in **Table 5** for new construction and retrofit on a dollar per tributary acre basis assuming a 1-inch capture from the contributing watershed.

Construction cost data is site specific, and the values given in **Table 5** are based on one inch capture volume and should be considered valid for planning purposes only. Future versions of the ASCE BMP (2000) database will include cost data for various devices.

Table 5
Generalized Capital Cost for Conventional BMPs

Runoff Control	**New Construction**	**Retrofit Construction**
Drain Inlet Insert	1,000 $/Acre	1,000 $/Acre
Extended Detention Basin	10,000 $/Acre	25,000 $/Acre
Vegetated Swales	10,000 $/Acre	30,000 $/Acre
Filter Strips	17,000 $/Acre	37,000 $/Acre
Infiltration Basin	20,000 $/Acre	38,000 $/Acre
Media Filters	27,000 $/Acre	55,000 $/Acre

Source: Barrett, (1999)

Operation and maintenance costs are also difficult to estimate on a general basis since variables such as maintenance access and constituent load are site specific**. Table 6** gives general maintenance costs for conventional BMPs on an annual basis.

Table 6
Generalized Maintenance Cost for Conventional BMPs

Runoff Control	**Maintenance Cost (per year)**
Drain Inlet Insert	$500
Extended Detention Basin	3% of construction cost
Vegetated Swales	$5/foot
Filter Strips	$1/square foot
Infiltration Basin	3% of construction cost
Media Filters	5% of construction cost

Widespread Implementation

Structural Best Management Practices (BMPs) and non-structural BMPs are applied to various types of land uses according to their compatibility with the given land use, and the type of constituents of concern in the runoff. Numerous studies have been completed discussing siting criteria and constituent removal efficiencies for BMPs. There are fewer works assessing BMP effectiveness on a watershed basis, specifically in relationship to the ability of a conventional BMP system to achieve compliance with water quality standards. There is even less research defining the relationship between structural BMPs and receiving water quality. Currently, compliance with water quality standards is presumptive, given a “comprehensive” BMP installation program and adequate maintenance for the program.

Receiving Water Impacts

There is very little published evaluations of the benefits of conventional BMPs for receiving waters water quality-beneficial uses.

Maxted and Shaver (1997) published a work entitled, *The Use of Retention Basins to Mitigate Storm water Impacts on Aquatic Life.* In this paper, the authors reviewed eight watersheds, two of which had been retrofitted with 'storm water' controls.

The study looked at watersheds with either detention or retention ponds. The facility generally had to control peak flows from storms with recurrance intervals of 2, 10 and 100-years, as well as provide detention or retention of the first inch of runoff from the watershed. Further, the BMPs had to be a least 2-years old to avoid construction-related stream impacts. Watersheds with at least 20% impervious cover were studied.

Advanced Treatment

Advanced treatment controls for storm water are becoming a source of greater interest with the advent of water quality-based effluent limits (WQBELs). Advanced treatment controls may include ion-exchange, reverse osmosis, disinfection, or ultrafiltration. None of these technologies has been tested on a prototype scale for storm water and their cost and effectiveness is unknown with respect to application to urban area storm water runoff treatment. Ozone and UV disinfection systems have been developed for storm water runoff applications but limited data on their effectiveness has been published.

Advanced treatment may be a last resort option in existing urban areas faced with Total Maximum Daily Load (TMDL) waste load allocations (WLAs), as well as when compliance with water quality standards in the storm water runoff is required. Further study will need to be done to determine the capital and operation and maintenance cost for these devices, as well as the impacts to downstream receiving waters as a result of their operation. Many advanced treatment processes, such as reverse osmosis and ion exchange result in a brine that must be disposed of to the sanitary sewer or other location. Flow equalization and pretreatment would also be a necessity for these processes.[3]

Management Measures

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993).

A combination of best management practices (BMPs) will be used to implement this TMDL. Public outreach and stakeholder involvement in implementation of this TMDL will be ongoing.

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3 Scott Taylor, PE and G. Fred Lee, PhD, PE, DEE, ***Stormwater Runoff Water Quality Science/Engineering Newsletter, Urban Stormwater Runoff Water Quality Management Issues***, Volume 3, Number 2, May 19, 2000.

Time line

Implementation Action	Year 1	Year 2	Year 3	Year 4	Year 5
Public Outreach and Involvement	X	X	X	X	X
Establish Milestones	X				
Secure Funding	X				
Implement Management Measures (BMPs)		X	X		
Monitor BMPs		X	X	X	X
Determine BMP Effectiveness				X	X
Re-evaluate Milestones				X	X
Achieve compliance with standards					X

Assurances

New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution. The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. Several statutory provisions on nuisance law could also be applied to nonpoint source water pollution. The Water Quality Act (20 NMAC 6.2) (NMWQCC 1995a) also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (see Section 1100E and Section 1105C) (NMWQCC 1995b) states:

> *These water quality standards do not grant the Commission or any other entity the power to create, take away or modify property rights in water.* New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State.*

> *Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's Clean Water Action Plan has been developed in a coordinated manner with the State's 303(d) process. All Category I watersheds identified in New Mexico's Unified Watershed Assessment process are totally coincident with the impaired waters lists for 1996 and 1998 as approved by EPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

The description of legal authorities for regulatory controls/management measures in New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution. The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. Several statutory provisions on nuisance law could also be applied to nonpoint source water pollution.

NMED nonpoint source water quality management utilizes a voluntary approach. The state provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through §319 of the Clean Water Act. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Nonpoint Source Program will target efforts to this and other watersheds with TMDLs. The Nonpoint Source Program coordinates with the Nonpoint Source Taskforce. The Nonpoint Source Taskforce is the New Mexico statewide focus group representing federal and state agencies, local governments, tribes and pueblos, soil and water conservation districts, environmental organizations, industry, and the public. This group meets on a quarterly basis to provide input on the §319 program process, to disseminate information to other stakeholders and the public regarding nonpoint source issues, to identify complementary programs and sources of funding, and to help review and rank §319 proposals.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including Federal, State and private land, NMED has established Memoranda of Understanding (MOUs) with various Federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other State agencies, such as the New Mexico State Highway and Transportation Department. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

The time required to attain standards in this case is estimated to be five years.

Milestones

Milestones will be used for determining if control actions are being implemented and standards attained. For this TMDL several milestones will be established including the following:

- Develop BMPs to reduce fecal coliform loading in storm water
- Implementation of BMPs

- Post implementation monitoring of BMP effectiveness
- Re-assessment of BMP effectiveness
- New BMP approaches if original approach proves ineffective

Milestones will be re-evaluated periodically, depending on what BMPs were implemented. Further implementation of this TMDL will be revised based on this re-evaluation.

Monitoring Plan

Pursuant to Section 106(e)(1) of the Federal Clean Water Act (33U.S.C. §1251 et seq.), the SWQB has established appropriate monitoring methods, systems, and procedures in order to compile and analyze data on quality of surface waters of New Mexico. In accordance with the New Mexico Water Quality Act (NMSA, 1978, §74-6-1 et seq.), the SWQB has developed and implemented a comprehensive water quality monitoring strategy for surface waters of the State. The monitoring strategy establishes methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives. These objectives are: development of water quality-based controls, to evaluate the effectiveness of such controls, and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of five years.

The SWQB maintains current EPA approved quality assurance and quality control plans to cover all monitoring activities. This document, the "Quality Assurance Project Plan for Water Quality Management Programs" (QAPP), is updated annually. The QAPP identifies data quality objectives required to provide information of sufficient quality to meet established goals of the program. Additional site specific QAPP documents are prepared for each stream survey to assure these objectives are being met.

Current priorities for monitoring surface waters are driven by the CWA §303(d) list of streams requiring TMDLs. Short-term efforts will be directed toward those waters that are on the TMDL consent decree list (Forest Guardians, 1997) and that are due within the first two years of the monitoring schedule. Once assessment monitoring is completed, those reaches still showing impacts and requiring a TMDL will be targeted for more intensive monitoring. Methods of data acquisition include; fixed-station monitoring, intensive surveys of priority water bodies including biological assessments, and compliance monitoring of industrial, federal, and municipal dischargers, and are specified in the SWQB assessment protocol.

Long term monitoring for assessments will be accomplished through establishment of sampling sites that are representative of the water body and which can be revisited every five years.

This gives an unbiased assessment of the water body and establishes a long term monitoring record for simple trend analyses. This information will provide time relevant information for use in CWA §305(b) assessments and to support the need for developing TMDLs.

This approach provides:

- a systematic, detailed review of water quality data and allows for a more efficient use of valuable monitoring resources,
- information at a scale where implementation of corrective activities is feasible,
- an established order of rotation and predictable sampling in each basin that allows coordinated efforts with other programs,
- for enhanced efficiency and improves the basis for management decisions.

It should be noted that a basin is not ignored during its 4 year sampling hiatus. The rotating basin program will be supplemented with other data collection efforts that will be classified as field studies. This time will be used to analyze data collected, to conduct field studies to further characterize identified problems, to develop TMDLs, and implement corrective actions. Both types of monitoring, long term and field studies, can contribute to the CWA §305 and §303 listing processes, but they should be stored in the primary database with distinguishing codes that will allow for separate data retrievals.

The following schedule is a draft of the sampling seasons through 2002 and will be done in a consistent manner to support the New Mexico Unified Watershed Assessment (UWA) and the Nonpoint Source Management Program. This sampling regime will reflect seasonal variation by sampling in spring, summer, and fall for each of the watersheds.

- 1998 Jemez Watershed, Upper Chama Watershed (above El Vado), Cimarron Watershed, Santa Fe River, San Francisco Watershed
- 1999 Lower Chama Watershed, Red River Watershed, Middle Rio Grande, Gila River Watershed (summer and fall), Santa Fe River
- 2000 Gila River Watershed (spring), Mimbres Watershed, Dry Cimarron Watershed, Upper Rio Grande 1 (Pilar north to the NM/CO border)), Shumway Arroyo
- 2001 Upper Rio Grande 2 (Pilar south to Cochiti Reservoir), Upper Pecos Watershed (Ft Sumner north to thee headwaters), Closed Basins, Zuni Watershed
- 2002 Lower Pecos Watershed (Roswell south to the NM/TX border including Ruidoso), Canadian River Watershed, Lower Rio Grande (southern border of Isleta Pueblo south to the NM/TX border), San Juan River Watershed, Rio Puerco Watershed

In addition to the regularly scheduled instream monitoring, NPDES compliance monitoring will be conducted. NPDES discharge monitoring will include regular monitoring requirements for each of the TMDL parameters to assure continued compliance. Regularly scheduled inspections, conducted by the PSRS will also be conducted to assure compliance with permit requirements. As used in this strategy, "compliance monitoring" is a generic term that includes all activities conducted by the SWQB to verify compliance or non-compliance with effluent limitations and other conditions of NPDES permits.

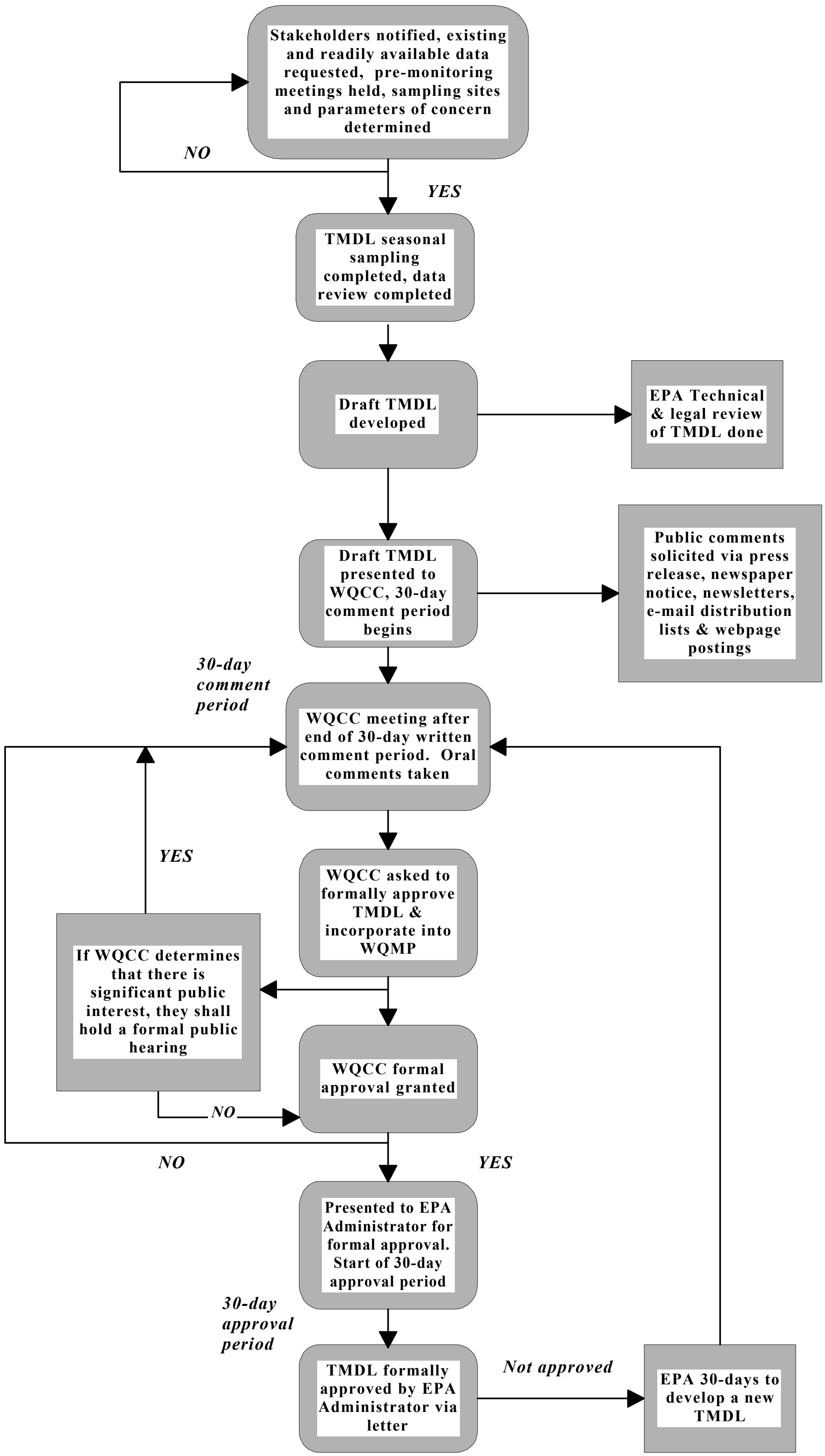
The SWQB routinely conducts two types of compliance monitoring activities: compliance evaluation inspections (CEI) and compliance sampling inspections (CSI).

As part of the terms of the reissued NPDES permit the permittee will be required to conduct regular compliance monitoring and report this information to the SWQB and EPA through quarterly Discharge Monitoring Reports.

Public Participation

Public participation in development of this TMDL has been extensive. A flow chart of this process is shown in **Figure 4**. Response to comments is attached as Appendix G. All meetings and the draft document notice of availability were extensively advertised via newsletters, email distribution lists, webpage postings, and press releases to area newspapers

Figure 4. Public Participation Flow Chart.



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Appendices

Appendix A.	**New Mexico Environment Department, Surface Water Quality Bureau 1999 Middle Rio Grande Sampling Sites and Parameters**
Appendix B.	**Results of 1999 NMED/SWQB Middle Rio Grande Surface Water Quality Survey.**
Appendix C.	**Table of City of Albuquerque Stormwater Sampling Sites**
Appendix D.	**Fecal Coliform Results of the June 1979 Tague/Drypolcher Albuquerque Stormwater Study**
Appendix E.	**Fecal Coliform Results of the July 1988 Pierce Rio Grande Study**
Appendix F.	**Precipitation Tables**
Appendix G.	**Public Comments and Bureau Responses**

Appendix A Middle Rio Grande Sampling Sites & Parameters

From the southern border of the Santa Ana Pueblo down to the northern border of the Isleta Pueblo

SITE	SAMPLES TO BE COLLECTED
1 MRG 105005770 Rio Grande below Angostura diversion works	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
2 MRG 105005765 Rio Grande@Highway 44 bridge in Bernalillo	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
3 MRG 105005760 Bernalillo WWTF discharge	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
4 MRG 105005755 Rio Grande upstream from Rio Rancho Utility Company (RRUC) WWTF #3	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
5 MRG 105005750 Effluent discharge from RRUC WWTF #3	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
6 MRG 105005749 Rio Grande upstream from RRUC WWTF #2	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
7 MRG 105005747 Effluent discharge from RRUC WWTF #2	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
8 MRG 105005745 Rio Grande upstream from Alameda bridge	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
9 MRG 105005740 Rio Grande@Rio Bravo bridge	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
10 MRG 105005735 Effluent discharge from Albuquerque South- Side Water Reclamation Plant	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
11 MRG 105005730 Rio Grande@I-25 bridge	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual
12 MRG61C Rio Grande upstream from the Isleta Diversion works	Total ammonia, fecal coliform, nitrate/nitrite, TKN, TOC, total phosphorus, DO, temperature, pH, turbidity, conductivity, total chlorine residual

Appendix B Results of 1999 NMED/SWQB Middle Rio Grande Surface Water Quality Survey.

CHEMISTRY

SITE	DATE	TIME	QA Rep INFO	Water Temp (C)	Cond Field Corr to 25 deg C (uhmo)	DO (mg/L)	pH Field (S.U.)	Turb Field (NTU)	Total P (mg/L)	Nitrate + ite N (mg/L)	Total NH3 (mg/L)	T I N 630 + 610 (mg/L)	Kjeldahl N (mg/L)	T O N 625 - 610 (mg/L)	Total N 625+630 (mg/L)	Total Org C (mg/L)	Total Cl residual μg/L
Rio Grande Below Angostura Diversion Works	990614	0945		16.4	303.2	8.03	7.94	1000L	3.01	0.1K	0.1K	0.2KC	4.81	4.71LC	4.91KC	6.90	
Rio Grande Below Angostura Diversion Works	990615	0720		16.7	273	7.94	7.73		0.09	0.1K	0.1K	0.2KC	0.50	0.40LC	0.60KC	5K	
Rio Grande Below Angostura Diversion Works	990616	0745		17.2	268.8	7.73	7.67		0.07	01K	0.1K	0.2KC	0.44	0.34LC	0.54KC	5K	
Rio Grande Below Angostura Diversion Works	990617	1115		18.1	287.4	7.91	8.04		2.16	0.1K	0.1K	0.2KC	5.42	5.32LC	5.52KC	9.70	
Rio Grande Below Angostura Diversion Works	991101	0800		9.3	308.5	9.15	8.1		0.05	0.1K	0.1K	0.2KC	0.41	0.31LC	0.51KC	13.00	0
Rio Grande Below Angostura Diversion Works	991101	0800	QA Rep						0.05	0.1K	0.1K	0.2KC	0.28	0.18LC	0.38KC	9.57	
Rio Grande Below Angostura Diversion Works	991102	0730		8.8	317.3	9.05	8.21		0.04	0.1K	0.1K	0.2KC	0.39	0.29LC	0.49KC	10.10	1
Rio Grande Below Angostura Diversion Works	991103	0730		8.5	313	9.32	8.24		0.03	0.1K	0.1K	0.2KC	0.39	0.29LC	0.49KC	7.88	2
Rio Grande Below Angostura Diversion Works	991104	0730		8.6	312	9.44	8.08		0.07	0.1K	0.1K	0.2KC	0.39	0.29LC	0.49KC	5.90	2
Rio Grande Above Highway 44 Bridge	990614	1020		17.2	308.1	7.84	7.96	1000L	1.87	0.1K	0.1K	0.2KC	2.64	2.54LC	2.74KC	6.70	
Rio Grande Above Highway 44 Bridge	990614	1020	QA Rep						1.85	0.1K	0.1K	0.2KC	2.68	2.58LC	2.78KC	5.30	
Rio Grande Above Highway 44 Bridge	990615	0750		16.8	274.4	7.30	8.02		0.08	0.1K	0.1K	.2KC	0.66	0.56LC	0.76KC	5K	
Rio Grande Above Highway 44 Bridge	990616	0815		17.4	270.3	7.68	8.06		0.05	0.1K	0.1K	0.2KC	0.36	0.26LC	0.46KC	5K	
Rio Grande Above Highway 44 Bridge	990617	1140		18.4	XXXXX	7.53	7.99		0.49	0.1K	0.1K	0.2KC	1.05	0.95LC	1.15KC	5K	
Rio Grande Above Highway 44 Bridge	991101	0900		10.1	315.7	7.78	8.25		0.04	0.1K	0.1K	0.2KC	0.31	0.21LC	0.41KC	8.55	3
Rio Grande Above Highway 44 Bridge	991102	0815		9.2	921.3	8.79	8.43		0.04	0.1K	0.1K	.02KC	0.33	0.23LC	0.43KC	9.24	0
Rio Grande Above Highway 44 Bridge	991103	0820		8.7	318.8	8.45	8.52		0.03K	0.1K	0.1K	0.2KC	0.31	0.21LC	0.41KC	7.29	0
Rio Grande Above Highway 44 Bridge	991104	0800		8.8	316.5	8.79	8.25		0.04	0.1K	0.1K	0.2KC	0.30	0.20LC	0.40KC	7.54	0
Bernalillo WWTF discharge	990614	1045		27.5	1383		7.27	5.55	4.40	18.80	0.125	18.925C	1.55	1.425	20.35	8.50	
Bernalillo WWTF discharge	990614	1045	QA Rep						4.36	19.30	0.133	19.433C	1.89	1.757	21.19	10.40	
Bernalillo WWTF discharge	990615	0810		22.4	1395		7.41		3.91	18.20	0.1K	18.3KC	1.56	1.46LC	19.76	6.20	
Bernalillo WWTF discharge	990616	0830		22.7	1394		7.36		3.52	18.30	0.1K	18.4KC	1.35	1.25LC	19.65	6.06	
Bernalillo WWTF discharge	990617	1200		23.2	1368		7.25		3.82	16.50	0.1K	16.6KC	1.21	1.11LC	17.71	7.40	
Bernalillo WWTF discharge	991101	0945		18.3	1346		7.2		3.06	20.50	0.1K	20.6KC	1.33	1.23LC	21.83	14.60	436L
Bernalillo WWTF discharge	991101	0945	QA Rep						3.06	20.00	0.1K	20.1KC	1.33	1.23LC	21.33	15.90	
Bernalillo WWTF discharge	991102	0845		17.7	1366		7.58		3.26	19.80	0.1K	19.9KC	1.36	1.26LC	21.16	14.90	477L
Bernalillo WWTF discharge	991103	0850		17.2	1355		7.56		2.92	19.70	0.1K	19.8KC	1.33	1.23LC	21.03	15.10	455L
Bernalillo WWTF discharge	991104	0840		17	1306		7.37		3.14	2.10	0.1K	2.2KC	1.14	1.04LC	4.28	16.70	95

SITE	DATE	TIME	QA Rep INFO	Water Temp (C)	Cond Field Corr to 25 deg C (uhmo)	DO (mg/L)	pH Field (S.U.)	Turb Field (NTU)	Total P (mg/L)	Nitrate + ite N (mg/L)	Total NH3 (mg/L)	T I N 630 + 610 (mg/L)	Kjeldahl N (mg/L)	T O N 625 - 610 (mg/L)	Total N 625+630 (mg/L)	Total Org C (mg/L)	Total Cl residual μg/L
Rio Grande Above Rio Rancho WWTF #3	990614	1115		21.1	285	7.60	7.91	250.00	0.19	0.1K	0.1K	0.2KC	0.52	0.42LC	0.62KC	5K	
Rio Grande Above Rio Rancho WWTF #3	990615	0905		18.2	274.6	7.71	7.96		0.13	0.1K	0.1K	0.2KC	0.44	0.34LC	0.54KC	5K	
Rio Grande Above Rio Rancho WWTF #3	990616	0900		18.4	271	7.79	8.06		0.07	0.1K	0.1K	0.2KC	0.38	0.28LC	0.48KC	5K	
Rio Grande Above Rio Rancho WWTF #3	990616	0900	QA Rep						0.06	0.1K	0.1K	0.2KC	0.39	0.29LC	0.49KC	5K	
Rio Grande Above Rio Rancho WWTF #3	990617	1225		20.3	265	7.43	7.75		0.32	0.1K	0.1K	0.2KC	0.77	0.67LC	0.87KC	6.10	
Rio Grande Above Rio Rancho WWTF #3	991101	1030		11.9	316	9.26	8.2		0.03K	0.1K	0.1K	0.2KC	0.32	0.22LC	0.42KC	9.07	1
Rio Grande Above Rio Rancho WWTF #3	991102	0930		10.2	320.5	9.28	8.51		0.03K	0.1K	.01K	.02KC	0.35	0.25LC	0.45KC	11.10	0
Rio Grande Above Rio Rancho WWTF #3	991103	0935		9.5	316	9.67	8.32		0.06	0.1K	0.1K	0.2KC	0.38	0.28LC	0.48KC	9.20	4
Rio Grande Above Rio Rancho WWTF #3	991104	0925		9.6	315	9.72	8.25		0.04	0.1K	0.1K	0.2KC	0.22	0.12LC	0.42KC	8.91	1
Rio Rancho WWTF #3 discharge	990614	1125		24.5	1156		7.36	3.08	4.22	9.09	0.1K	9.19KC	1.41	1.31LC	10.5	5.20	
Rio Rancho WWTF #3 discharge	990615	0915		24.5	1147		7.54		3.75	8.94	0.1K	9.04KC	1.47	1.37LC	10.41	8.00	
Rio Rancho WWTF #3 discharge	990616	0915		24.4	1109		7.6		3.97	9.34	0.1K	9.44KC	1.15	1.05LC	10.49	6.15	
Rio Rancho WWTF #3 discharge	990616	0915	QA Rep						4.02	9.43	0.1K	9.53KC	1.19	1.09LC	10.62	5.06	
Rio Rancho WWTF #3 discharge	990617	1235		24.9	1130		7.3		4.47	10.50	0.1K	10.6KC	1.37	1.27LC	11.87	6.60	
Rio Rancho WWTF #3 discharge	991101	1040		23.3	1067		7.2		3.01	10.80	0.1K	10.9KC	1.69	1.59LC	12.49	15.60	0
Rio Rancho WWTF #3 discharge	991102	0945		22.8	1071		7.64		3.74	5.46	0.1K	5.56KC	4.38	4.28LC	9.84	18.50	2
Rio Rancho WWTF #3 discharge	991102	0945	QA Rep						3.86	10.80	0.1K	10.9KC	4.73	4.63LC	15.53	18.30	
Rio Rancho WWTF #3 discharge	991103	0945		21.9	1071		7.53		3.47	11.60	0.1K	11.7KC	1.71	1.61LC	13.31	16.40	3
Rio Rancho WWTF #3 discharge	991104	0940		21.5	1057		7.39		3.99	12.50	0.1K	12.6KC	1.72	1.62LC	14.22	16.20	1
Rio Grande Above Rio Rancho WWTF #2	990614	1145		18.6	278	7.94	7.89	235.00	0.22	0.1K	0.1K	0.2KC	0.58	0.48LC	0.68KC	5K	
Rio Grande Above Rio Rancho WWTF #2	990615	1020		18.2	275.2	8.05	7.84		0.15	0.1K	0.1K	0.2KC	0.38	0.28LC	0.48KC	5K	
Rio Grande Above Rio Rancho WWTF #2	990616	1010		18.5	269.6	7.67	7.97		0.11	0.1K	0.1K	0.2KC	0.37	0.27LC	0.47KC	5.00	
Rio Grande Above Rio Rancho WWTF #2	990617	1300		19.5	264.5	7.32	7.54		0.47	0.1K	0.1K	0.2KC	0.97	.087LC	1.07KC	5.10	
Rio Grande Above Rio Rancho WWTF #2	990617	1300	QA Rep						0.44	0.1K	0.1K	0.2KC	0.99	0.89LC	1.09KC	5.80	
Rio Grande Above Rio Rancho WWTF #2	991101	1150		12.4	316.4	8.98	8.2		0.05	0.1K	0.1K	0.2KC	0.31	0.21LC	0.41KC	9.47	0
Rio Grande Above Rio Rancho WWTF #2	991102	1100		11.2	320.2	9.12	8.36		0.04	0.1K	0.1K	0.2KC	0.35	0.25LC	0.45KC	10.80	1
Rio Grande Above Rio Rancho WWTF #2	991103	1100		10.7	318	9.56	8.34		0.03	0.1K	0.1K	0.2KC	0.36	0.26LC	0.46KC	7.80	0
Rio Grande Above Rio Rancho WWTF #2	991104	1050		10.8	315.9	9.72	8.31		0.05	0.1K	0.1K	0.2KC	0.22	0.12LC	0.32KC	9.72	1
Rio Rancho WWTF #2 discharge	990614	1155		24.7	834		7.57	2.95	1.71	11.90	0.1K	12.0KC	1.09	0.99LC	12.99	6.30	
Rio Rancho WWTF #2 discharge	990615	1030		24.6	830		7.54		1.05	11.40	0.1K	11.5KC	1.48	1.38LC	12.88	9.33	
Rio Rancho WWTF #2 discharge	990616	1020		24.4	822		7.48		1.25	12.60	0.1K	12.7KC	1.07	0.97LC	13.67	5.70	
Rio Rancho WWTF #2 discharge	990617	1310		25	820		7.17		2.05	12.50	0.1K	12.6KC	1.04	0.94LC	13.54	6.80	

SITE	DATE	TIME	QA Rep INFO	Water Temp (C)	Cond Field Corr to 25 deg C (uhmo)	DO (mg/L)	pH Field (S.U.)	Turb Field (NTU)	Total P (mg/L)	Nitrate + ite N (mg/L)	Total NH3 (mg/L)	T I N 630 + 610 (mg/L)	Kjeldahl N (mg/L)	T O N 625 - 610 (mg/L)	Total N 625+630 (mg/L)	Total Org C (mg/L)	Total Cl residual μg/L
Rio Rancho WWTF #2 discharge	991102	1110		22.2	812		8.53		0.30	12.60	0.1K	12.7KC	1.29	1.19LC	13.89	15.10	1
Rio Rancho WWTF #2 discharge	991103	1110		22.2	810		7.49		0.70	14.10	0.1K	14.2KC	1.37	1.27LC	15.47	13.80	2
Rio Rancho WWTF #2 discharge	991104	1110		21.8	814		7.37		1.46	15.60	0.1K	15.7KC	0.90	0.80LC	16.5	15.90	0
Rio Grande Above Alameda Bridge	990614	1315		19.4	281	7.75	7.45	363.00	0.23	0.1K	0.1K	0.2KC	0.60	0.50LC	0.70KC	5K	
Rio Grande Above Alameda Bridge	990615	1130		18.8	274.7	7.83	8.14		0.19	0.1K	0.1K	0.2KC	0.59	0.49LC	0.69KC	5K	
Rio Grande Above Alameda Bridge	990616	1110		18.8	270.1	7.07	7.25		0.11	0.1K	0.1K	0.2KC	0.37	0.27LC	0.47KC	5K	
Rio Grande Above Alameda Bridge	990617	1335		19.5	252	7.08	7.54		2.73	0.1K	0.1K	0.2KC	5.77	5.47LC	5.67KC	10.10	
Rio Grande Above Alameda Bridge	991101	1320		15.5	369.8	7.96	8.0		0.13	0.1K	0.1K	0.2KC	0.50	0.40LC	0.60KC	10.30	0
Rio Grande Above Alameda Bridge	991102	1215		13.4	392.3	8.38	8.18		0.06	0.1K	0.1K	0.2KC	0.35	0.25LC	0.45KC	13.30	5
Rio Grande Above Alameda Bridge	991102	1215	QA Rep						0.09	0.1K	0.1K	0.2KC	0.47	0.37LC	0.57KC	12.10	
Rio Grande Above Alameda Bridge	991103	1210		13.2	393.3	8.71	8.35		0.05	0.1K	0.1K	0.2KC	0.36	0.26LC	0.46KC	6.00	2
Rio Grande Above Alameda Bridge	991104	1205		13.1	384.7	8.89	8.23		0.07	0.1K	0.1K	0.2KC	0.25	0.15LC	0.35KC	7.24	4
Rio Grande Above Rio Bravo Bridge	990614	1515		21.4	287.9	7.47	7.99	1000L	0.48	0.1K	0.1K	0.2KC	0.93	0.83LC	1.03KC	5K	
Rio Grande Above Rio Bravo Bridge	990615	1240		20.6	282.6	7.21	8.05		0.50	0.1K	0.1K	0.2KC	0.95	0.85LC	1.05KC	5K	
Rio Grande Above Rio Bravo Bridge	990615	1240	QA Rep						0.50	0.1K	0.1K	0.2KC	1.04	0.94LC	1.04KC	5K	
Rio Grande Above Rio Bravo Bridge	990616	1245		21	273.9	7.01	8.04		0.14	0.1K	0.1K	0.2KC	0.40	0.30LC	0.50KC	5.20	
Rio Grande Above Rio Bravo Bridge	990617	0820		18.8	252.9	6.56	8.13		0.40	0.1K	0.1K	0.2KC	1.01	0.91LC	1.11KC	7.73	
Rio Grande Above Rio Bravo Bridge	991101	1415		14.8	339.4	7.92	8.2		0.09	0.1K	0.1K	0.2KC	0.45	0.35LC	0.55KC	9.05	0
Rio Grande Above Rio Bravo Bridge	991102	1315		13	336.8	8.62	8.39		0.08	0.1K	0.1K	0.2KC	0.38	0.28LC	0.48KC	12.60	2
Rio Grande Above Rio Bravo Bridge	991103	1305		12.3	356.7	9.24	8.43		0.06	0.1K	0.1K	0.2KC	0.36	0.26LC	0.46KC	6.30	0
Rio Grande Above Rio Bravo Bridge	991104	1300		12.6	342.7	8.52	8.28		0.07	0.1K	0.1K	0.2KC	0.18	0.08LC	0.28KC	7.00	0
Albuquerque WWTF discharge	990614	1450		26.2	785	6.72	6.84	5.41	3.63	12.30	0.1K	12.4KC	1.67	1.57LC	13.97	7.30	
Albuquerque WWTF discharge	990615	1300		26.3	807		7.06		3.78	10.30	0.1K	10.4KC	1.81	1.71LC	12.11	7.81	
Albuquerque WWTF discharge	990615	1300	QA Rep						3.79	10.30	0.1K	10.4KC	1.81	1.71LC	12.11	6.62	
Albuquerque WWTF discharge	990616	1300		26.5	827		6.85		3.74	10.50	0.1K	10.6KC	1.62	1.52LC	12.12	10.60	
Albuquerque WWTF discharge	990617	0810		25.5	827		7.06		3.36	9.85	0.1K	9.95KC	1.76	1.66LC	11.61	7.37	
Albuquerque WWTF discharge	991101	1445		24.4	769		7.0		2.98	12.80	0.1K	12.9KC	1.38	1.28LC	14.18	14.20	461L
Albuquerque WWTF discharge	991102	1400		23.5	807		7.0		3.18	13.30	0.1K	13.4KC	1.38	1.28LC	14.68	17.10	455L
Albuquerque WWTF discharge	991103	1345		23.9	826		7.01		3.26	12.00	0.1K	12.1KC	1.35	1.25LC	13.35	14.30	455L
Albuquerque WWTF discharge	991104	1330		24.0	811		6.79		3.22	13.50	0.1K	13.6KC	0.84	0.74LC	14.34	11.90	467L
Rio Grande Above I-25 Bridge	990614	1430		21.4	317.2	7.37	7.76	1000L	0.73	0.1K	0.1K	0.2KC	1.48	1.38LC	1.58KC	5K	
Rio Grande Above I-25 Bridge	990615	1330		21.5	259.9	7.26	7.97		0.92	0.1K	0.1K	0.2KC	1.58	1.48LC	1.68KC	5K	

SITE	DATE	TIME	QA Rep INFO	Water Temp (C)	Cond Field Corr to 25 deg C (uhmo)	DO (mg/L)	pH Field (S.U.)	Turb Field (NTU)	Total P (mg/L)	Nitrate + ite N (mg/L)	Total NH3 (mg/L)	T I N 630 + 610 (mg/L)	Kjeldahl N (mg/L)	T O N 625 - 610 (mg/L)	Total N 625+630 (mg/L)	Total Org C (mg/L)	Total Cl residual µg/L
Rio Grande Above I-25 Bridge	990616	1330		22.3	295.2	7.17	7.55		0.25	0.1K	0.1K	0.2KC	0.72	0.62LC	0.82KC	5K	
Rio Grande Above I-25 Bridge	991102	1430		13.7	381.7	7.95	8.1		0.34	1.18	0.1K	1.28KC	0.48	0.38LC	1.66	13.60	4
Rio Grande Above I-25 Bridge	991103	1415		13.1	389.6	8.72	8.14		0.40	1.21	0.1K	1.31KC	0.51	0.41LC	1.71	10.50	5
Rio Grande Above I-25 Bridge	991104	1415		14.0	370	8.81	7.92		0.33	0.92	0.1K	1.02KC	0.41	0.31LC	1.33	7.93	4
Rio Grande Above Isleta Diversion	990614	1410		20.9	306	7.60	7.93	109.00	0.21	0.1K	0.1K	0.2KC	0.77	0.67LC	0.87KC	5K	
Rio Grande Above Isleta Diversion	990615	1340		21.5	310	7.10	7.98		1.20	0.21	0.1K	0.313KC	2.09	1.99LC	2.30	5.09	
Rio Grande Above Isleta Diversion	990616	1345		21.9	297.2	7.17	7.73		0.23	0.12	0.1K	0.221KC	0.60	0.50LC	0.72	5K	
Rio Grande Above Isleta Diversion	990617	0730		19.6	288	6.90	7.48		0.44	0.14	0.1K	0.241KC	0.94	0.84LC	1.08	5K	
Rio Grande Above Isleta Diversion	991101	1600		15.6	359.6	7.36	8.1		0.28	0.55	0.1K	0.65KC	0.42	0.32LC	0.97	9.35	1
Rio Grande Above Isleta Diversion	991102	1500		13.4	360	8.61	8.26		0.21	0.51	0.1K	0.61KC	0.44	0.34LC	0.95	13.10	0
Rio Grande Above Isleta Diversion	991103	1450		13.4	368.6	8.62	8.31		0.23	0.62	0.1K	0.72KC	0.39	0.29LC	1.01	6.10	0
Rio Grande Above Isleta Diversion	991104	1450		14.8	364.8	8.76	8.12		0.25	0.62	0.1K	0.72KC	0.31	0.21LC	0.93	7.90	0
Rio Grande Above Isleta Diversion	991104	1450	QA Rep						0.25	0.63	0.1K	0.73KC	0.37	0.27LC	1.00	8.33	
Method Blank	990614	0945							0.03K	0.1K	0.1K	0.2K	0.13	0.03LC	0.23KC	5K	

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FECAL COLIFORM RAW DATA

SITE	DATE	TIME	COMP INFO	31616 Fecal Coli Col/100ml mem-filt	31614 Fecal Coli Col/100ml MPN	Request ID Number	SLD Number	116 Intensive Survey Number
Rio Grande Below Angostura Diversion Works	990628	1010		20		2288561	9904056	993504
Rio Grande Above Highway 44 Bridge	990628	1025		34		2288562	9904057	993504
Rio Grande at Bernalillo WWTF discharge	990628	1035		23		2288563	9904058	993504
Rio Grande Above Rio Rancho WWTF #3	990628	1055		37		2288564	9904059	993504
Rio Rancho WWTF #3 discharge	990628	1100		12B		2288565	9904060	993504
Rio Grande Above Rio Rancho WWTF #2	990628	1125		49		2288566	9904061	993504
Rio Rancho WWTF #2 discharge	990628	1130		5300		2288567	9904062	993504
Rio Grande Above Alameda Bridge	990628	1200		2400		2486568	9904063	993504
Rio Grande Above Alameda Bridge	990628	1200	QA REP	50		2519573	9904068	993504
Rio Grande Above Rio Bravo Bridge	990628	1230		180B		2288569	9904064	993504
Albuquerque WWTF discharge	990628	1245		19B		2288570	9904065	993504
Rio Grande Above I-25 Bridge	990628	1300		540		2288571	9904066	993504
Rio Grande Above Isleta Diversion	990628	1315		400B		2288572	9904067	993504
Rio Grande Below Angostura Diversion Works	990706	0800			300	2288574	9904174	993504
Rio Grande Above Highway 44 Bridge	990706	0820			900	2288575	9904175	993504
Rio Grande at Bernalillo WWTF discharge	990706	0835		1K		2288576	9904176	993504
Rio Grande Above Rio Rancho WWTF #3	990706	0855			1600L	2288577	9904177	993504
Rio Rancho WWTF #3 discharge	990706	0905		15B		2288578	9904178	993504
Rio Grande Above Rio Rancho WWTF #2	990706	0925			500	2288579	9904179	993504
Rio Rancho WWTF #2 discharge	990706	0935		3500		2288580	9904180	993504
Rio Grande Above Alameda Bridge	990706	0955		1000		2288581	9904181	993504
Rio Grande Above Rio Bravo Bridge	990706	1030		2400B		2288582	9904182	993504
Albuquerque WWTF discharge	990706	1045		11B		2288583	9904183	993504
Rio Grande Above I-25 Bridge	990706	1100		2100B		2288584	9904184	993504
Rio Grande Above Isleta Diversion	990706	1115		1800B		2288585	9904185	993504
Rio Grande Above Isleta Diversion	990706	1115	QA REP	1600B		2288586	9904186	993504
Rio Grande Below Angostura Diversion Works	990712	0855		110B		2288587	9904374	993504
Rio Grande Above Highway 44 Bridge	990712	0920		160B		2288588	9904375	993504
Rio Grande at Bernalillo WWTF discharge	990712	0935		10KB		2288589	9904376	993504
Rio Grande Above Rio Rancho WWTF #3	990712	0955		200		2288590	9904381	993504
Rio Rancho WWTF #3 discharge	990712	1000		2100		2288591	9904382	993504
Rio Grande Above Rio Rancho WWTF #2	990712	1030		330		2288592	9904383	993504
Rio Rancho WWTF #2 discharge	990712	1035		7300B		2288593	9904384	993504
Rio Grande Above Alameda Bridge	990712	1055		250		2288594	9904385	993504
Rio Grande Above Alameda Bridge	990712	1055	QA REP	280		2288599	9904380	993504

SITE	DATE	TIME	COMP INFO	31616 Fecal Coli Col/100ml mem-filt	31614 Fecal Coli Col/100ml MPN	Request ID Number	SLD Number	116 Intensive Survey Number
Rio Grande Above Rio Bravo Bridge	990712	1200		170B		2288595	9904386	993504
Albuquerque WWTF discharge	990712	1215		30B		2288596	9907377	993504
Rio Grande Above I-25 Bridge	990712	1235		170B		2288597	9907378	993504
Rio Grande Above Isleta Diversion	990712	1245		290		2288598	9904379	993504
Rio Grande Below Angostura Diversion Works	990719	0830			300	2288600	9904601	993504
Rio Grande Above Highway 44 Bridge	990719	0850		340		2288601	9904602	993504
Rio Grande Above Highway 44 Bridge	990719	0850	QA REP	360		2288612	9904613	993504
Rio Grande at Bernalillo WWTF discharge	990719	0905		10K		2288602	9904603	993504
Rio Grande Above Rio Rancho WWTF #3	990719	0925			1600	2288603	9904604	993504
Rio Rancho WWTF #3 discharge	990719	0926		50B		2288604	9904605	993504
Rio Grande Above Rio Rancho WWTF #2	990719	1000			2400	2288605	9904606	993504
Rio Rancho WWTF #2 discharge	990719	1005		8500		2288606	9904607	993504
Rio Grande Above Alameda Bridge	990719	1030			1300	2288607	9904608	993504
Rio Grande Above Rio Bravo Bridge	990719	1105			5000	2288608	9904609	993504
Albuquerque WWTF discharge	990719	1115		180		2288609	9904610	993504
Rio Grande Above I-25 Bridge	990719	1130			16000	2288610	9904611	993504
Rio Grande Above Isleta Diversion	990719	1145			5000	2288611	9904612	993504
Rio Grande Below Angostura Diversion Works	990726	0850		80B		2288613	9904802	993504
Rio Grande Above Highway 44 Bridge	990726	0910		400		2288614	9904803	993504
Rio Grande at Bernalillo WWTF discharge	990726	0920		10KB		2288615	9904804	993504
Rio Grande Above Rio Rancho WWTF #3	990726	0945		110B		2288616	9904805	993504
Rio Rancho WWTF #3 discharge	990726	0946		50B		2288617	9904806	993504
Rio Grande Above Rio Rancho WWTF #2	990726	1010		90B		2288618	9904807	993504
Rio Rancho WWTF #2 discharge	990726	1015		20000		2288619	9904808	993504
Rio Rancho WWTF #2 discharge	990726	1015	QA REP	16000B		2288620	9904809	993504
Rio Grande Above Alameda Bridge	990726	1040		350		2288621	9904810	993504
Rio Grande Above Rio Bravo Bridge	990726	1120			500	2288622	9904811	993504
Albuquerque WWTF discharge	990726	1130		30B		2288623	9904812	993504
Rio Grande Above I-25 Bridge	990726	1150			500	2288624	9904813	993504
Rio Grande Above Isleta Diversion	990726	1200		240		2288625	9904814	993504
Rio Grande Above Rio Rancho WWTF #2	990729	1000		82B		2288626	9904961	993504
Rio Rancho WWTF #2 discharge	990729	1005		3000		2288627	9904960	993504
Rio Grande Above Alameda Bridge	990729	1035		81B		2288628	9904959	993504
Rio Grande Above Rio Bravo Bridge	990729	1115		70B		2288629	9904958	993504
Albuquerque WWTF discharge	990729	1145		3B		2288630	9904957	993504

SITE	DATE	TIME	COMP INFO	31616 Fecal Coli Col/100ml mem-filt	31614 Fecal Coli Col/100ml MPN	Request ID Number	SLD Number	116 Intensive Survey Number
Rio Grande Above I-25 Bridge	990729	1200		150B		2288631	9904956	993504
Rio Grande Above Isleta Diversion	990729	1215		140B		2288632	9904955	993504
Rio Grande Above Rio Rancho WWTF #2	990802	0840			1600L	2288640	9904984	993504
Rio Rancho WWTF #2 discharge	990802	0845		410		2288641	9904985	993504
Rio Rancho WWTF #2 discharge	990802	0845	QA REP	210		2288647	9904990	993504
Rio Grande Above Alameda Bridge	990802	0910			1600L	2288642	9904986	993504
Rio Grande Above Rio Bravo Bridge	990802	0945			1600L	2288643	9904987	993504
Albuquerque WWTF discharge	990802	0955		3		2288644	9904988	993504
Rio Grande Above I-25 Bridge	990802	1010			1600L	2288645	9904981	993504
Rio Grande Above Isleta Diversion	990802	1020			1600L	2288646	9908989	993504

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FECAL COLIFORM GEOMETRIC MEANS CALCULATED WITHOUT REMARKED VALUES INCLUDED

Station	Date/result 28-Jun	Date/result 6-Jul	Date/result 12-Jul	Date/result 19-Jul	Date/result 26-Jul	Date/result 29-Jul	Date/result 2-Aug	Geometric Mean, no remarked values, No QA	Geometric Mean no remarked values, with QA
Precipitation in last 48 hours at ABQ	0.10	0.42	0	0.56	0	0	0.30		
Rio Below Angostura Diversion	20	300	110	300	80			110	110
Rio at Hiway 44 Bridge	34	900	160	340	400			232	249
Bernalillo WWTP	23	1K	10K	10K	10K			23	23
Rio Above RRUC # 3	37	1600L	200	1600	110			190	190
RRUC # 3 Discharge	12	15	2100	50	50			62	62
Rio Above RRUC # 2	49	500	330	2400	90	82B	1600L	281	281
RRUC # 2 Discharge	5300	3500	7300	8500	20000	3000	410	4325	2963
Rio Abv Alameda Bridge	2400	1000	250	1300	350	81B	1600L	771	451
Rio Abv Rio Bravo Bridge	180	2400	170	5000	500	70B	1600L	712	712
Albuquerque WWTP	19	11	30	180	30	3B	3B	32	32
Rio Above I-25 Bridge	540	2100	170	16000	500	150B	1600L	1091	1091
Rio Above Isleta Diversion	400	1800	290	5000	240	140B	1600L	758	758
Rio at Hiway 44 Bridge QA				360					
RRUC # 2 Discharge QA					16000 B		210		
Rio Abv Alameda Bridge QA	50		280						
Rio Above Isleta Diversion QA		1600 B							

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"B" Remark Code = Results based upon colony counts outside the acceptable range.

"K" Remark Code = Off scale low. Actual value not known, but known to be less than value shown.

FECAL COLIFORM GEOMETRIC MEANS CALCULATED WITH REMARKED VALUES TAKEN AS VALUE

	28-Jun	6-Jul	12-Jul	19-Jul	26-Jul	29-Jul	2-Aug	Geometric Mean, with remarked values	Geometric Mean with QA samples with remarked values
Rio Below Angostura Diversion	20	300	110	300	80			110	110
Rio at Hiway 44 Bridge	34	900	160	340	400			232	249
Bernalillo WWTP	23	1	10	10	10			7	7
Rio Above RRUC # 3	37	1600	200	1600	110			291	291
RRUC # 3 Discharge	12	15	2100	50	50			62	62
Rio Above RRUC # 2	49	500	330	2400	90	82	1600	302	302
RRUC # 2 Discharge	5300	3500	7300	8500	20000	3000	410	4325	3574
Rio Abv Alameda Bridge	2400	1000	250	1300	350	81	1600	620	429
Rio Abv Rio Bravo Bridge	180	2400	170	5000	500	70	1600	574	574
Albuquerque WWTP	19	11	30	180	30	3	3	16	16
Rio Above I-25 Bridge	540	2100	170	16000	500	150	1600	868	868
Rio Above Isleta Diversion	400	1800	290	5000	240	140	1600	663	740
Rio at Hiway 44 Bridge QA				360					
RRUC # 2 Discharge QA					16000		210		
Rio Abv Alameda Bridge QA	50		280						
Rio Abv Isleta Diversion QA		1600							

Appendix C Table of City of Albuquerque Stormwater Sampling Sites

Station Name (site number)	USGS Station Number	Total Drainage Area (mi^2)	Percent within City Limits	Land Use within City Limits (in percent)				
				Residential	Commercial	Industrial	Open Space	Agricultural or Vacant
Maraposa Diversion of San Antonio Arroyo at Albuquerque (site 300A)	083299375	30.5	54.8	10.8	0.9	14.2	0.7	73.4
City of Albuquerque Lift Station #41 at Albuquerque (site 400A)	08330050	3.81	100.0	34.9	34.1	10.2	11.6	9.2
City of Albuquerque Lift Station #32 at Albuquerque (site 400B)	08330075	NA	NA	NA	NA	NA	NA	NA
San Jose Drain at Woodward Road at Albuquerque (site 500)	08330200	1.95	100.0	40.7	29.8	9.4	1.9	18.2
North Floodway Channel Near Alameda (site 9900)	08329900	92.2	59.9	40.7	15.1	3.9	3.7	36.6
South Diversion Channel above Tijeras Arroyo near Albuquerque (site 200)	08330775	11.0	72.5	13.0	28.5	21.3	8.3	28.9

				Land Use within City Limits (in percent)				
Station Name (site number)	**USGS Station Number**	**Total Drainage Area (mi^2)**	**Percent within City Limits**	**Residential**	**Commercial**	**Industrial**	**Open Space**	**Agricultural or Vacant**
Campus Wash at Albuquerque	08329700	3.8	NA	NA	NA	NA	NA	NA
S. Fk. Hahn Arroyo at Albuquerque	08329838	2	NA	NA	NA	NA	NA	NA
N. Fk. Hahn Arroyo at Albuquerque	08329839	1.5	NA	NA	NA	NA	NA	NA
Hahn Arroyo at Albuquerque	08329840	4.3	NA	NA	NA	NA	NA	NA
Academy Acres Drain at Albuquerque	08329880	0.13	NA	NA	NA	NA	NA	NA
La Cueva Tributary at Albuquerque	08329888	NA	NA	NA	NA	NA	NA	NA
N. Camino Arroyo at Sunset Hills in Albuquerque	08329911	2.1	NA	NA	NA	NA	NA	NA
Arroyo 19a at Albuquerque	08329935	1.62	NA	NA	NA	NA	NA	NA
Ladera Arroyo at Albuquerque	08329938	0.87	NA	NA	NA	NA	NA	NA
Tramway Floodway at Albuquerque	08330540	1.6	NA	NA	NA	NA	NA	NA
Tijeras Arroyo near Albuquerque	08330600	128	NA	NA	NA	NA	NA	NA

				Land Use within City Limits (in percent)				
Station Name (site number)	**USGS Station Number**	**Total Drainage Area (mi^2)**	**Percent within City Limits**	**Residential**	**Commercial**	**Industrial**	**Open Space**	**Agricultural or Vacant**
Embudo Arroyo at Albuquerque Background Site #1	08329720	NA	NA	NA	NA	NA	NA	NA
Pino Arroyo at Ventura at Albuquerque	08329872	5.4	NA	NA	NA	NA	NA	NA
Grant Line Arroyo at Villa Del Oso	08329860	0.08	NA	NA	NA	NA	NA	NA

City of Albuquerque Stormwater Fecal Coliform Results from the South Diversion Channel

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
South Diversion Channel	UR200	7/25/92	NA	50,000
South Diversion Channel	UR200	7/31/92	23:00	60,000
South Diversion Channel	UR200	8/6/92	18:20	60,000
South Diversion Channel	UR200	8/11/92	23:45	60,000
South Diversion Channel	UR200	8/24/92	11:00	60,000
South Diversion Channel	UR200	9/15/92	12:55	600,000
South Diversion Channel	UR200	8/1/93	22:45	37,000
South Diversion Channel	UR200	8/27/93	21:15	80,000
South Diversion Channel	UR200	10/17/93	18:30	7,000
South Diversion Channel	UR200	11/13/93	17:35	5,800
South Diversion Channel	UR200	8/15/94	12:30	64,000
South Diversion Channel	UR200	10/15/94	NA	48,000
South Diversion Channel	UR200	10/26/94	5:34	8,000
South Diversion Channel	UR200	11/11/94	16:50	6,000
South Diversion Channel	UR200	7/18/95	23:05	80,000
South Diversion Channel	UR200	8/23/95	21:30	80,000
South Diversion Channel	UR200	9/28/95	14:36	80,000
South Diversion Channel	UR200	8/23/96	8:00	38,000
South Diversion Channel	UR200	8/29/96	19:30	76,000
South Diversion Channel	UR200	9/14/96	17:55	40,000
South Diversion Channel	UR200	8/25/98	19:40	58,000
South Diversion Channel	UR200	7/4/99	20:15	40,000
South Diversion Channel	UR200	3/7/00	13:30	4,900
Fecal Coliform Average at this Station: 69,248fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from the San Antonio Arroyo

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
San Antonio Arroyo	UR300	8/7/92	17:55	15,450
San Antonio Arroyo	UR300	8/11/92	22:05	60,000
San Antonio Arroyo	UR300	9/15/92	11:15	600,000
San Antonio Arroyo	UR300	9/19/92	10:20	39,000
San Antonio Arroyo	UR300	8/1/93	20:10	7,100
San Antonio Arroyo	UR300	8/9/93	21:40	80,000
San Antonio Arroyo	UR300	8/27/93	14:45	15,000
San Antonio Arroyo	UR300	5/25/94	19:20	21,500
San Antonio Arroyo	UR300	7/28/94	20:05	50,000
San Antonio Arroyo	UR300	8/20/94	15:25	42,000
San Antonio Arroyo	UR300	9/7/95	19:15	35,000
San Antonio Arroyo	UR300	8/7/96	19:05	8,000
San Antonio Arroyo	UR300	9/14/96	15:35	26,000
San Antonio Arroyo	UR300	10/4/96	12:30	8,200
San Antonio Arroyo	UR300	8/5/97	16:55	20,000
San Antonio Arroyo	UR300	8/21/97	17:30	16,000
San Antonio Arroyo	UR300	7/8/98	20:25	66,000
San Antonio Arroyo	UR300	10/20/98	10:30	26,000
San Antonio Arroyo	UR300	8/2/99	20:50	3,600
Fecal Coliform Average at this Station: 59,939fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Alcalde Pump Station

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Alcalde Pump Station	UR400	7/23/92	18:12	60,000
Alcalde Pump Station	UR400	7/31/92	19:57	60,000
Alcalde Pump Station	UR400	8/6/92	17:02	60,000
Alcalde Pump Station	UR400	8/11/92	21:35	60,000
Alcalde Pump Station	UR400	8/24/92	7:30	74,000
Alcalde Pump Station	UR400	10/28/92	15:00	50,000
Alcalde Pump Station	UR400	7/28/93	NA	80,000
Alcalde Pump Station	UR400	8/26/93	20:00	1,800
Alcalde Pump Station	UR400	5/11/94	16:30	80,000
Alcalde Pump Station	UR400	1/5/95	15:30	9,650
Alcalde Pump Station	UR400	10/26/98	17:02	60,000
Alcalde Pump Station	UR400	9/10/94	17:10	44,000
Fecal Coliform Average at this Station: 53,288fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Barelas Pump Station

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Barelas Pump Station	UR400B	9/3/94	18:42	60,000
Barelas Pump Station	UR400B	9/7/95	NA	80,000
Barelas Pump Station	UR400B	1/31/96	9:12	1,600
Barelas Pump Station	UR400B	7/16/96	16:15	3,300
Barelas Pump Station	UR400B	10/4/96	11:15	80,000
Fecal Coliform Average at this Station: 44,980fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from San Jose Pump Station

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
San Jose Pump Station	UR500	7/25/92	NA	60,000
San Jose Pump Station	UR500	8/6/92	16:20	60,000
San Jose Pump Station	UR500	8/11/92	20:55	60,000
San Jose Pump Station	UR500	9/15/92	6:15	600,000
San Jose Pump Station	UR500	9/19/92	8:15	75,000
San Jose Pump Station	UR500	10/28/92	15:01	43,000
San Jose Pump Station	UR500	7/14/93	20:05	80,000
San Jose Pump Station	UR500	7/28/93	14:50	80,000
San Jose Pump Station	UR500	8/5/93	15:00	80,000
San Jose Pump Station	UR500	5/11/94	17:35	27,000
San Jose Pump Station	UR500	8/14/94	22:45	83,000
San Jose Pump Station	UR500	9/10/94	17:10	80,000
San Jose Pump Station	UR500	7/18/95	NA	80,000
San Jose Pump Station	UR500	9/7/95	18:18	80,000
San Jose Pump Station	UR500	7/16/96	16:15	3,600
San Jose Pump Station	UR500	8/3/96	20:31	80,000
San Jose Pump Station	UR500	8/2/99	21:40	60,000
Fecal Coliform Average at this Station: 95,976fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Piedra Lisa Channel East of Tramway

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Piedra Lisa Channel East of Tramway	UR600	8/27/93	14:00	80,000
Fecal Coliform Average at this Station: 80,000fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Embudo Arroyo at Monte Largo Street

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Emudo Arroyo at Monte Largo Street	UR650	8/1/98	17:50	4,200
Emudo Arroyo at Monte Largo Street	UR650	7/16/00	18:33	48,000
Fecal Coliform Average at this Station: 26,100fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from West Side Storm, Vulcan Road

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
West Side Storm, Vulcan Road	UR700	8/9/93	22:15	1,500
West Side Storm, Vulcan Road	UR700	8/27/93	15:10	1,200
Fecal Coliform Average at this Station: 1,350fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Menaul Detention Basin Inflow

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Menaul Detention Basin Inflow	UR800	3/8/94	10:45	1,400
Menaul Detention Basin Inflow	UR800	2/2/95	9:30	1,200
Menaul Detention Basin Inflow	UR800	8/7/96	19:59	80,000
Menaul Detention Basin Inflow	UR800	8/23/96	22:24	70,000
Menaul Detention Basin Inflow	UR800	9/6/96	21:34	80,000
Menaul Detention Basin Inflow	UR800	9/14/96	12:19	80,000
Menaul Detention Basin Inflow	UR800	10/4/96	10:00	18,500
Menaul Detention Basin Inflow	UR800	5/19/97	15:30	14,000
Menaul Detention Basin Inflow	UR800	3/27/00	10:10	100
Menaul Detention Basin Inflow	UR800	6/29/00	10:50	80,000
Menaul Detention Basin Inflow	UR800	6/30/00	9:05	80,000
Menaul Detention Basin Inflow	UR800	7/6/00	8:50	500
Menaul Detention Basin Inflow	UR800	7/7/00	9:10	1,200
Fecal Coliform Average at this Station: 38,992fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Menaul Detention Basin Outflow

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Menaul Detention Basin Outflow	UR900	7/2/96	13:00	22,100
Menaul Detention Basin Outflow	UR900	7/9/96	1:09	72,000
Menaul Detention Basin Outflow	UR900	7/10/96	22:33	25,000
Menaul Detention Basin Outflow	UR900	7/26/96	12:45	1
Menaul Detention Basin Outflow	UR900	8/3/96	21:44	80,000
Menaul Detention Basin Outflow	UR900	8/7/96	19:51	80,000
Menaul Detention Basin Outflow	UR900	8/23/96	22:43	52,500
Menaul Detention Basin Outflow	UR900	9/6/96	21:44	7,400
Menaul Detention Basin Outflow	UR900	9/14/96	13:11	80,000
Menaul Detention Basin Outflow	UR900	10/5/96	11:53	4,500
Menaul Detention Basin Outflow	UR900	5/19/97	17:45	4,200
Menaul Detention Basin Outflow	UR900	3/24/00	13:10	300
Menaul Detention Basin Outflow	UR900	3/2700	8:30	1
Menaul Detention Basin Outflow	UR900	3/29/00	8:30	1
Menaul Detention Basin Outflow	UR900	6/29/00	11:00	56,000
Menaul Detention Basin Outflow	UR900	6/30/00	9:10	80,000
Menaul Detention Basin Outflow	UR900	7/6/00	9:00	3,200
Menaul Detention Basin Outflow	UR900	7/7/00	9:15	400
Fecal Coliform Average at this Station: 31,534fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Washington Business Park Runoff

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Washington Business Park Runoff	UR950	8/5/97	17:27	80,000
Washington Business Park Runoff	UR950	9/9/97	18:25	15,450
Fecal Coliform Average at this Station: 47,725fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from Tijeras Canyon Arroyo at I-25

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
Tijeras Canyon Arroyo at I-25	TIJCAN01	8/14/93	NA	45,000
Fecal Coliform Average at this Station: 45,000fcu/100ml				

City of Albuquerque Stormwater Fecal Coliform Results from the North Diversion Channel

Sampling Site Location	Sampling Site Identifier	Sampling Date	Time	Fecal Coliform CT/100ml
North Diversion Channel	UR9900	7/23/92	16:30	60,000
North Diversion Channel	UR9900	7/31/92	22:00	22,000
North Diversion Channel	UR9900	8/6/92	17:15	60,000
North Diversion Channel	UR9900	9/19/92	9:46	80,000
North Diversion Channel	UR9900	10/28/92	15:49	28,000
North Diversion Channel	UR9900	7/20/93	4:49	90,000
North Diversion Channel	UR9900	8/1/93	19:56	17,600
North Diversion Channel	UR9900	8/14/93	15:16	80,000
North Diversion Channel	UR9900	8/26/93	20:00	12,000
North Diversion Channel	UR9900	2/8/94	3:00	1,000
North Diversion Channel	UR9900	6/21/94	20:52	56,000
North Diversion Channel	UR9900	8/8/94	17:10	69,000
North Diversion Channel	UR9900	10/14/94	21:40	15,500
North Diversion Channel	UR9900	1/5/95	15:30	1,900
North Diversion Channel	UR9900	5/29/95	15:10	6,000
North Diversion Channel	UR9900	7/16/95	17:25	80,000
North Diversion Channel	UR9900	8/22/95	19:25	23,750
North Diversion Channel	UR9900	9/7/95	19:04	66,000
North Diversion Channel	UR9900	9/28/95	12:31	29,000
North Diversion Channel	UR9900	9/17/96	19:50	18,000
North Diversion Channel	UR9900	5/20/97	15:51	66,000
North Diversion Channel	UR9900	8/4/97	14:40	24,000
North Diversion Channel	UR9900	8/25/98	18:52	48,000
North Diversion Channel	UR9900	10/20/98	11:05	21,000
North Diversion Channel	UR9900	8/10/99	11:30	25,000
North Diversion Channel	UR9900	2/22/00	9:30	900
North Diversion Channel	UR9900	6/2/00	20:45	0
Fecal Coliform Average at this Station: 37,061fcu/100ml				

Appendix D Fecal Coliform Results of the June 1979 Tague/Drypolcher Albuquerque Stormwater Study

North Floodway Channel Alameda

Date	Time	Fecal Coliform MFM-FCBR/100ml	Stream Flow INST-CFS
78/06/29	0700	120,000	300
78/06/29	0715	220,000B	280
78/06/29	0730	110,000	240
78/06/29	1000	5,000	119
78/06/29	1100	15,000	116
78/06/29	1230	3,000	86
78/07/20	2100	1,000,000	505
78/07/20	2200	4,000,000	300
78/07/21	0115	1,500,000	116
78/08/03	1725	11,000	1,000
78/08/03	1825	76,000	560
78/08/22	1840	25,000	315
78/08/22	2015	24,000	5
78/08/22	2030	42,000	740
78/08/22	2045	37,000	532
78/08/22	2100	14,000	425
78/08/22	2115	19,000	325
78/08/22	2130	45,000	300
78/08/22	2200	20,000	252
78/08/23	0030	49,000	113
78/08/23	0100	27,000	86
Fecal Coliform Average on this Study: 350,571fcu/100ml			
Flow Average on this Study: 320CFS			

Appendix E **Fecal Coliform Results of the July 1988 Pierce Rio Grande Study**
(Yellow denotes exceedence of the 2,000/100ml standard)

Station 1 – Rio Grande at Angostura Diversion Dam

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/27	0915	133
88/07/28	**0730**	**24,000**

Station 2 – Jemez River Below Jemez Canyon Dam

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	0855	40K
88/07/27	0835	24
88/07/28	0810	40K

Station 3 – Rio Grande at Highway 44 Bridge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	0925	80K
88/07/27	0935	67
88/07/28	**0835**	**5,900**

Station 4 – Bernalillo Wastewater Treatment Plant

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1020	40K
88/07/27	1000	1K
88/07/28	0850	2,000K

Station 5 – Rio Grande above AUC Discharge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1210	80K
88/07/27	1055	109
88/07/28	**0930**	**3,000**

Station 6 – AUC Discharge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1150	100
88/07/27	1045	500
88/07/28	**0920**	**4,100**

Station 7 – Rio Grande at Alameda Bridge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1240	400K
88/07/27	1145	340
88/07/28	**1010**	**600,000L**

Station 8 – Rio Grande at Rio Bravo Bridge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1330	640
88/07/27	1225	410
88/07/28	1040	700

Station 9 – Albuquerque Wastewater Treatment Plant

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1415	40K
88/07/27	1330	12
88/07/28	1115	2K

Station 10 – Rio Grande at I-25 Bridge

Date	Time	Fecal Coliform MFM-FCBR/100ml
88/07/25	1445	400K
88/07/27	1255	560
88/07/28	1150	400K

Appendix F Precipitation Data

ALBUQUERQUE WSFO AIRPORT, NEW MEXICO
Monthly Total Precipitation (inches)
Station (290234)

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1914	0.02	0.40	0.40	0.84	1.02	0.14	2.01	2.00	0.20	1.93	0.00 z	2.43 a	11.39
1915	0.68	0.50	0.51 a	2.05	0.00 z	0.00 z	2.92	0.83	0.00 z	0.00 z	0.00 z	0.00 z	7.49
1916	2.16 a	0.00 z	0.00	0.00 z	0.00	0.00 z	0.00 z	1.95	0.34	2.77	0.00	0.00	7.22
1917	0.35	0.73	0.00	0.12	0.50	0.18	0.25	0.56	0.60	0.00	0.00	0.00	3.29
1918	0.29	0.31	0.98	0.33	0.49	0.34	0.95	1.46	0.15	1.79	0.24	0.30	7.63
1919	0.00	0.13	1.25	1.93	1.34	0.84	4.12	0.98	1.36	1.61	0.68	0.79	15.03
1920	0.04	0.30	0.43	0.38	1.07	0.67	0.15	0.76	0.29	1.12	0.08	0.23	5.52
1921	0.12	0.18	0.86	0.00	0.28	2.46	2.77	2.60	0.37	0.37	0.00	0.28	10.29
1922	0.03	0.07	0.47	0.16	0.31	0.33	0.25	1.28	0.12	0.13	0.89	0.05	4.09
1923	0.14	0.34	0.99	0.70	0.35	0.00	0.34	2.34	0.45	0.84	1.10	0.36	7.95
1924	0.00 z	0.00 z	0.00 z	0.00 z	0.22	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.22
1925	0.52	0.00	0.07	0.26	0.22	0.57	0.58	0.49	1.13	1.23	0.26	0.15	5.48
1926	0.15	0.04	1.08	0.63	1.99	0.34	1.16	0.47	1.04	1.21	0.00	1.10	9.21
1927	0.03	0.42	0.35	0.21	0.00	1.61	1.93	1.63	1.14	0.22	0.00	0.16 a	7.70
1928	0.00	0.21	0.10	0.57	1.63	0.00	2.54	1.96	0.05	0.88	0.27	0.20	8.41
1929	0.05	0.35	0.08	0.08	3.56	0.00	1.23	1.44	3.31	1.56	0.74	0.18	12.58
1930	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00
1931	0.20	1.02	0.52	2.58	0.99	0.53	0.69	0.23	2.18	0.57	1.19	0.07	10.77
1932	0.45	0.40	0.27	0.34	1.41	0.09	2.01	2.20	0.78	1.46	0.00	0.37	9.78
1933	0.08	0.01	0.09	0.39	0.23	3.81	2.04	2.42	1.12	0.24	0.91	0.05	11.39
1934	0.06	0.04	0.01	0.13	0.72	0.37	0.61	2.10	1.08	0.24	0.84	0.78	6.98
1935	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00
1936	0.55	0.12	0.11	0.09	0.27	0.43	0.67	0.62	2.05	0.17	0.00	0.13	5.21
1937	0.21	0.11	0.63	0.42	2.78	1.91	1.02	0.22	0.87	0.79	0.01	0.48	9.45
1938	0.12	0.49	0.22	0.20	0.02	1.51	1.45	0.17	2.36	0.63	0.02	0.36	7.55
1939	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00
1940	0.52	0.58	0.48	0.21	1.71	1.32	0.62	3.25	1.99	0.36	1.45	0.87	13.36
1941	1.17	0.20	1.00	1.20	3.07	0.90	2.15	1.07	1.85	2.67	0.37	0.23	15.88
1942	0.13	0.54	0.39	1.97	0.00	0.22	0.20	1.42	1.55	0.73	0.00	1.10	8.25
1943	0.25	0.26	0.23	0.06	1.41	1.20	1.19	1.33	0.39	0.22	0.14	0.94	7.62
1944	0.00 z	0.00 z	0.49	0.91	0.57	0.85	1.58	1.44	0.65	0.86	0.56	0.76	8.67
1945	0.34	0.32	0.50	0.77	0.00	0.00	1.09	2.27	0.26	0.43	0.00	0.38	6.36
1946	0.25	0.33	1.03	0.26	0.31	0.03	2.28	1.49	0.57	1.02	0.54	0.12	8.23

1947	0.00	0.00	0.03	0.03	0.48	0.23	0.38	1.45	0.67	0.31	0.36	0.91	4.85
1948	0.00 j	1.31 e	0.41	0.33	0.94	0.57	0.46 f	0.51	0.80	0.60	0.11	0.11 a	5.69
1949	0.58 e	0.29	0.65	0.67	1.35	0.25 a	2.21	0.72	0.87	0.14	0.00	0.59	8.32
1950	0.02	0.38	0.04	0.27	0.06	0.23	2.00	0.08	1.01	0.01	0.00	0.00	4.10
1951	0.41	0.27	0.29	0.38	0.10	0.02	0.85	2.22	0.05	0.37	0.14	0.28	5.38
1952	0.20	0.17	0.59	0.76	0.65	1.64	1.91 a	1.10	0.34	0.00	0.53	0.20	8.09
1953	0.00	0.43	0.74	0.69	0.03	0.35	0.53	0.59	0.06	0.46	0.91	0.29 a	5.08
1954	0.20	0.03 a	0.24	0.00	0.51	0.01	1.45	0.65	0.77	0.25	0.22	0.14	4.47
1955	0.29	0.18	0.00	0.04	0.53	0.33	1.60	1.32	1.94	0.06	0.00	0.22	6.51
1956	0.46	0.49	0.00	0.00	0.18	0.43	1.49	0.62	0.02	0.34	0.03	0.00	4.06
1957	0.78	0.59	0.52	0.38	0.35	0.04	2.48	1.32	0.00	2.59	1.24	0.32	10.61
1958	0.21	0.27	1.71	0.62	0.43	0.22	0.14	1.74	1.34	1.72	0.37	1.35	10.12
1959	0.17	0.04	0.42	0.43	0.80	0.78	0.73	2.79	0.36	1.70	0.07	1.85	10.14
1960	0.34	0.38	0.44	0.19	0.71	0.91	0.47	0.78	0.56	2.88	0.07	0.39	8.12
1961	0.23	0.10	0.61	0.73	0.01	0.11	2.70	1.69	1.09	0.47	0.48	0.65	8.87
1962	1.01	0.11	0.18	0.07	0.01	0.19	1.24	0.00	0.71	0.75	0.61	0.51	5.39
1963	0.29	0.24	0.55	0.14	0.03	0.11	1.43	3.00	0.63	0.76	0.29	0.00	7.47
1964	0.07	1.12	0.13	0.61	0.35	0.00	1.87	0.98	1.57	0.04	0.21	0.49	7.44
1965	0.47	0.60	0.49	0.49	0.19	0.99	1.65	0.61	1.18	0.89	0.33	1.42	9.31
1966	0.42	0.30	0.00	0.04	0.02	1.66	1.63	1.06	1.04	0.54	0.09	0.01	6.81
1967	0.01	0.44	0.25	0.00	0.04	1.71	0.61	3.30	0.79	0.18	0.15	0.56	8.04
1968	0.01	0.98	1.48	0.51	0.99	0.05	3.33	1.49	0.30	0.12	0.59	0.82	10.67
1969	0.08	0.34	0.41	1.76	1.31	0.59	0.94	0.95	1.08	2.37	0.01	0.72	10.56
1970	0.00	0.27	0.42	0.05	0.33	0.40	1.22	2.24	0.79	0.25	0.08	0.23	6.28
1971	0.27	0.21	0.03	0.78	0.16	0.02	1.05	0.87	1.44	1.15	0.67	1.40	8.05
1972	0.12	0.12	0.08	0.00	0.18	0.55	1.00	2.93	1.00	3.08	0.69	0.36	10.11
1973	0.85	0.33	2.18	0.91	0.66	1.37	1.80	1.19	1.13	0.35	0.08	0.03	10.88
1974	0.88	0.11	0.85	0.14	0.01	0.22	2.40	0.79	1.58	1.96	0.38	0.51	9.83
1975	0.26	0.99	0.95	0.10	0.66	0.00	1.43	1.40	1.66	0.00	0.28	0.28	8.01
1976	0.00	0.40	0.09	0.31	0.82	0.60	1.32	0.73	0.45	0.03	0.24	0.20	5.19
1977	0.88	0.13	0.63	1.07	0.10	0.04	0.69	2.28	0.78	0.76	0.42	0.13	7.91
1978	1.32	1.02	0.54	0.05	0.69	1.05	0.24	2.49	0.59	1.22	1.00	0.76	10.97
1979	1.07	0.62	0.14	0.24	2.48	1.02	0.80	1.53	0.40	0.27	0.91	0.87	10.35
1980	0.87	0.58	0.60	0.60	0.56	0.01	0.08	2.61	1.83	0.09	0.30	0.74	8.87
1981	0.05	0.67	0.80	0.30	0.53	0.35	1.07	1.68	0.41	1.43	0.37	0.00	7.66
1982	0.32	0.20	0.84	0.05	0.52	0.09	1.32	1.09	1.34	0.26	0.60	0.78	7.41
1983	1.10	0.71	0.61	0.02	0.32	1.21	0.55	0.27	0.91	1.20	0.44	0.42	7.76
1984	0.33	0.00	0.62	0.50	0.16	0.48	1.13	2.70	1.13	3.04	0.63	1.36	12.08
1985	0.49	0.54	0.70	1.69	1.12	0.53	1.16	0.49	1.53	2.15	0.19	0.16	10.75
1986	0.22	1.01	0.17	0.33	1.11	2.57	1.51	2.26	0.53	1.54	1.29	0.44	12.98

1987	0.66	0.61	0.07	1.00	0.58	0.13	0.91	2.98	0.20	0.44	0.42	0.34	8.34
1988	0.15	0.07	0.85	1.42	0.62	1.25	2.26	3.29	2.63	0.32	0.22	0.03	13.11
1989	0.57	0.35	0.48	0.00	0.02	0.02	1.51	0.48	0.31	0.97	0.00	0.28	4.99
1990	0.21	0.49	0.41	1.71	0.45	0.27	2.36	1.79	0.96	0.15	0.86	0.59	10.25
1991	0.60	0.06	0.14	0.00	1.14	0.65	2.63	1.26	1.43	0.26	1.93	1.49	11.59
1992	0.60	0.20	0.63	0.22	1.81	0.67	2.01	2.17	0.79	0.70	1.12	1.16	12.08
1993	0.94	1.82	0.22	0.00	0.20	0.44	0.23	3.05	0.49	0.64	0.97	0.03	9.03
1994	0.02	0.26	0.59	0.07	1.87	0.28	0.61	2.70	1.21	1.54	1.38	0.62	11.15
1995	0.55	0.39	0.16	0.69	0.08	0.20	0.35	0.74	2.32	0.00	0.03	0.17	5.68
1996	0.17	0.19	0.02	0.00	0.02	2.86	1.03	1.54	1.45	1.52	0.95	0.00	9.75
1997	0.55	0.12	0.11	1.65	0.42	1.03	2.04	1.96	2.43	0.32	0.73	1.00	12.36
1998	0.14	0.66	2.34	0.64	0.00	0.17	2.37	0.88	0.15	1.80	0.46	0.22	9.83
1999	0.12	0.00	1.10	0.59	0.54	0.60	1.47	3.04	0.54	0.26	0.00	0.03	8.29
2000	0.30	0.30	1.27	0.00	0.08	0.72 a	0.02 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	2.67

Period of Record Statistics

MEAN	0.37	0.38	0.51	0.51	0.66	0.64	1.36	1.50	0.96	0.88	0.43	0.49	8.62
S.D.	0.38	0.33	0.46	0.57	0.73	0.72	0.83	0.88	0.69	0.82	0.43	0.48	2.67
SKEW	1.87	1.67	1.61	1.60	1.82	1.95	0.63	0.35	0.94	1.08	1.05	1.52	0.24
MAX	2.16	1.82	2.34	2.58	3.56	3.81	4.12	3.30	3.31	3.08	1.93	2.43	15.88
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	3.29

Appendix G Public Comments and Bureau Responses