US EPA-APPROVED

TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR THE

Middle Rio Grande Watershed

JUNE 30, 2010

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***COVER PHOTO**: Rio Grande at Los Padillas below Albuquerque WWTP, July 27, 2005.*

LIST OF ABBREVIATIONS AND DEFINITIONS

AU	Assessment Unit
BLM	Bureau of Land Management
BMP	Best management practices- effective, practical, structural or nonstructural methods which prevent or reduce the movement of pollutants from the land to surface water.
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CGP	Construction general storm water permit
CWA	Clean Water Act
^{o}C	Degrees Celsius
^{o}F	Degrees Fahrenheit
Ecoregion	Ecological regions based on geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology.
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information Systems
HUC	Hydrologic unit code- a way of identifying all of the drainage basins in the United States in a catalogued arrangement from largest (Regions) to smallest (Cataloging Units).
LA	Load allocation
LFCC	Low Flow Conveyance Channel
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
MOS	Margin of safety
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Storm Water Permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System-as authorized by the Clean Water Act, permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.
%	Percent
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
STORET	Storage and Retrieval Database- a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and others.
SWPPP	Storm Water Pollution Prevention Plan-a written document that describes the construction operator's activities to comply with the requirements in the construction general permit
SWQB	Surface Water Quality Bureau
TMDL	Total maximum daily load
USDA	U.S. Department of Agriculture

USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission- The commission is the state water pollution control agency for NM, and for all purposes of the federal Clean Water Act and the wellhead protection and sole source aquifer programs of the federal Safe Drinking Water Act.
WQS	Water quality standards (NMAC 20.6.4 as amended through 2007)
WRAS	Watershed Restoration Action Strategy
WWTP	Wastewater treatment plant

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop Total Maximum Daily Load (TMDL) management plans for waterbodies determined to be water quality limited. A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's or a Tribe'swater quality standard. It also allocates the load capacity to known point sources and nonpoint sources at a given flow. Total maximum daily loads are defined in 40 Code of Federal Regulations Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources and background conditions, and includes a Margin of Safety (MOS). TMDL = WLA + LA + MOS

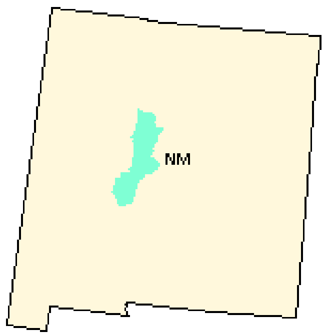
The Surface Water Quality Bureau (SWQB) held a pre-survey public meeting in Rio Rancho, NM on February 16, 2005 and conducted a surface water quality survey of the Middle Rio Grande watershed in 2005. Sampling stations were established along the streams in the watershed to evaluate the impact of tributary streams and to work toward establishing background conditions. As a result of assessing data generated during this monitoring effort, SWQB staff documented impairments of the New Mexico water quality standards for dissolved aluminum on Rio Grande (San Marcial at USGS Gage to Rio Puerco) and *E.coli* on Rio Grande (San Marcial at USGS Gage to Rio Puerco), Rio Grande (Rio Puerco to Isleta Pueblo boundary), Rio Grande (Isleta Pueblo boundary to Alameda Street Bride), and Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion). This TMDL document addresses the above noted impairments as summarized in the tables that follow.

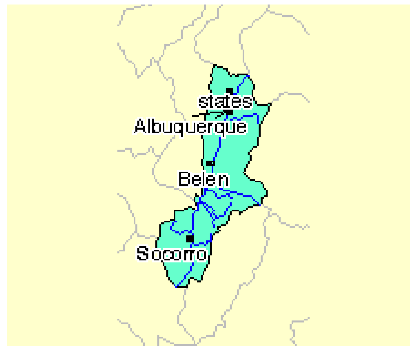
The data used to develop this TMDL were collected during the 2005 survey and additional collections by SWQB and other agencies from 2000-2007.

The 2005 Middle Rio Grande Watershed study also identified other potential water quality impairments in this watershed which are not addressed in this document. Subsequent TMDLs will be prepared in the near future in a separate TMDL document. SWQB developed TMDLs for fecal coliform in 2001 for the Rio Grande from Isleta Pueblo boundary to Angostura Diversion. The following *E.coli* TMDLs were developed to reflect the change in the water quality standards from fecal coliform to *E.coli*.

Additional water quality data will be collected by New Mexico Environment Department during the standard rotational period for water quality stream surveys. As a result, targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate attainment category on the Clean Water Act Integrated §303(d)/§305(b) list of waters (NMED/SWQB 2008a).

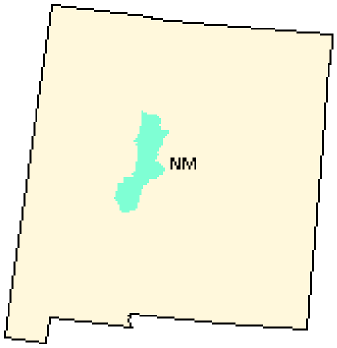
TOTAL MAXIMUM DAILY LOAD FOR *E.COLI* RIO GRANDE (NON-PUEBLO ALAMEDA TO ANGOSTURA DIVERSION)

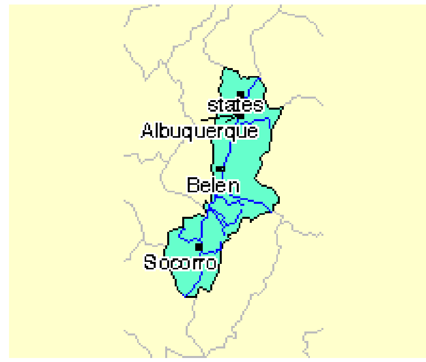




New Mexico Standards Segment	Rio Grande Basin 20.6.4.106
Assessment Unit Identifier	Rio Grande (non-Pueblo Alameda to Angostura Diversion) NM-2105.1_00 (formerly NM-MRG3-30000)
Assessment Unit Length	11.66 miles
Parameters of Concern	*E.coli*
Designated Uses Affected	Secondary Contact
Geographic Location	Rio Grande-Albuquerque USGS Hydrologic Unit Code 13020203
Scope/size of Watershed	17, 006 square miles
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover	Forest (94%), Barren/sand/clay (3%), Residential/commercial (1%), open water (1%)
Probable Sources	Avian Sources (waterfowl and/or other), Impervious Surface/Parking Lot Runoff, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Source Unknown, Wastes from Pets.
Land Management	USFS (38%), Private (36%), BLM (10%), Pueblo (9%), State (4%)
IR Category	5/5C
Priority Ranking	High
TMDL for:	**WLA + LA + MOS = TMDL**
E.coli	
High	$3.15 \times 10^{11} + 4.93 \times 10^{12} + 2.77 \times 10^{11} = 5.54 \times 10^{12}$ cfu/100 mL/day
Moist	$9.11 \times 10^{10} + 1.43 \times 10^{12} + 3.26 \times 10^{12} = 8.06 \times 10^{10}$ cfu/100 mL/day
Dry	$3.26 \times 10^{10} + 5.10 \times 10^{11} + 1.15 \times 10^{12} = 2.92 \times 10^{10}$ cfu/100mL/day
Low	$1.68 \times 10^{10} + 2.63 \times 10^{11} + 7.93 \times 10^{9} = 2.96 \times 10^{9}$ cfu/100 mL/day

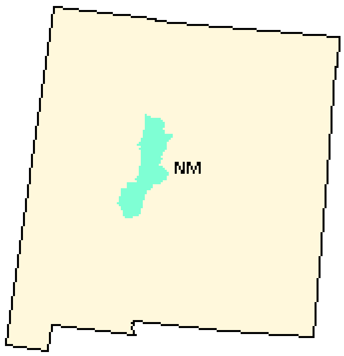
TOTAL MAXIMUM DAILY LOAD FOR *E.COLI*
RIO GRANDE (ISLETA PUEBLO BOUNDARY TO ALAMEDA BRIDGE)

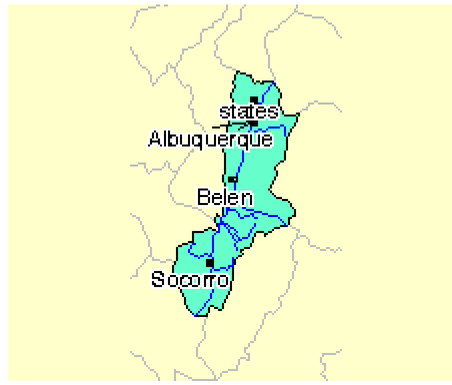




New Mexico Standards Segment	Rio Grande Basin 20.6.4.105
Assessment Unit Identifier	Rio Grande (Isleta Pueblo boundary to Alameda bridge) NM-2105_50 (formerly NM-MRG3-30000)
Assessment Unit Length	20.4 miles
Parameters of Concern	*E.coli*
Designated Uses Affected	Secondary Contact
Geographic Location	Rio Grande-Albuquerque USGS Hydrologic Unit Code 13020203
Scope/size of Watershed	17, 501 square miles
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover	Forest (93%), Residential/commercial (3%), Barren/sand/clay (3%), Open water (1%)
Probable Sources	Avian Sources (waterfowl and/or other), Impervious Surface/Parking Lot Runoff, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Source Unknown, Wastes from Pets.
Land Management	USFS (38%), Private (37%), BLM (10%), Pueblo (9%), State (4%)
IR Category	5/5B
Priority Ranking	High
TMDL for:	**WLA + LA + MOS = TMDL**
E.coli	
High	$5.08 \times 10^{11} + 3.36 \times 10^{12} + 1.40 \times 10^{12} = 5.27 \times 10^{12}$ cfu/100 mL/day
Moist	$2.28 \times 10^{11} + 8.41 \times 10^{11} + 5.77 \times 10^{11} = 1.65 \times 10^{12}$ cfu/100 mL/day
Mid-range	$1.98 \times 10^{11} + 5.66 \times 10^{11} + 1.38 \times 10^{11} = 9.03 \times 10^{11}$ cfu/100 mL/day
Dry	$1.58 \times 10^{11} + 2.09 \times 10^{11} + 2.10 \times 10^{11} = 5.77 \times 10^{11}$ cfu/100 mL/day
Low	$1.40 \times 10^{11} + 4.86 \times 10^{10} + 1.89 \times 10^{9} = 1.89 \times 10^{11}$ cfu/100 mL/day

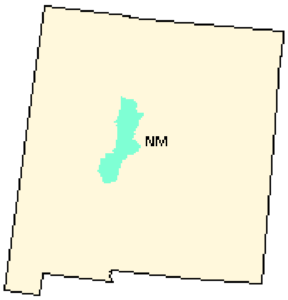
TOTAL MAXIMUM DAILY LOAD FOR *E.COLI*
RIO GRANDE (RIO PUERCO TO ISLETA PUEBLO BOUNDARY)

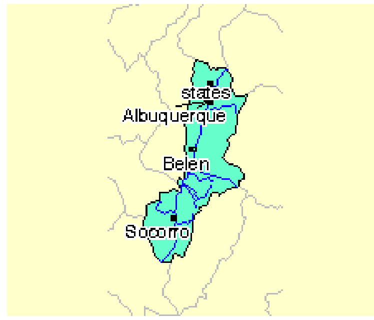




New Mexico Standards Segment	Rio Grande Basin 20.6.4.105
Assessment Unit Identifier	Rio Grande (Rio Puerco to Isleta Pueblo boundary) NM-2105_40 (formerly NM-MRG3-20000)
Assessment Unit Length	35.4 miles
Parameters of Concern	*E.coli*
Designated Uses Affected	Secondary Contact
Geographic Location	Rio Grande-Albuquerque USGS Hydrologic Unit Code 13020203
Scope/size of Watershed	18,841 square miles
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover	Forest (92%), Barren/sand/clay (4%), Residential/commercial (3%), Open water (1%)
Probable Sources	Avian Sources (waterfowl and/or other), Impervious Surface/Parking Lot Runoff, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Wastes from Pets.
Land Management	Private (39%), USFS (36%), Pueblo (10%), BLM (9%), State (4%)
IR Category	5
Priority Ranking	High
TMDL for:	**WLA + LA + MOS = TMDL**
E.coli	
High	$1.66 \times 10^{10} + 9.00 \times 10^{12} + 3.02 \times 10^{12} = 1.20 \times 10^{13}$ cfu/100 mL/day
Moist	$1.66 \times 10^{10} + 2.47 \times 10^{12} + 1.34 \times 10^{12} = 3.83 \times 10^{12}$ cfu/100 mL/day
Dry	$1.66 \times 10^{10} + 1.59 \times 10^{11} + 9.26 \times 10^{9} = 1.85 \times 10^{11}$ cfu/100 mL/day

TOTAL MAXIMUM DAILY LOAD FOR ALUMINUM AND *E.COLI*
RIO GRANDE (SAN MARCIAL AT USGS GAGE TO RIO PUERCO)





New Mexico Standards Segment	Rio Grande Basin 20.6.4.105
Assessment Unit Identifier	Rio Grande (San Marcial at USGS gage to Rio Puerco) NM-2105_10 (formerly NM-MRG3-10000)
Assessment Unit Length	59.39 miles
Parameters of Concern	Aluminum, *E.coli*
Designated Uses Affected	Marginal Warmwater Aquatic Life, Secondary Contact
Geographic Location	Rio Grande-Albuquerque USGS Hydrologic Unit Code 13020203
Scope/size of Watershed	27, 410 square miles
Land Type	Chihuahuan Desert Ecoregion (24)
Land Use/Cover	Forest (91%), Barren/sand/clay (5%), Residential/commercial (2%), Open water (1%)
Probable Sources	Avian Sources (waterfowl and/or other), Impervious Surface/Parking Lot Runoff, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, Natural Sources, On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Wastes from Pets.
Land Management	Private (37%), USFS (28%), Pueblo (15%), BLM (13%), State (5%)
IR Category	5
Priority Ranking	High
TMDL for:	**WLA + LA + MOS = TMDL**
Aluminum	
High	1.89 + 1171 + 558 = 1731 lbs/day
Dry	1.89 + 38.8 + 2.13 = 42.8 lbs/day
E.coli	
High	$6.21 \times 10^{9} + 7.72 \times 10^{12} + 3.67 \times 10^{12} = 1.14 \times 10^{13}$ cfu/100 mL/day
Moist	$6.21 \times 10^{9} + 2.16 \times 10^{12} + 1.23 \times 10^{12} = 3.40 \times 10^{12}$ cfu/100 mL/day
Mid-range	$6.21 \times 10^{9} + 1.10 \times 10^{12} + 5.56 \times 10^{11} = 1.66 \times 10^{12}$ cfu/100 mL/day
Dry	$6.21 \times 10^{9} + 2.61 \times 10^{11} + 1.40 \times 10^{10} = 2.81 \times 10^{11}$ cfu/100 mL/day

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1.0 INTRODUCTION

Under Section 303 of the Clean Water Act (CWA), states establish water quality standards, which are submitted and subject to approval of the U.S. Environmental Protection Agency (USEPA). Under Section 303(d)(1) of the CWA, states are required to develop a list of waters within a state that are impaired and establish a total maximum daily load (TMDL) for each pollutant. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA 1999). A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's or a tribe's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources and natural background conditions, and includes a margin of safety (MOS). This document provides TMDLs for assessment units within the Middle Rio Grande watershed that are impaired based on a comparison of measured concentrations with water quality criteria.

This document is divided into several sections. Section 2.0 provides background information on the location and history of the Middle Rio Grande watershed, provides applicable water quality standards for the assessment units addressed in this document, and briefly discusses the water quality survey conducted in the Middle Rio Grande in 2005. Section 3.0 presents the TMDLs developed for dissolved aluminum and Section 4.0 includes the *E.coli* TMDLs developed for the Middle Rio Grande watershed. Pursuant to Section 106(e)(1) of the Federal CWA, Section 5.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 6.0 discusses implementation of TMDLs and the relationship between TMDLs and Watershed Restoration Action Strategies (WRAS). Section 7.0 discusses assurance, Section 8.0 public participation in the TMDL process, and Section 9.0 provides references.

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2.0 BACKGROUND

The Middle Rio Grande (MRG) watershed was sampled by the Surface Water Quality Bureau (SWQB) from March to October 2005. The Middle Rio Grande Basin includes the Rio Grande from San Marcial to Angostura Diversion. Surface water quality monitoring stations were selected to characterize water quality of the stream reaches. The SWQB has divided the MRG into four assessment units (AU) and all four AUs are addressed with TMDLs in this document. The 2005 MRG Tributary study also identified other potential water quality impairments in this watershed which are not addressed in this document. The results of water quality assessments performed following the MRG tributary survey are available on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. Subsequent TMDLs will be prepared in the near future in a separate TMDL document. SWQB developed fecal coliform TMDLs for the Rio Grande from the Isleta Pueblo boundary to Angostura Diversion in 2001 (NMED/SWQB, 2001). The *E.coli* TMDLs discussed in this document were developed to reflect the changes in the State of New Mexico Water Quality Standards from fecal coliform to *E.coli*.

2.1 Description and Land Ownership

The Rio Grande drainage extends from the southern Colorado Rockies and enters into New Mexico just north of the Rio Grande Gorge. The Middle Rio Grande watershed (US Geological Survey [USGS] Hydrologic Unit Code [HUC] 13020203) is located in Sandoval, Bernalillo, Valencia, and Socorro Counties in central New Mexico (NM).

The Rio Grande-Albuquerque HUC (13020203) covers approximately 3,204 square miles (mi^2) in central New Mexico (NM). Land use for the 13020203 HUC includes 57% shrubland, 24% grassland, 9% forest, 5% residential/commercial, 2% pasture/hay crops, and 2% barren rock/quarries (Figure 2.1). Land ownership for the 13020203 HUC is 52% private, 12% BLM, 9% USFS, 10% FWS, 10% Pueblo, 5% State, and 2% Department of Defense (Figure 2.2). The values listed in the Executive Summary describe the individual Assessment Unit watersheds.

Twenty-three river water quality sites and five drain and arroyo sites were sampled during this survey (Figures 2.1 through 2.3). Table 2.2 details location descriptions of sampling stations in each assessment unit (AU), station numbers, and STORET identification codes.

Natural Heritage New Mexico is a division of the Museum of Southwestern Biology at the University of New Mexico. The organization stores and retrieves data and maps of the distribution of plants and animals throughout New Mexico. Data from the Natural Heritage New Mexico website was used in the development of Table 2.1 which displays the state and federally listed endangered and threatened species within the HUC discussed in this TMDL.

2.2 History and Geology

The Rio Grande drainage extends from the southern Colorado Rockies through New Mexico and Texas where it finally reaches the Gulf of Mexico at sea level. Native American communities, including Pueblo, Navajo, and Apache groups have occupied the region since the early 1300's. Since early Spanish occupancy, the basin has experienced irrigated farming, grazing, fire suppression, and intensive hunting and along with the introduction of exotic plants, droughts, and floods the valley has undergone drastic changes since pre-colonial times (Scurlock, 1998). The acequia system of southern Colorado and northcentral New Mexico is the oldest, continuously operated water management system in the United States. The first acequias were established when Oñate established the first Spanish colony in New Mexico in 1598 (Rivera, 1999). Spanish settlements eventually extended down river to Cochiti and as far south as Socorro. Missions reached the Bernalillo to Isleta Pueblo reach of the Rio Grande by the mid-1620's. The Spanish providence in New Mexico was divided into two administrative units, the lower reach between Cochiti and Socorro was named Rio Abajo (Scurlock, 1998). Spanish land grants were issued in the late 1700's through the early 1800's and the farming and grazing that occurred on these land grants continue to be an important part of the cultural identity of the basin. The first non-Spanish Europeans in the Rio Grande valley were French trappers from the Mississippi Valley who came during the 18th and early 19th centuries. (Scurlock, 1998). The Santa Fe Trail was eventually established and linked up the with Camino Real that followed the Rio Grande into Mexico. Settlements in the Rio Grande Valley continued as the railroad was established in the region. The Middle Rio Grande Valley currently supports diverse land uses, from agriculture to the largest municipality in the state (Albuquerque, est 1706).

The MRG basin is primarily comprised of alluvial deposits, specifically the Quemado Formation and Upper Santa Fe Group (Figure 2.3). A number of gypsum mines operate in the basin below Cochiti Reservoir. Both the Ortiz and San Pedro Mountains in the Rio Grande basin contain Tertiary volcanic intrusions that pushed up on the east side of the Rio Grande Rift. An noteworthy result of this intrusions was the formation of turquoise, which has been mined in the area as early as 900 A.D. (Chronic, 1987). Gold, silver, anthracite coal, and lead were later mined in the mountains in the MRG basin. The 20-mile long Sandia Mountains flank the east side of Albuquerque. The Sandia Mountains are comprised of 1.4 billion year old Precambrian granite covered in 300-million year old Pennsylvanian sedimentary rocks and reach to over 10,000 feet in elevation (Chronic, 1987). South of the Sandia Mountains are the Manzano Mountains which are also fault block mountains. The Albuquerque volcanoes, west of the city, were last active in the Pleistocene Era and similar volcanoes exist south of Albuquerque near Isleta. Throughout this area, the Rio Grande Rift is much deeper than it seems and is filled with thousands of feet of alluvial deposits. The Albuquerque-Belen basin extends south of Albuquerque and is comprised of similar alluvial terraces as in the Albuquerque area. Small volcanoes also continue south of Albuquerque and include Sierra Lucero and Ladrone Peak (Chronic, 1987). The Rio Grande floodplain is broad and marshy downstream of the Rio Puerco and is the seasonal home to migratory birds. The floodplain is marshy near Socorro due to the Socorro Constriction from the surrounding mountain ranges. The Lemitar Mountains, southwest of the convergence of the Rio Salado with the Rio Grande, consist of a series of Precambrian and Paleozoic rocks. The southernmost end of this range consists of Tertiary lava flows that overlay the Paleozoic sedimentary rocks (Chronic, 1987). The mountains downstream of the Lemitar

Mountains include the Los Piños Mountains and the Socorro Mountains. The former is primarily Pennsylvanian and Permian sedimentary rocks and the latter is comprised of volcanic rocks from a former caldera. Continuing southward along the Rio Grande valley are the Magdalena, San Mateo, and Mimbres Mountains. Continuing southward along the Rio Grande valley to Elephant Butte Reservoir, the rocks to the west of the river continue to be volcanic.

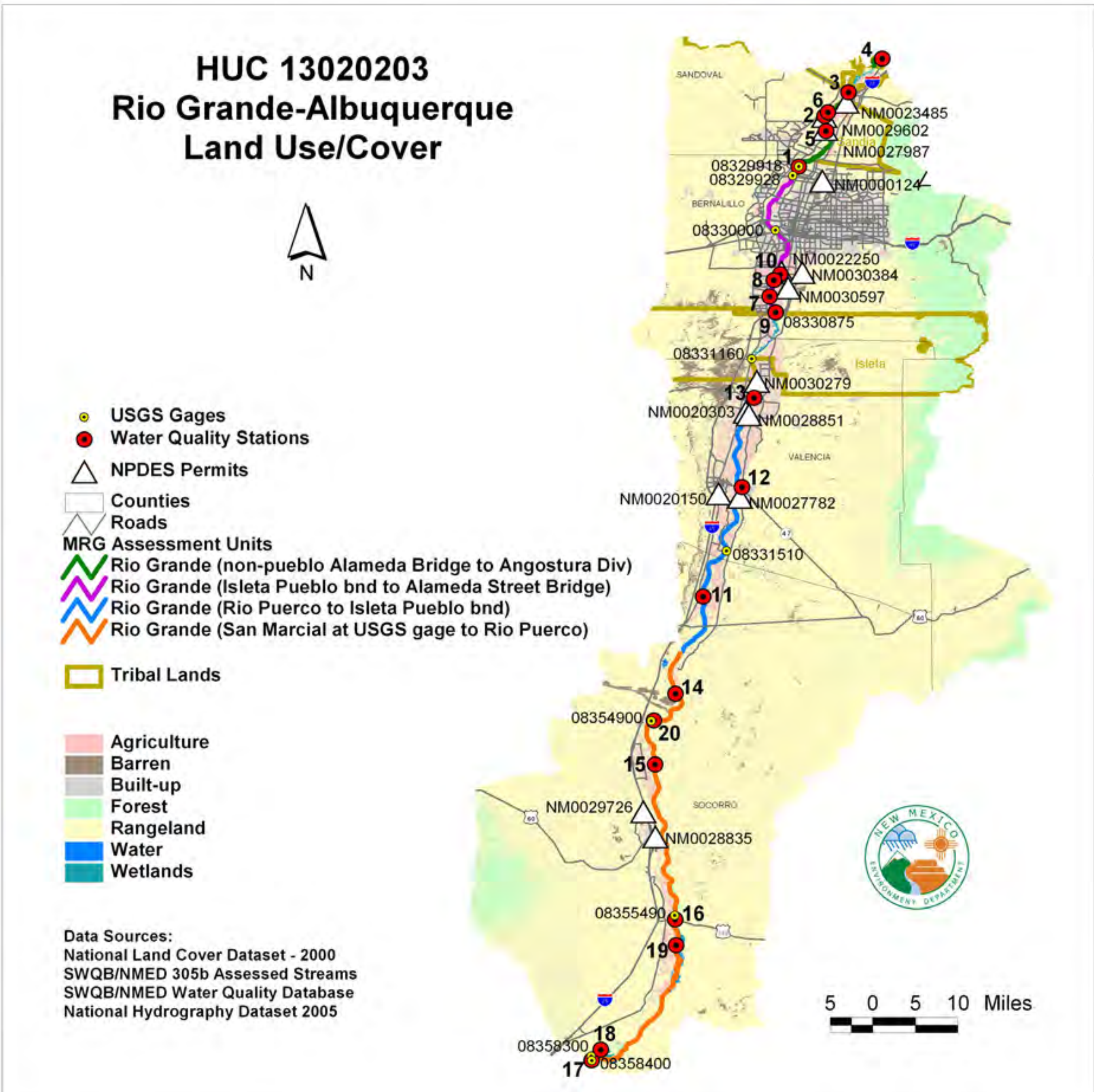

Figure 2.1 Middle Rio Grande Watershed Land Use/Land Cover

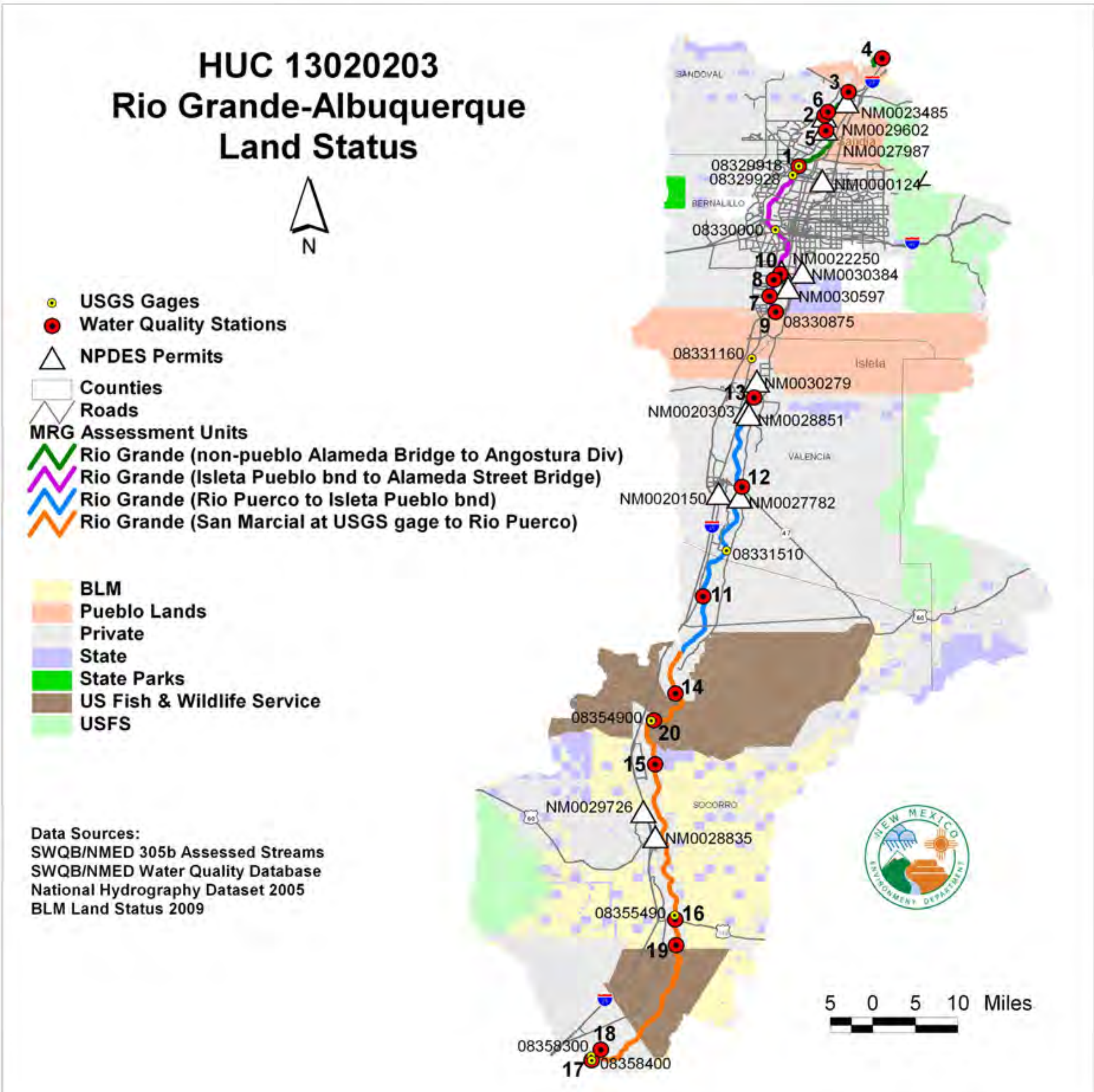

Figure 2.2 Middle Rio Grande Watershed Land Ownership

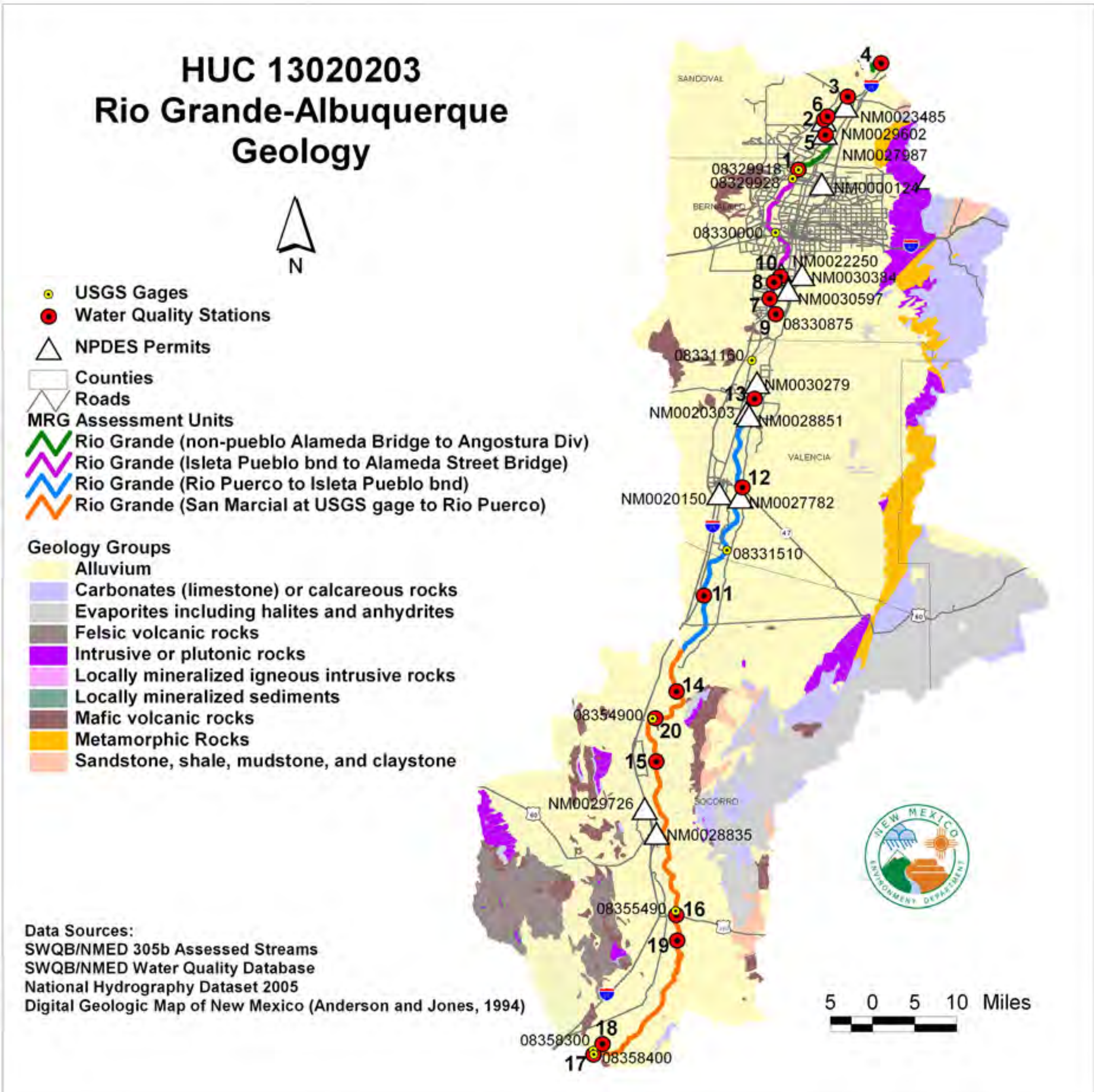

Figure 2.3 Middle Rio Grande Watershed Geology

Table 2.1 State and Federally Listed Endangered and Threatened Species

HUC	Common Name	Scientific Name	Status
13020203	Chupadera Springsnail	*Pyrgulopsis chupaderae*	C, E
13020203	Socorro Isopod	*Thermosphaeroma thermophilum*	LE, E
13020203	Socorro Springsnail	*Pyrgulopsis neomexicana*	LE, E
13020203	Rio Grande Silvery Minnow	*Hybognathus amarus*	LE, E
13020203	Bald Eagle	*Haliaeetus leucocephalus*	T
13020203	Common Black-Hawk	*Buteogallus anthracinus*	T
13020203	Piping Plover	*Charadrius melodus*	LE, LT, T
13020203	Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C
13020203	Whooping Crane	*Grus americana*	LE, XN, E
13020203	Mexican Spotted Owl	*Strix occidentalis lucida*	LT
13020203	Southwestern Willow Flycatcher	*Empidonax traillii extimus*	LE, E
13020203	Bell's Vireo	*Vireo bellii*	T
13020203	Gray Vireo	*Vireo vicinior*	T
13020203	New Mexican Jumping Mouse	*Zapus hudsonius luteus*	E
13020203	Spotted Bat	*Euderma maculatum*	T

Notes:

C = Candidate taxa for which the USFWS has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
E = State of New Mexico-endangered status.
LE = Federally listed endangered species.
LT = Federally listed threatened species.
T = State of New Mexico-threatened status.
XN = nonessential experimental population

2.3 Water Quality Standards

The EPA-approved water quality standards (WQS) currently applicable to the Rio Grande are set forth in the following section of *New Mexico Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC), effective August 2007:

20.6.4.105 RIO GRANDE BASIN - The main stem of the Rio Grande from the headwaters of Elephant Butte reservoir upstream to Alameda bridge (Corrales bridge) and intermittent water below the perennial reaches of the Rio Puerco that enters the main stem of the Rio Grande.

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

B. **Applicable Criteria**:
(1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

20.6.4.106 RIO GRANDE BASIN - The main stem of the Rio Grande from Alameda bridge (Corrales bridge) upstream to the Angostura diversion works and intermittent water in the Jemez river below the Jemez pueblo boundary that enters the main stem of the Rio Grande.

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

B. **Applicable Criteria**:
(1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

20.6.4.900 NMAC provides standards applicable to attainable or designated uses unless otherwise specified in 20.6.4.101 through 20.6.4.899 NMAC. 20.6.4.13 NMAC lists general criteria that apply to all surface waters of the state at all times, unless a specified criterion is provided elsewhere in 20.6.4 NMAC.

Additionally, both the Pueblo of Sandia and the Pueblo of Isleta have standards for the Rio Grande that are applicable to tribal waters within the watershed discussed in this document. Section V, Part A of the Pueblo of Sandia Water Quality Standards (Pueblo of Sandia, 2008) reads:

A. *The uses and standards are as follows for the segment of the Rio Grande that passes through the PUEBLO OF SANDIA Reservation, from a northernmost point located in Township 13 North, Range 4 East, Section 31, Southeast Quarter of the Northwest Quarter of the Southeast Quarter, to a southernmost point located in Township 11 North, Range 3 East, Section 3, Northeast Quarter of the Northwest Quarter of the Southwest Quarter, and the following waterways: Albuquerque Main Canal, Bernalillo Acequia, Corrales Main Canal, Sandia Acequia and Wasteway, Alameda Lateral, Bosque Lateral No. 2, and Sandia Lateral No. 2 (Station 426+00 at Albuquerque Main Canal).*

Section V, Part A.2 (Pueblo of Sandia, 2008) lists the standard for E.coli as follows:

c. *<u>Escherichia coli</u>*

1. *geometric mean maximum: 47 colonies/100 ml*

2. *single sample maximum of 88 colonies/100 ml, in accordance with an illness rate of 4 per 1,000 exposures*

Likewise, Section V of the Pueblo of Isleta Water Quality Standards (Pueblo of Isleta, 2002) reads:

A. *The designated uses are as follows for the segment of the Rio Grande that passes through the PUEBLO OF ISLETA Reservation, from a northernmost point located in Township 8 North, Range 2 East, Section 1, Southwest Quarter, approximately ¼ mile south of the I-25 overpass over the Rio Grande, to a southernmost point located in Township 7 North, Range 2 East, Section 15, Northeast Quarter, approximately two miles north of the State Road 49 bridge over the Rio Grande, including all tributaries thereof, except for water bodies such as Drains, that are especially designated in this Section (Section V):*
   1. *Uses:*
      a. *Warmwater fishery use*
      b. *Primary contact ceremonial use*
      c. *Primary contact recreational use*
      d. *Agricultural water supply use*
      e. *Industrial water supply use*
      f. *Wildlife usage*

The applicable WQS specific to both the Primary Contact Ceremonial Use and the Primary Contact Recreational Use are listed in Section IV, Parts D and E as follows:

a) *Bacteria*
   - *Geometric mean maximum Escherichia coli (E.coli): 47 per 100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days)*
   - *Single sample maximum: 88 colonies/100 mL.*

The appropriate tribal WQS will be used in the TMDL calculations in this document (Section 3.1 and Section 4.1). Assessment Units that are upstream of water with Tribal jurisdiction will have TMDLs calculated based on the Tribal, rather than the State, WQS. The regulations in 40 CFR §131.10(b) require the development of the TMDL using the Tribal standards in order to be protective of the downstream standards. The regulations in 40 CFR §122.4(d) require allocations and effluent limits to be developed using the Tribal standards in order to be protective of the downstream waters.

2.4 Water Quality Sampling

The Middle Rio Grande watershed was sampled by the SWQB in 2005. A brief summary of the survey and the hydrologic conditions during the sample period is provided in the following subsections. A more detailed description of the Middle Rio Grande survey can be found in *Water Quality Monitoring of the Middle Rio Grande: 2000-2007* (NMED/SWQB 2009b). Survey summary reports are also available by contacting SWQB at 505-827-0187 or by emailing the contacts listed on the SWQB website at http://www.nmenv.state.nm.us/swqb.

2.4.1 Survey Design

Surface water quality samples were collected monthly between March and October during the 2005 SWQB study. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches) throughout the watershed (Table 2.2, Figures 2.1 through 2.3). Stations were located to evaluate the impact of tributary streams and to determine ambient and background water quality conditions. Surface water grab and composite samples were analyzed for a variety of chemical/physical parameters. Data from grab samples and field measurements are housed in the SWQB provisional water quality database and were uploaded to USEPA's Storage and Retrieval (STORET) database.

Table 2.2 SWQB 2005 Middle Rio Grande Sampling Stations

Site Number	Assessment Unit	STORET ID	Station Description
1	Rio Grande (non-Pueblo Alameda to Angostura Diversion)	32RGrand445.4	Rio Grande above Alameda Bridge [a, c, t]
2		32RGrand458.0	Rio Grande above Rio Rancho WWTF #3
3		32RGrand464.2	Rio Grande abv Hwy 550 Bridge [a]
4		30RGrand473.7	Rio Grande Below Angostura Diversion Works [c]
5		32RGrand455.0	Rio Grande blw RR WWTF #2 [c]
6		32RGrand458.9	Rio Grande on Sandia Pueblo [b]
NM0023485		NM0023485	Bernalillo WWTP effluent
NM0027987		NM0027987	Rio Rancho #2 WWTP
7	Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)	32RGrand419.7	Rio Grande @ Los Padillas [s, t]
8		32RGrand416.5	Rio Grande @ Los Padillas [d]
9		32RGrand413.2	Rio Grande @ I-25 Bridge [d]
10		32RGrand421.2	Rio Grande blw Abq WWTF [d]
NM0022250		NM0022250	Albuquerque WWTP effluent
11	Rio Grande (Rio Puerco to Isleta Pueblo bnd)	32RGrand361.7	Rio Grande @ Abeytas [s, t]
12		32RGrand385.5	Rio Grande at Belen (309 Bridge) [a, c]
13		32RGrand394.8	Rio Grande at Hwy 6 at Los Lunas, NM [a, c, t]
NM0020150		NM0020150	Belen WWTP effluent
NM0030279		NM0030279	Bosque Farms WWTP effluent
NM0020303		NM0020303	Los Lunas WWTP effluent
14	Rio Grande (San Marcial at USGS gage to Rio Puerco)	32RGrand341.2	Rio Grande @ La Joya [c, t]
15		32RGrand323.4	Rio Grande @ Lemitar [c]
16		32RGrand292.1	Rio Grande at San Antonio [a, c, t]
17		32RGrand258.0	Rio Grande at USGS gage near San Marcial [t]
18		32RGrand261.0	Rio Grande Conveyance Channel at San Marcial near USGS gage 0858300
19		32RGrand286.9	Rio Grande @ Bosque del Apache [d]
20		32RGrand332.5	Rio Grande at San Acacia above diversion dam [d]
NM0028835		NM0028835	Socorro WWTP effluent

[a] Grab and composite samples collected throughout 2005
[b] EMAP site
[c] SWQB MRG (2005) and BoR (2006-2007) grant site
[d] SWQB MRG BoR (2006-2007) grant site only
[s] Sonde deployed
[t] Water thermograph deployed

All sampling and assessment techniques used during the 2005 SWQB survey are detailed in the *Quality Assurance Project Plan* (QAPP) (NMED/SWQB 2009a) and assessment protocols (NMED/SWQB 2008b) both of which are available online or may be obtained by contacting the SWQB at 505-827-0187. As a result of the 2005 SWQB monitoring effort, several impairments were identified. Accordingly, these impairments were added to the 2008-2010 Integrated CWA §303 (d)/305(b) list (NMED/SWQB 2008a).

2.4.2 Hydrologic Conditions

There are 69 U.S. Geological Survey (USGS) gaging stations in the 13020203 HUC watershed. The real-time, active USGS gages on the Rio Grande in the 13020203 HUC are listed in Table 2.3. Tables 2.4-2.7 display the mean daily streamflow for the 4 USGS gages used in the TMDL calculations.

The Flood Control Act of 1948 established the MRG Project which authorized the Bureau of Reclamation to perform maintenance on the river channel and the Low Flow Conveyance Channel (LFCC). The initial work on the MRG Project in the 1950's and 1960's consisted of the construction of the LFCC between San Acacia Diversion Dam and Elephant Butte Reservoir. (USBR, 2007). The LFCC was constructed to reduce seepage losses as water moved downstream to Elephant Butte Reservoir. After 1959, most of the water from the Rio Grande was diverted to the LFCC at the San Acacia Diversion Dam and travelled 75 miles downstream to the head of Elephant Butte Reservoir (Price *et al*, 2007). The LFCC parallels the Rio Grande and serves as an riverside drain. (MRGESCP, 2004). During the irrigation season, the Rio Grande is intermittent in this reach. The March 2003 Biological Opinion specifies that the Bureau of Reclamation will pump water from the LFCC into the Rio Grande when intermittency is likely and these pumping actions are subject to permits from the Office of the State Engineer (MRGESCP, 2004).

The 2005 SWQB survey was performed over varying flow conditions from March to October. As stated in the Assessment Protocol (NMED/SWQB 2008b), data collected during all flow conditions, including low flow conditions (i.e., flows below the 4-day, 3-year low flow frequency [4Q3]), will be used to determine attainment status of designated or existing uses. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions, unless the WQS specify a qualifier.

Table 2.3: Active real-time USGS gages on Rio Grande in HUC 13020203

Gage Number	Gage Name	Period of Record [1]	4Q3* (cfs)
08317400	Rio Grande below Cochiti Dam, NM	1974-2008	148
08329918	Rio Grande at Alameda Bridge at Alameda, NM	2003-2008	233
08329928	Rio Grande near Alameda, NM	1989-2008	191
08330000	Rio Grande at Albuquerque, NM	1942-2008	72.3
08330875	Rio Grande at Isleta Lakes near Isleta, NM	2002-2008	147
08331160	Rio Grande near Bosque Farms, NM	2006-2008	n/a
08331510	Rio Grande at State Hwy 346 near Bosque, NM	2005-2008	n/a
08354900	Rio Grande Floodway at San Acacia, NM	1958-2008	2.90
08355490	Rio Grande above US Hwy 380 near San Antonio, NM	2005-2008	n/a
08358400	Rio Grande Floodway at San Marcial, NM	1949-2008	0
08358300	Rio Grande Conveyance Channel at San Marcial, NM [2]	1951-2008	6.20

* 4Q3 calculated using USGS flow data and DFlow 3.1b software

1 Impoundment of the Rio Grande behind Cochiti Reservoir began in 1973. The 4Q3 was calculated for the period of record beginning in 1974.

2 Conveyance channel is managed by U.S. Bureau of Reclamation and is a diversion of the Rio Grande.

n/a = not available due to limited flow data

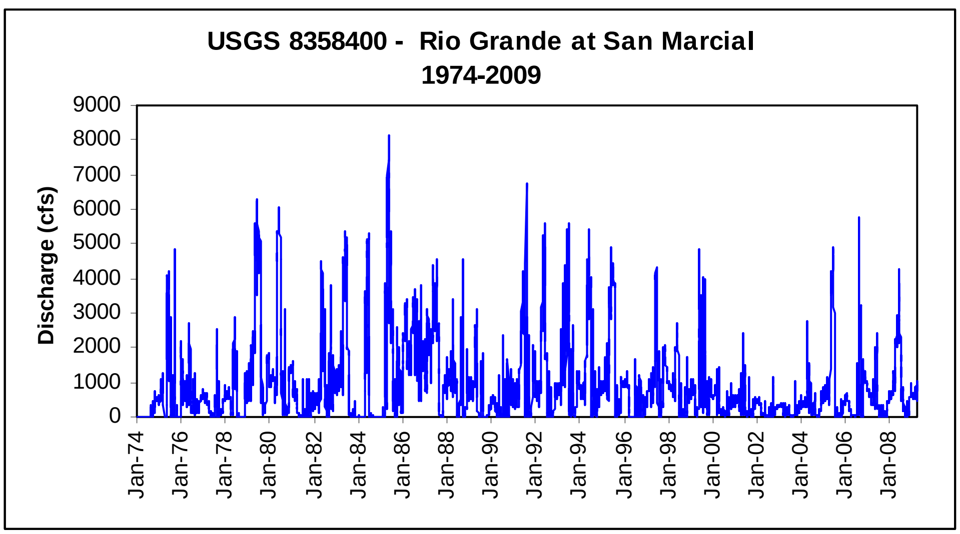

Figure 2.4 Daily Mean Streamflow: USGS 08358400 - Rio Grande at San Marcial

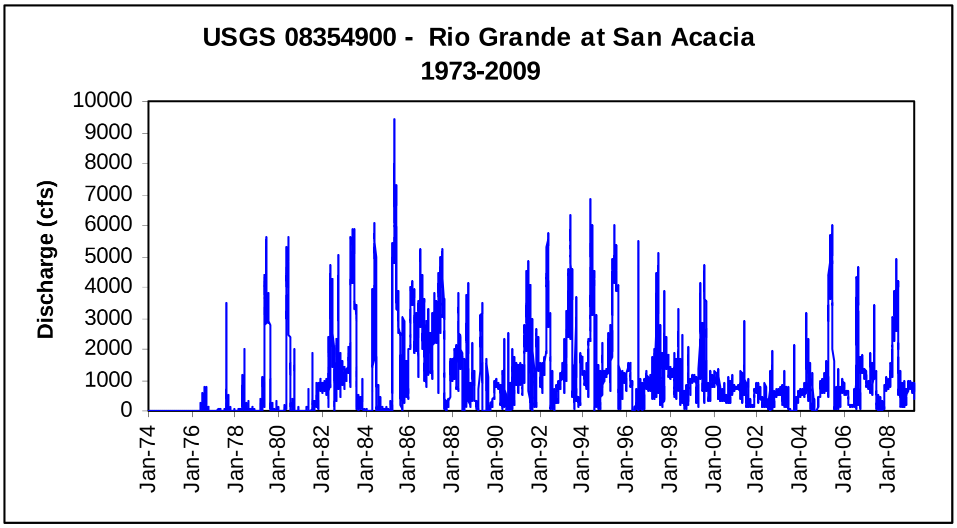

Figure 2.5 Daily Mean Streamflow: USGS 08354900 - Rio Grande at San Acacia

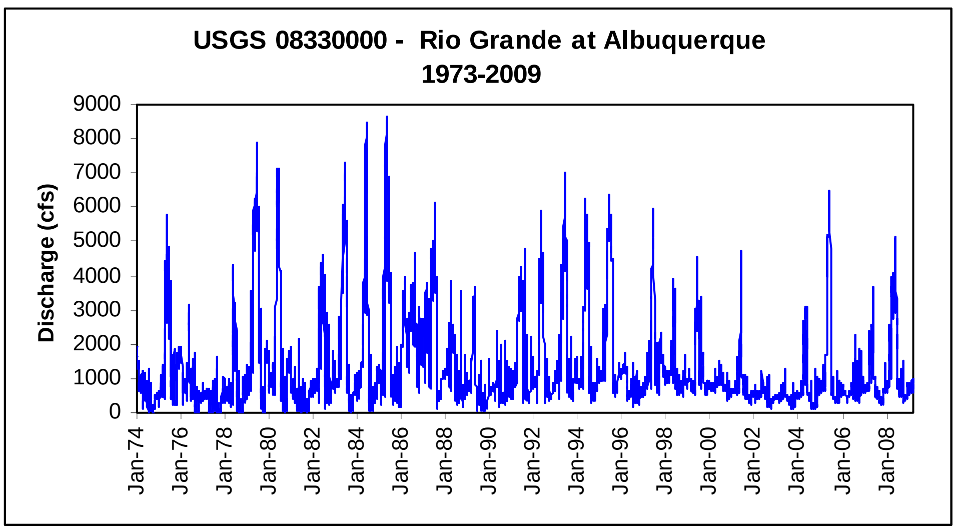

Figure 2.6 Daily Mean Streamflow: USGS 08330000 - Rio Grande at Albuquerque

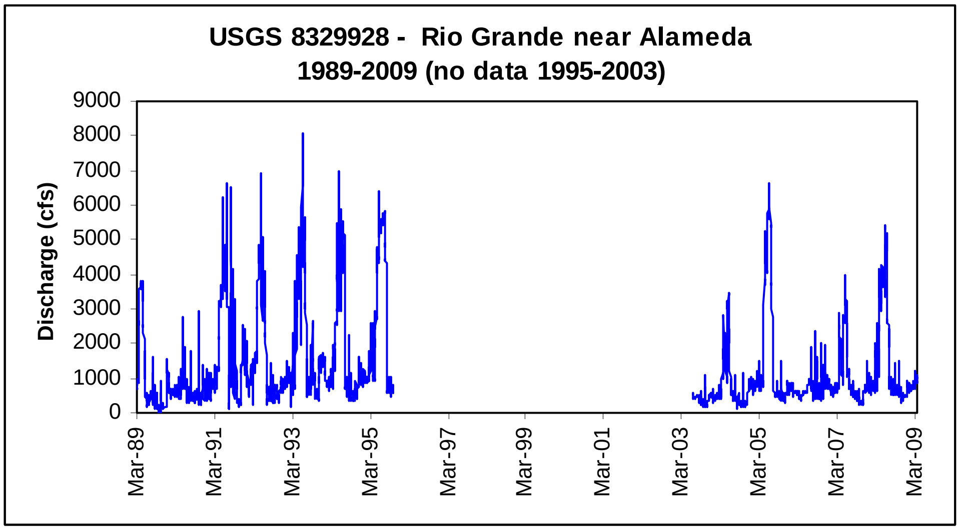

Figure 2.7 Daily Mean Streamflow: USGS 08329928 - Rio Grande near Alameda

3.0 ALUMINUM

Assessment of the data from the 2005 SWQB intensive water quality survey as well as other data collection efforts in the Middle Rio Grande watershed identified several exceedences of the New Mexico water quality standards for dissolved aluminum in Rio Grande (San Marcial at USGS gage to Rio Puerco). Consequently, this AU was listed on the 2008-2010 Integrated CWA §303(d)/§305(b) List (NMED/SWQB 2008a) for aluminum.

3.1 Target Loading Capacity

Target values for these aluminum TMDLs will be determined based on 1) the presence of numeric criteria 2) the degree of experience in applying the criterion, and 3) the ability to easily monitor and produce quantifiable and reproducible results. This TMDL is also consistent with New Mexico's antidegradation policy.

According to the New Mexico water quality standards (20.6.4.900 NMAC), the dissolved aluminum chronic criterion is 0.087 mg/L and the dissolved aluminum acute criterion is 0.75 mg/L for aquatic life uses. Of the values assessed for the 2008-2010 Integrated CWA §303(d)/§305(b) List, the chronic criterion was exceeded 4 of 8 times on the Rio Grande (San Marcial at USGS gage to Rio Puerco) AU. These exceedences are presented in Appendix C and Figure 3.2. The determination of these impairments was based on the application of the Assessment Protocol (NMED/SWQB 2008b). The samples that were not spatially or temporally independent were averaged and the Assessment Protocols were then applied to the averaged value.

High chronic levels of dissolved aluminum can be toxic to fish, benthic invertebrates, and some single-celled plants. Aluminum concentrations from 0.100-0.300 mg/L increase mortality, retard growth, gonadal development and egg production of fish (http://www.bae.ncsu.edu/programs/extension/wqg/). High acute levels of dissolved aluminum can be especially detrimental to aquatic life increasing mortality rates for many species of fish and macroinvertebrates.

3.2 Flow

Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified period. A flow duration curve relates flow values to the percent of time those values have been met or exceeded. The use of "*percent of time*" provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low along the x-axis. The x-axis represents the duration amount, or "*percent of time*", as in a cumulative frequency distribution. The y-axis represents the flow value (e.g., cubic feet per second) associated with that "*percent of time*" (or duration). Flow duration curve development typically uses daily average discharge rates, which are sorted from the highest value to the lowest (Figures 3.1 and 3.2). Using this convention, flow duration intervals are expressed as a percentage, with zero corresponding to the highest stream discharge in the record (i.e., flood conditions) and 100 to the lowest (i.e., drought conditions). Thus, a flow duration interval of sixty associated with a stream discharge of 357 cubic feet per second (cfs) implies that sixty percent of all observed daily average stream discharge values equal or exceed 357 cfs (Figure 3.1). It should be noted that impoundment of water in Cochiti Reservoir began in 1973. The flow regime of the Rio Grande changed significantly following the construction of this reservoir, therefore, flow data available before 1974 were not used in this analysis.

Duration curve analysis identifies intervals, which can be used as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree). Flow duration curve intervals can be grouped into several broad categories or zones. These zones provide additional insight about conditions and patterns associated with the impairment. A common way to look at the duration curve is by dividing it into five zones, as illustrated in Figures 3.1 and 3.2: one representing *high flows (0-10%)*, another for *moist conditions (10-40%)*, one covering *mid-range flows (40-60%)*, another for *dry conditions (60-90%)*, and one representing *low flows (90-100%)* (Cleland 2003). This particular approach places the midpoints of the moist, mid-range, and dry zones at the 25th, 50th, and 75th percentiles respectively (i.e., the quartiles). The high zone is centered at the 5th percentile, while the low zone is centered at the 95th percentile.

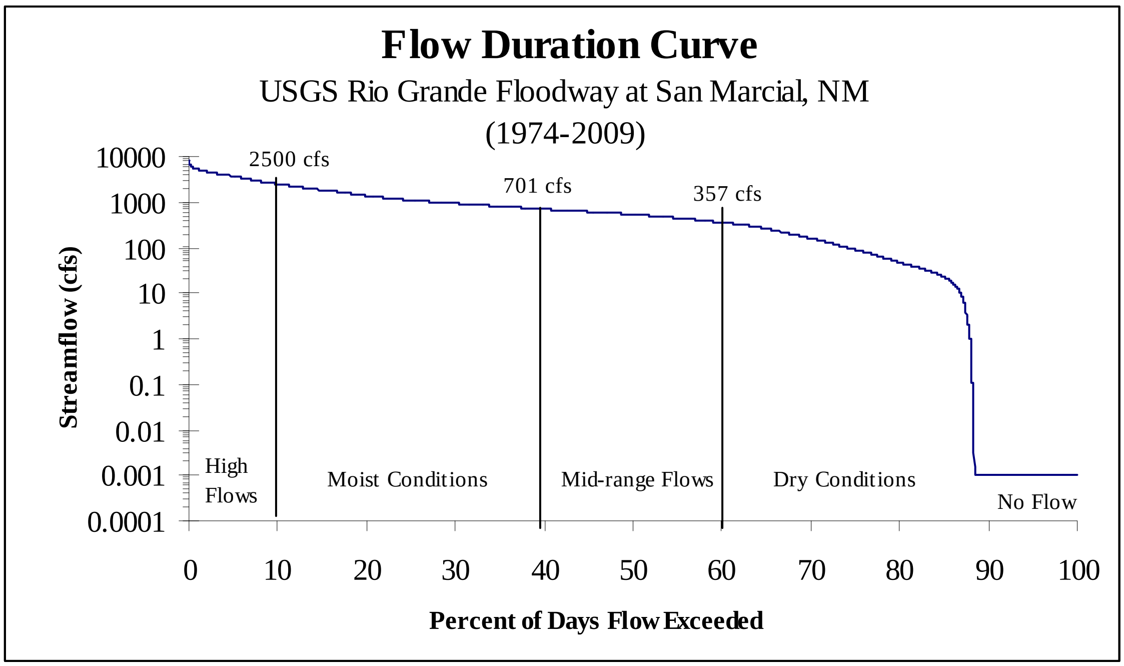

Figure 3.1 USGS 08358400 Rio Grande Floodway at San Marcial, NM (1974-2009)

The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates. Specifically, a maximum daily concentration limit can be used with basic hydrology and a duration curve to identify a TMDL that covers the full range of flow conditions. With this approach, ambient water quality data, taken with some measure or estimate of flow at the time of sampling, can be used to compute an instantaneous load. Using the relative percent exceedence from the flow duration curve that corresponds to the stream discharge at the time the water quality sample was taken, the computed load can be plotted in a duration curve format (Figure 3.2).

By displaying instantaneous loads calculated from ambient water quality data and the daily average flow on the date of the sample (expressed as a flow duration curve interval), a pattern develops, which describes the characteristics of the water quality impairment. Loads that plot above the curve indicate an exceedence of the water quality criterion (chronic dissolved aluminum in this case), while those below the load duration curve show compliance. The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left generally reflect probable nonpoint source contributions. This concept is illustrated in Figure 3.2.

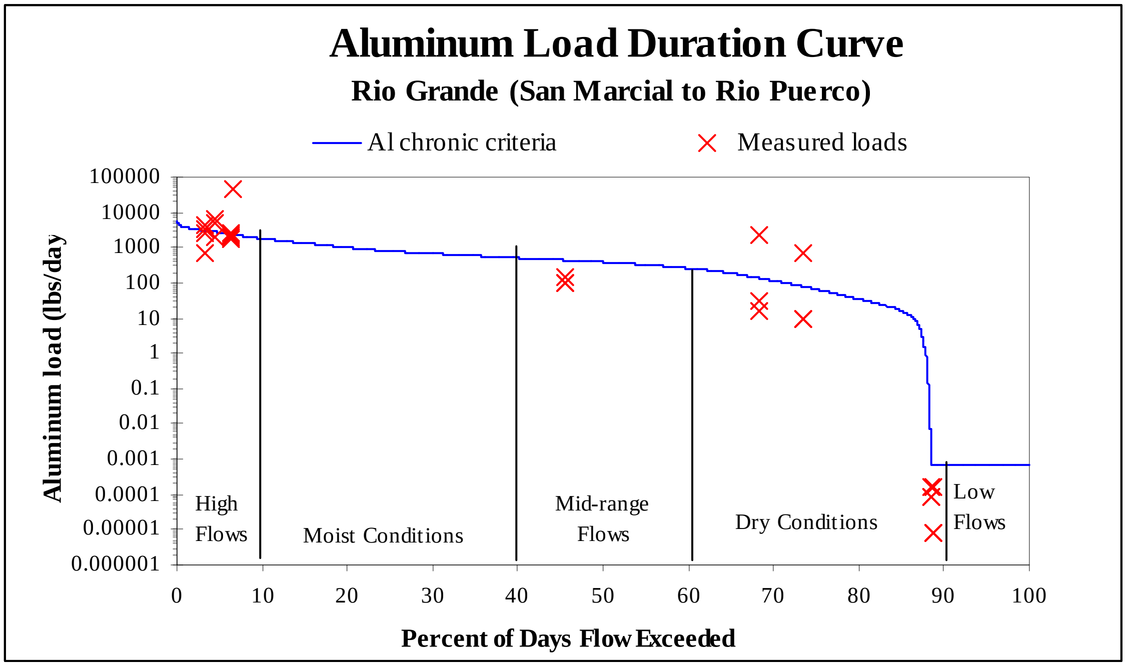

Figure 3.2 Aluminum Load Duration Curve – Rio Grande (San Marcial to Rio Puerco)

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning processes designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained.

3.3 Calculations

A target load for dissolved aluminum is calculated based on a flow, the current water quality criterion, and a conversion factor (8.34) that is used to convert mg/L units to lbs/day (see Appendix A for Conversion factor derivation). The critical flow was converted from cfs to million gallons per day using **Equation 1**. The target loading capacity is calculated using **Equation 2**. The results are shown in Table 3.1.

$$flow\frac{ft^3}{\sec}\times 1{,}728\frac{in^3}{ft^3}\times 0.004329\frac{gal}{in^3}\times 86{,}400\frac{\sec}{day}\times 10^{-6}\,MG/gal = flow(MGD) \quad \textit{(Eq. 1)}$$

Critical flow (MGD) x Criterion (mg/L) x 8.34 = Target Loading Capacity (Eq. 2)

Under the duration curve framework, the loading capacity is essentially the curve itself. The loading capacity, which sets the target load on any given day, is determined by the flow on the particular day of interest. However, a continuous curve that represents the loading capacity has some logistical drawbacks. It is often easier to communicate information with a set of fixed targets. Critical points along the curve can be used as an alternative method to quantify the loading capacity, such as the mid-point of each hydrologic zone (e.g., the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles). A unique loading capacity for each hydrologic zone allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes. The target loads (TMDLs) predicted to attain current standards were calculated using **Equation 1** and are shown in Table 3.1.

Table 3.1 Calculation of Target Loads: Rio Grande (San Marcial at to Rio Puerco)

	FLOW CONDITIONS				
	High	**Moist**^(b)^	**Mid-Range**^(b)^	**Dry**	**Low**^(b)^
Chronic dissolved aluminum criteria	0.087	-	-	0.087	-
Mid-point Flow (mgd)	2385	-	-	59	-
Conversion Factor^(a)^	8.34	-	-	8.34	-
TMDL	**1731 lbs/day**	**-**	**-**	**42.8 lbs/day**	**-**

a) *Conversion factor is based on Equation 1.*
b) *There are no TMDL calculations for Moist, Mid-Range, or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 3.2).*

It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems the target load will vary based on the changing flow. Management of the load to improve stream water quality and meet water quality criteria should be a goal to be attained. Meeting the calculated TMDL may be a difficult objective.

3.4 Waste Load Allocations and Load Allocations

3.4.1 Waste Load Allocation

There are two NPDES permitted discharges in the Rio Grande (San Marcial at USGS gage to Rio Puerco) AU. The City of Socorro Wastewater Treatment Plant (WWTP) (NM0028835, December 31, 2009 expiration) discharges into the Luis Lopez Drain, thence to Socorro Riverside Drain, thence to the Rio Grande in Water Quality Standards Segment 20.6.4.105. The NPDES permit does not have a limit for aluminum. A final effluent sample was collected in February 2004 as part of the permit renewal process. This sample yielded a dissolved aluminum concentration of 0.023 mg/L which is below the chronic dissolved aluminum criteria of 0.087 mg/L. The current permit uses 1.3 mgd as the design flow. The permit application describes the periodic discharge from the WWTP as occurring for 25 minutes with an average flow of 0.037 mgd per discharge and an average daily flow rate as 0.66 mgd. A WLA will be assigned based on design flow and the chronic water quality standard for dissolved aluminum from 20.6.4.900 NMAC and is discussed further in Table 3.2.

The New Mexico Firefighters Training Academy (NM0029726) discharges into Dry Arroyo, then Diversion Channel, and finally to the Rio Grande in Segment 20.6.4.105. NM0029726 likewise does not have a permit limit for aluminum. The permit effective July 1, 2009 (June 30, 2014 expiration) does not have a permit requirement for aluminum. However, according to the draft permit from EPA R6, "because analytical result of aluminum was not reported with the 2004 application, a monitoring requirement of dissolved aluminum is established." Dissolved aluminum samples collected from the ponds in April 2009 showed maximum results of 0.022 mg/L. On-site lagoons will be drained of approximately 1.3 million gallons at 3 to 5 year intervals to allow for silt removal. In order to be conservative, a WLA will be assigned and is further discussed in Table 3.2.

SWQB recognizes the TMDL provides a WLA for dissolved aluminum, but permits are required to include a limit for total aluminum. The Procedures for Implementing National Pollutant Discharge Elimination System Permits in New Mexico (2009) states:

> *"Monitoring requirements in permits can be expressed in the dissolved form, but limitations must be expressed in the total recoverable form, per the requirements of 40 CFR 122.45(c). When a limitation is required, or when the only effluent or ambient data available is in the total recoverable form, a 1:1 conversion to the dissolved form will be made for water quality screens. The reverse process will be made to obtain a limitation in the total recoverable form. During the permit development or the public participation process of the permit, the permittee shall be allowed the opportunity to submit data in the dissolved form for a water quality screening directly with numeric criteria in the proper form."*

The TMDL document presents WLA values for dissolved aluminum that are protective of the NM WQS for chronic aquatic life as applicable to NMAC 20.6.4.105. SWQB anticipates the facilities will monitor both dissolved and total aluminum in order to produce a relationship between the two constituents.

There are no Municipal Separate Storm Sewer System (MS4) storm water permits in this Assessment Unit. Sediment may be a component of some industrial and construction storm water discharges covered under General NPDES Permits, so the load from these discharges should be addressed. In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES construction general storm water permit (CGP) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. In addition, the current CGP also includes state specific requirements that the SWPPP must include site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control best management practices (BMPs) and/or other controls that are designed to prevent to the maximum extent practicable an increase in the sediment yield and flow velocity from pre-construction, pre-development conditions to assure that applicable standards in 20.6.4 NMAC, including the antidegradation policy, or WLAs are met. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Other industrial storm water facilities are generally covered under the current NPDES Multi-Sector General Storm Water Permit (MSGP). This permit also requires preparation of an SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In this case, compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

Individual wasteload allocations for the General Permits were not possible to calculate at this time in this watershed using available tools. Loads that are in compliance with the General Permits from facilities covered are therefore currently calculated as part of the watershed load allocation.

3.4.2 Load Allocation

In order to calculate the LA, the WLAs listed in Table 3.2 and the MOS were subtracted from the target capacity (TMDL), as shown below in **Equation 3**.

$$WLA + LA + MOS = TMDL \qquad \text{(Eq. 3)}$$
$$\text{In other words, } LA = TMDL - WLA - MOS$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors (see Section 3.7 for details). Results are presented in Table 3.4

Table 3.2 TMDLs for Dissolved Aluminum: Rio Grande (San Marcial to Rio Puerco)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**1731 lbs/day**	**-**	**-**	**42.8 lbs/day**	**-**
NM0028835 [(b)]	0.943	-	-	0.943	-
NM0029726 [(b)]	0.943	-	-	0.943	-
Total Waste Load Allocation	**1.89**	**-**	**-**	**1.89**	**-**
Load Allocation	**1171**	**-**	**-**	**38.8**	**-**
Margin of Safety	**558**	**-**	**-**	**2.13**	**-**

a) There are no TMDL calculations for Moist, Mid-Range, or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 3.2).
b) WLA calculated as WQS x design flow x 8.34.

The extensive data collection and analyses necessary to determine background aluminum loads for the Middle Rio Grande watershed were beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

3.5 Identification and Description of Pollutant Source(s)

Probable nonpoint sources that may be contributing to the observed load are displayed in Table 3.3:

Table 3.3 Pollutant source summary for Aluminum

Pollutant Sources	Magnitude	Location	Probable Sources[(a)]
Point: [(b)]	1.89 lbs/day [(c)]	Rio Grande (San Marcial at USGS Gage to Rio Puerco)	Municipal Point Source Discharges
Nonpoint:		Rio Grande (San Marcial at USGS Gage to Rio Puerco)	Avian Sources (waterfowl and/or other), Impervious Surface/Parking Lot Runoff, Municipal (Urbanized High Density Area), Natural Sources, On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Wastes from Pets.

Notes:
(a) From the 2008-2010 Integrated CWA 303(d)/305(b) list (NMED/SWQB 2008a). This list of probable sources for all impairments is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time.
(b) Current probable point source contributions (based on WLA in Table 3.2).
(c) *Based on NPDES permit values.*

3.6 Linkage of Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the potential sources of impairment. The Pollutant Source(s) Documentation Summary provides a visual analysis of probable sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Staff completing these forms identify probable sources of nonpoint source impairments along each reach as determined by field reconnaissance. It is important to consider not only the land directly adjacent to the stream, but also to consider upland and upstream areas in a more holistic watershed approach to implementing these TMDLs.

In general, increased metals in the water column can commonly be linked to sediment transport and accumulation, where the metals are a constituent part of the stream. This does not appear to be the case for the Rio Grande as evidenced by the fact that there is a very weak relationship between the dissolved aluminum and TSS concentrations according to the data used to determine the impairment (Figure 3.3). However, the degree to which sediment delivery and transport in this watershed is a natural phenomenon, or has been exacerbated by human activities, or is the result of a combination of both should be considered.

The Rio Puerco enters the Rio Grande just south of Bernardo, NM. When the Rio Puerco flows, it carries a heavy sediment load and is a major contributor of sediment to the Rio Grande (Chronic, 1987). Even though the highly erodible soils of the Rio Puerco Watershed are a significant source of sediment transport to the Rio Grande, the anthropogenic influence of highway construction, channelization, land development, and historical rangeland grazing practices may be contributing to impairment, particularly in the Rio Puerco and thus the Rio Grande. The geology in the Rio Puerco watershed contributes to the amount of sediment available for transport (NMED/SWQB, 2007). Two dissolved aluminum samples were collected at the Rio Puerco near Bernardo, NM USGS gage (08353000) in 2005. A sample collected on 2/24/2005 measured 0.0935 mg/L and a sample collected on 5/26/2005 measured 0.0012 mg/L. The February 2005 sample exceeds the chronic WQS of 0.087 mg/L for dissolved aluminum.

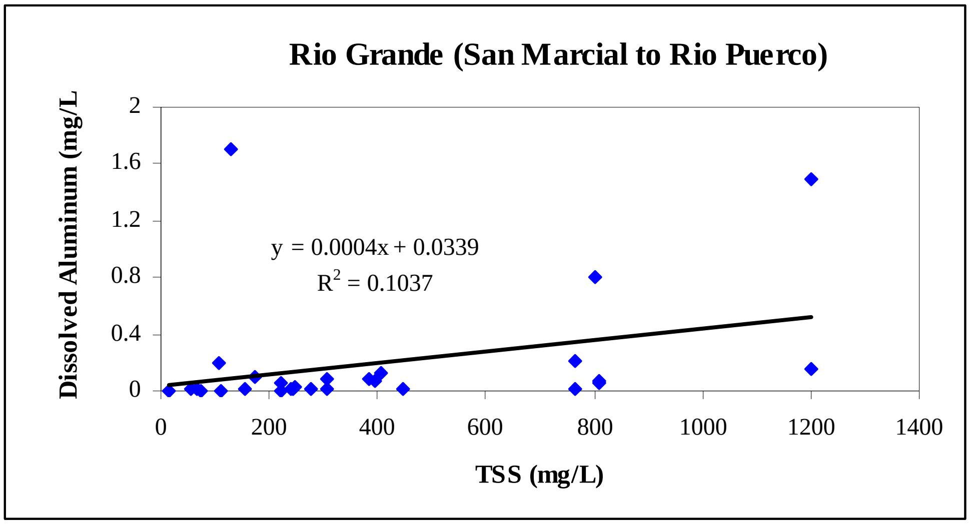

Figure 3.3 Relationship between dissolved aluminum and TSS

Normal aqueous chemical processes, enhanced by the slight natural acidity of snow and rain, are capable of rendering any naturally occurring aluminum available to the stream system. The fact that dissolved aluminum concentrations above the chronic aluminum criterion were measured during April, May, June, July, August, and October and during both High and Dry flow regimes is indicative of a year-round watershed source. Appendix C lists dissolved aluminum results along with daily USGS gage flows in relation to these samples.

3.7 Margin of Safety

TMDLs should reflect a margin of safety (MOS) based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For these aluminum TMDLs, the MOS was developed using a combination of conservative assumptions and explicit allocations. Therefore, this MOS is the sum of the following two elements:

- *Implicit Margin of Safety*

Treating aluminum as a conservative pollutant, that is a pollutant that does not readily degrade in the environment, was used as a conservative assumption in developing these loading limits.

- *Explicit Margin of Safety*

Using a duration curve framework, an explicit MOS can be identified for each listed reach and corresponding set of flow regimes. In this TMDL, the MOS was calculated based on the difference between the loading capacity at the midpoint of the relevant flow regimes (high and dry) and the loading capacity at the minimum flow in each flow regime. Given that the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point, a substantial MOS is provided. This explicit MOS ensures that allocations will not exceed the load associated with the minimum flow in each zone (USEPA 2006).

The MOS for the dry flow zone was determined using a different method because the lowest flow recorded was only 0.001 cfs. If the MOS was calculated as described above, the MOS would constitute the majority of the target load. In other words, there would not be enough load to allocate to point and nonpoint sources under this flow regime. Similar to previous SWQB TMDLs which were based on 4Q3 low-flows, there is inherent error in all flow measurements. A conservative MOS of **5 percent** was therefore explicitly allocated to the dry flow hydrologic zone.

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc). As new information becomes available, this unallocated capacity may be attributed to nonpoint sources including tributary streams (which could then be added to the load allocation); or it may be attributed to point sources (and become part of the waste load allocations).

3.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Seasonal variation was accounted for in these TMDLs by using 25 years of USGS flow records when estimating flows to develop flow exceedence percentiles.

During the 2005 water quality survey, dissolved aluminum exceedences occurred during spring, summer, and fall months. Higher flows may flush more nonpoint source runoff containing aluminum. It is also possible the criterion may be exceeded under a low flow condition when there is insufficient dilution of a point source. The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates during different seasons. Allocations within the TMDL are set in a way that reflects dominant concerns associated with appropriate hydrologic conditions.

3.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2035. Table 3.4 shows the population estimates for the counties discussed in this TMDL.

Table 3.4 Population Estimates by County

County	2007*	2015	2025	2035	% Increase (2007-2035)
Sandoval	123,694	144,087	182,592	217,806	43
Bernalillo	644,023	811,861	993,650	1,166,590	45
Valencia	75,807	89, 045	107,294	123,212	38
Socorro	18,788	20,012	21, 167	21,837	14

**estimate revised 11/2008*

According to the calculations, the overwhelming source of aluminum loading is from nonpoint sources (Table 3.2). Estimates of future growth are not anticipated to lead to a significant increase in aluminum concentrations that cannot be controlled with BMP implementation and appropriate NPDES permit limits in this watershed. However, it is imperative that BMPs continue to be utilized and improved upon in this watershed while continuing to improve watershed conditions and adhering to SWPPP requirements related to construction and industrial activities covered under the general permit. The existing Middle Rio Grande-Albuquerque Reach Watershed Restoration Action Strategy (Middle Rio Grande-Albuquerque Reach Watershed Group, 2008) defines framework for design, implementation, and maintenance of BMPs in the northern portion of the watershed addressed by this TMDL. Section 6.0 provides details on this WRAS.

4.0 BACTERIA

During the 2005 SWQB sampling monitoring effort in the Middle Rio Grande watershed, E. coli data showed several exceedences of the New Mexico water quality standard for secondary contact use in several assessment units. This data was combined with other sources of data to determine overall impairment for these assessment units. As a result, four assessment units in the Middle Rio Grande watershed were determined to be impaired with *E. coli* as a pollutant of concern (see summary in Table 4.1 and data in Appendix D). The determination of these impairments was based on the application of the Assessment Protocol (NMED/SWQB 2008b). The samples that were not spatially or temporally independent were averaged and the Assessment Protocols were then applied to the averaged value. When water quality standards have been achieved, the reach will be moved to the appropriate category on the Clean Water Act Integrated §303(d)/§305(b) list of assessed waters. Presence of E. coli bacteria is an indicator of the possible presence of other bacteria that may limit beneficial uses and present human health concerns. There are probable nonpoint and point sources of E. coli bacteria throughout the basin that could be contributing to the E. coli levels.

According to the New Mexico Water Quality Standards (WQS), the *E. coli* standard reads:

> *20.6.4.105 NMAC: The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.*
> *20.6.4.106 NMAC: The monthly geometric mean of E. coli bacteria 126/100mL or less; single sample 410/100mL or less.*

The Pueblo of Sandia and the Pueblo of Isleta have the following *E.coli* WQS (See Section 2.3):

<u>*Escherichia coli*</u>

1. *geometric mean maximum: 47 colonies/100 ml*
2. *single sample maximum of 88 colonies/100 ml, in accordance with an illness rate of 4 per 1,000 exposures*

Table 4.1. Summary of Bacteria Data in the Middle Rio Grande

Assessment Unit	**New Mexico Standards Segment**	***E. coli*: # Exceedences/ Total Samples [(a)]**	***E. coli*[(b)] %Exceedence**
Rio Grande (non-Pueblo Alameda to Angostura Diversion)	20.6.4.106	6/17	35%
Rio Grande (Isleta Pueblo bnd to Alameda Bridge)	20.6.4.105	4/16	25%
Rio Grande (Rio Puerco to Isleta Pueblo bnd)	20.6.4.105	2/7	29%
Rio Grande (San Marcial to Rio Puerco)	20.6.4.105	14/35	40%

Notes:

a) Of the values assessed for the 2008-2010 Integrated CWA §303(d)/§305(b) List
b) Exceedence rates ≥ 15% result in a determination of Non Support based on the assessment protocol (NMED/SWQB 2008b)

4.1 Target Loading Capacity

Overall, the target values for bacteria TMDLs will be determined based on (1) the presence of numeric criteria, (2) the degree of experience in applying the indicator and (3) the ability to easily monitor and produce quantifiable and reproducible results. For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to achieve numeric criteria. This TMDL is also consistent with New Mexico's antidegradation policy.

The segment-specific criteria leading to an assessment of use impairment for the four MRG Assessment Units is the numeric criteria stating that "The monthly geometric mean of *E. coli* bacteria 126cfu/100 mL or less; single sample 410cfu/100 mL or less" for the designated contact use (20.6.4.105 NMAC and 20.6.4.106 NMAC). However, in order to be protective of downstream waters, the WQS for the Pueblo of Sandia will be used for the TMDL calculations for the Rio Grande (non-Pueblo Alameda to Angostura) Assessment Unit. Likewise, the WQS for the Pueblo of Isleta will be used for the Rio Grande (Isleta Pueblo bnd to Alameda bridge) Assessment Unit.

4.2 Flow

Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified period. A flow duration curve relates flow values to the percent of time those values have been met or exceeded. The use of *"percent of time"* provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low along the x-axis. The x-axis represents the duration amount, or *"percent of time"*, as in a cumulative frequency distribution. The y-axis represents the flow value (e.g., cubic feet per second) associated with that *"percent of time"* (or duration). Flow duration curve development typically uses daily average discharge rates, which are sorted from the highest value to the lowest (Figures 4.1-4.4). Using this convention, flow duration intervals are expressed as a percentage, with zero corresponding to the highest stream discharge in the record (i.e., flood conditions) and 100 to the lowest (i.e., drought conditions). Thus, a flow duration interval of sixty associated with a stream discharge of 357 cubic feet per second (cfs) implies that sixty percent of all observed daily average stream discharge values equal or exceed 357 cfs (Figure 4.1). It should be noted that impoundment of water in Cochiti Reservoir began in 1973. The flow regime of the Rio Grande changed significantly following the construction of this reservoir, therefore, flow data available before 1974 were not used in this analysis.

Duration curve analysis identifies intervals, which can be used as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree). Flow duration curve intervals can be grouped into several broad categories or zones. These zones provide additional insight about conditions and patterns associated with the impairment. A common way to look at the duration curve is by dividing it into five zones, as illustrated in Figures 4.1 and 4.4: one representing *high flows (0-10%)*, another for *moist conditions (10-40%)*, one covering *mid-range flows (40-60%)*, another for *dry conditions (60-90%)*, and one representing *low flows (90-100%)* (Cleland 2003).

This particular approach places the midpoints of the moist, mid-range, and dry zones at the 25th, 50th, and 75th percentiles respectively (i.e., the quartiles). The high zone is centered at the 5th percentile, while the low zone is centered at the 95th percentile.

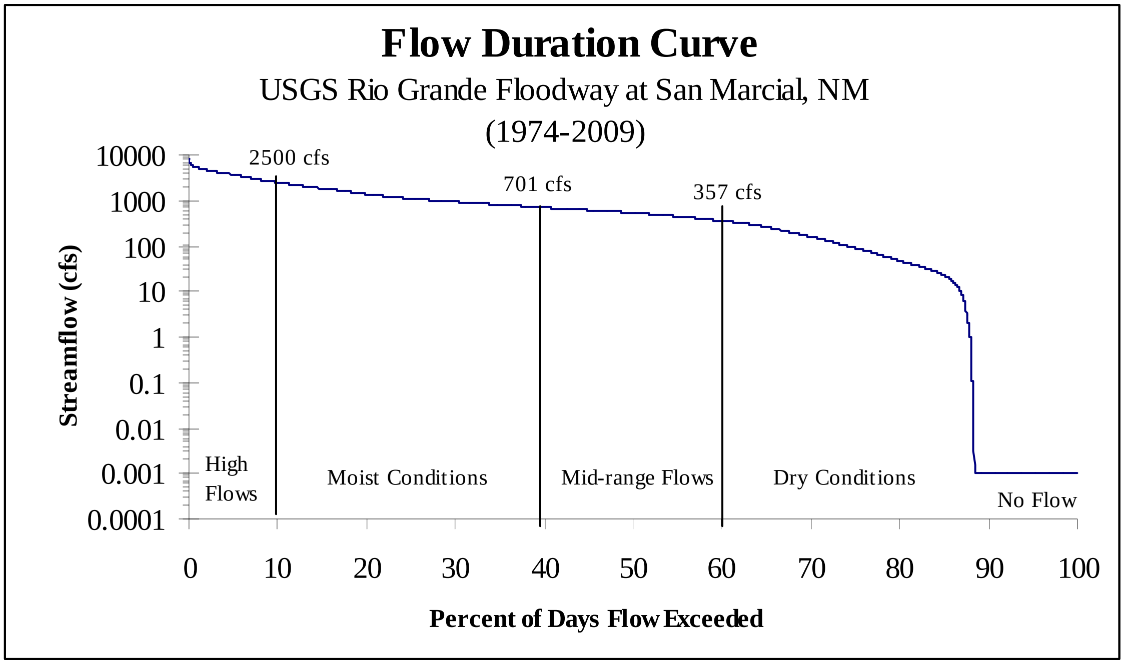

Figure 4.1 Flow Duration Curve: USGS 08358400 Rio Grande Floodway at San Marcial

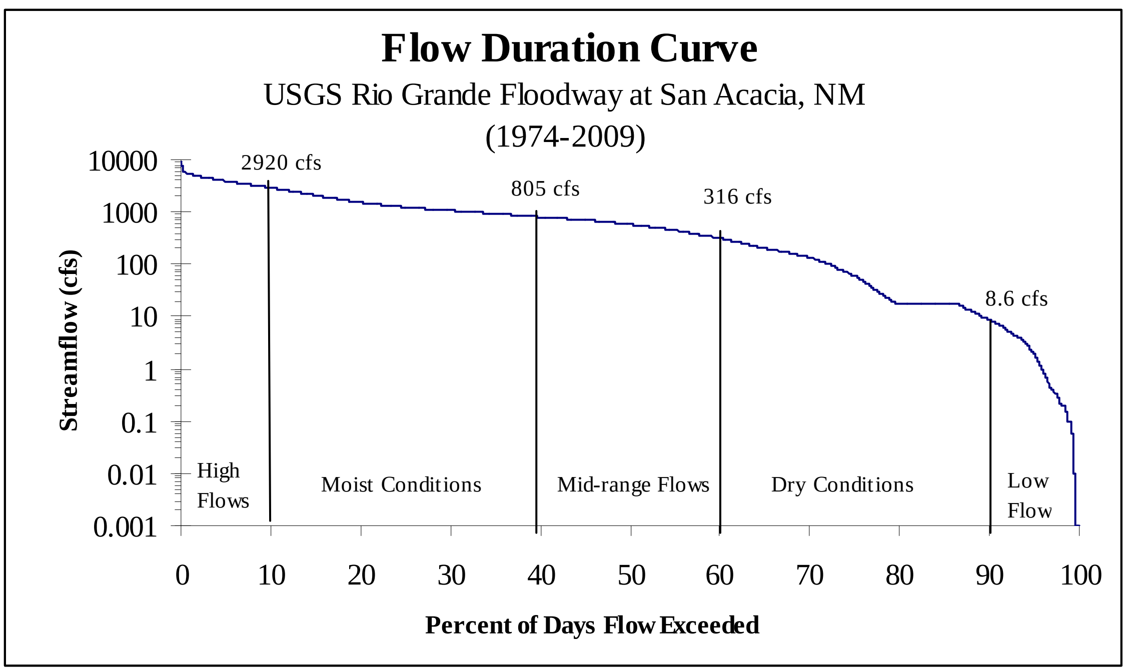

Figure 4.2 Flow Duration Curve: USGS 08354900 Rio Grande Floodway at San Acacia

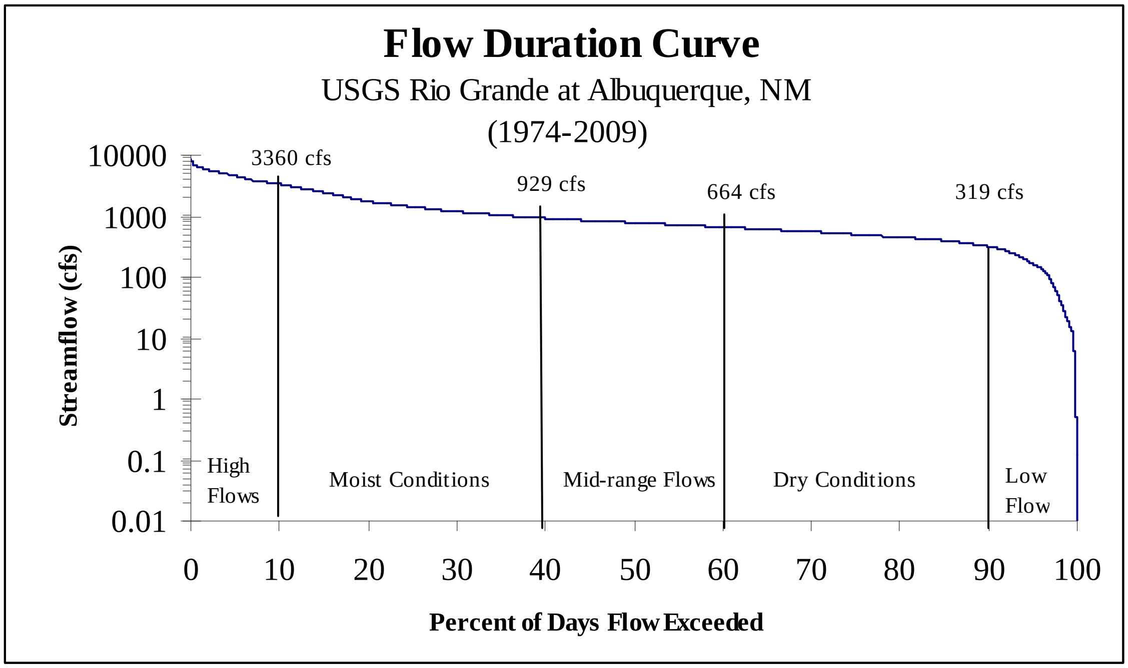

Figure 4.3 Flow Duration Curve: USGS 08330000 Rio Grande at Albuquerque, NM

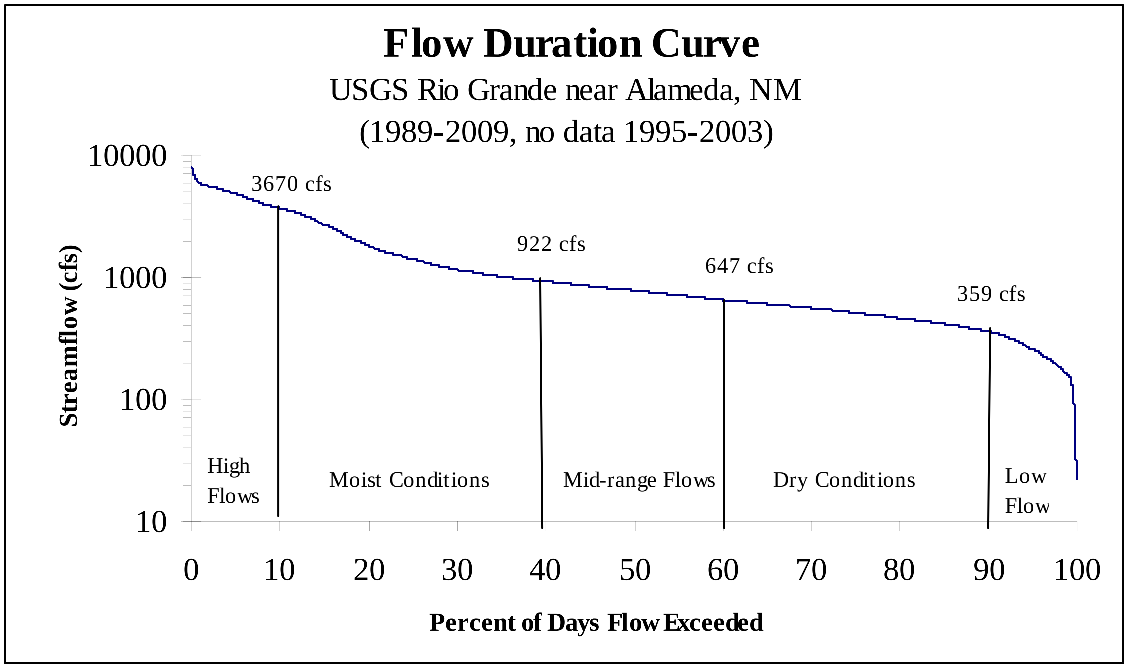

Figure 4.4 Flow Duration Curve: USGS 08329928 Rio Grande near Alameda, NM

The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates. Specifically, a maximum daily concentration limit can be used with basic hydrology and a duration curve to identify a TMDL that covers the full range of flow conditions. With this approach, ambient water quality data, taken with some measure or estimate of flow at the time of sampling, can be used to compute an instantaneous load. Using the relative percent exceedence from the flow duration curve that corresponds to the stream discharge at the time the water quality sample was taken, the computed load can be plotted in a duration curve format (Figures 4.1 - 4.4).

By displaying instantaneous loads calculated from ambient water quality data and the daily average flow on the date of the sample (expressed as a flow duration curve interval), a pattern develops, which describes the characteristics of the water quality impairment. Loads that plot above the curve indicate an exceedence of the water quality criterion, whereas those below the load duration curve show compliance. The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left generally reflect probable nonpoint source contributions. This concept is illustrated in Figures 4.5 – 4.8.

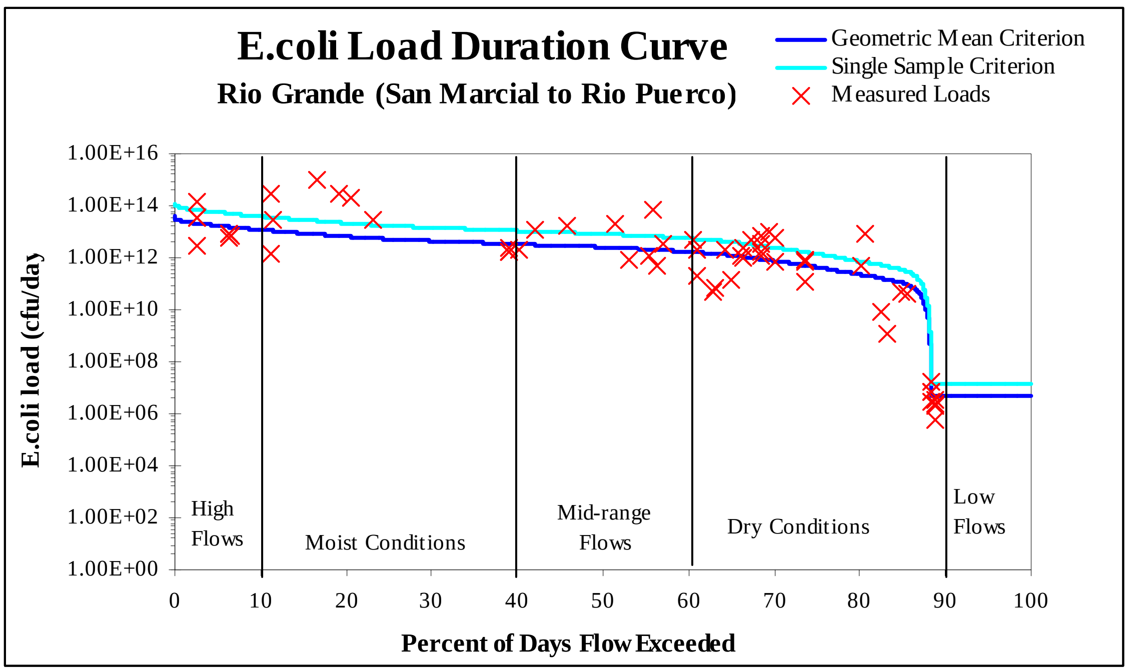

Figure 4.5 ***E. coli* Load Duration Curve – Rio Grande (San Marcial to Rio Puerco)**

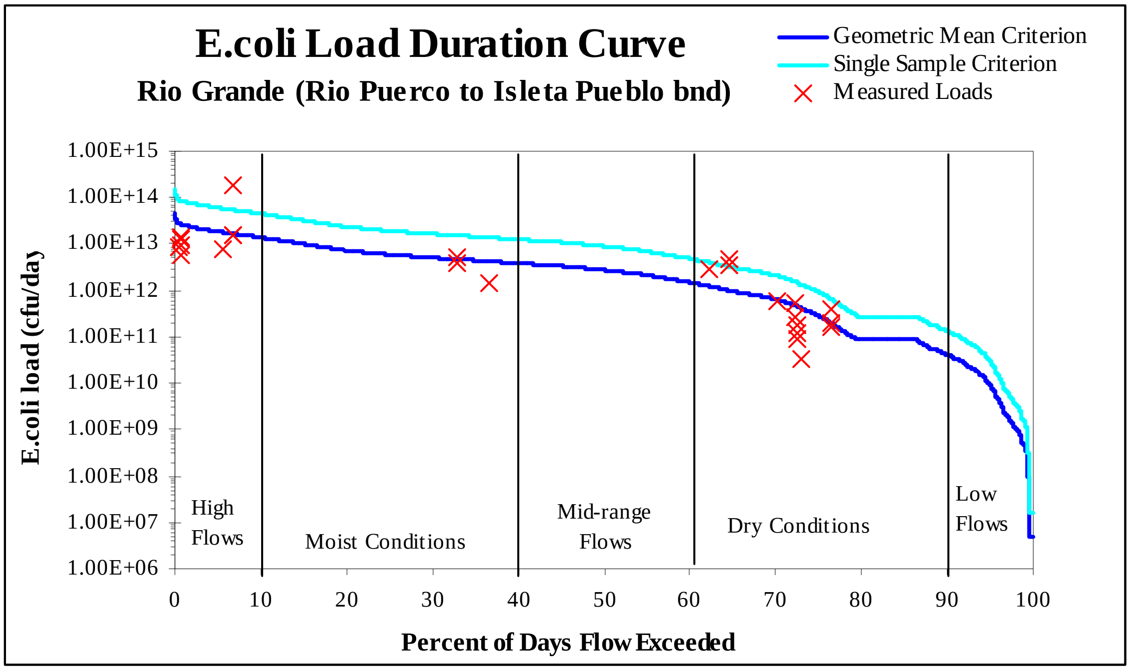

Figure 4.6 *E. coli* **Load Duration Curve – Rio Grande (Rio Puerco to Isleta Pueblo bnd)**

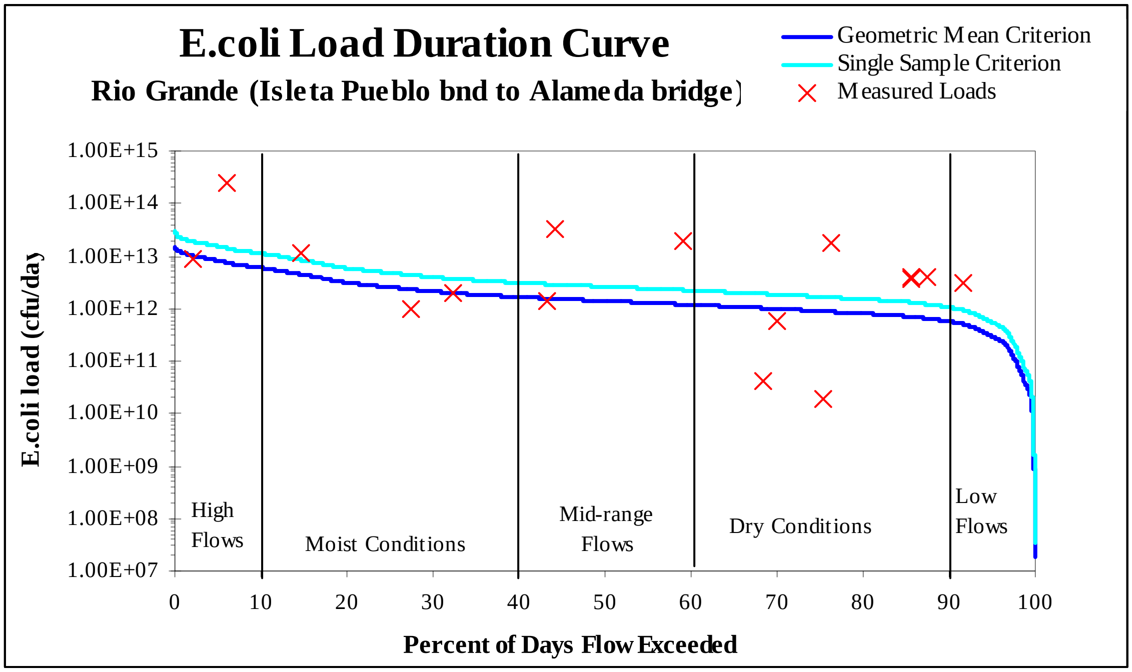

Figure 4.7 *E. coli* **Load Duration Curve–Rio Grande (Isleta Pueblo bnd to Alameda bridge)**

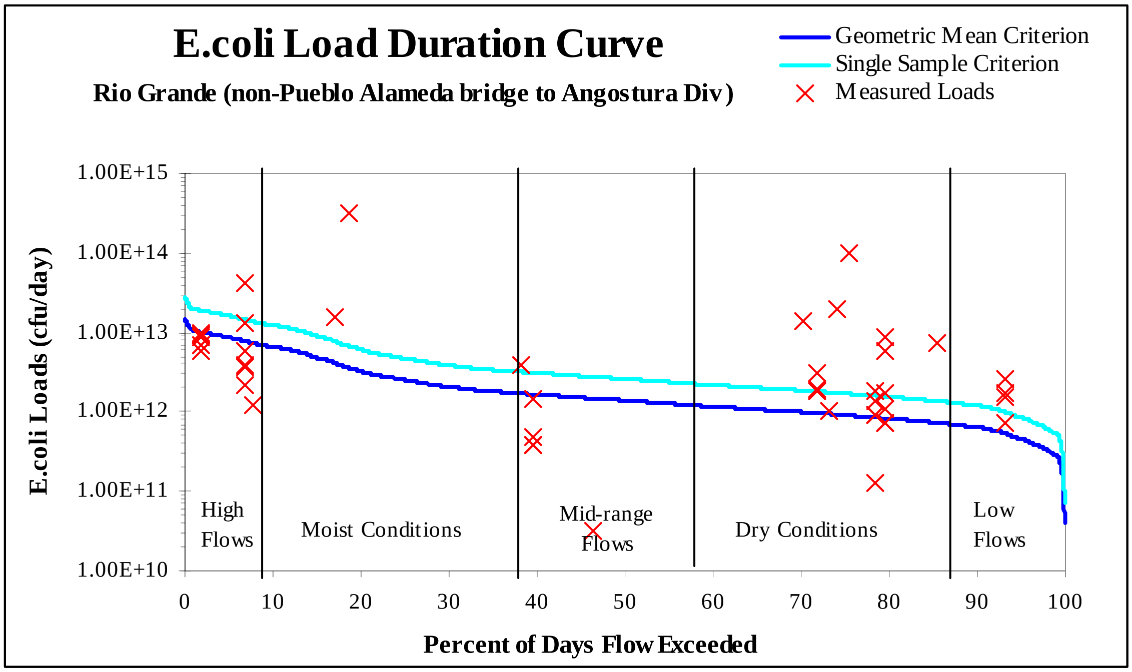

Figure 4.8 ***E. coli*** **Load Duration Curve–Rio Grande (non-Pueblo Alameda bridge to Angostura)**

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning processes designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained.

4.3 Calculations

Bacteria standards are expressed as colony forming units (cfu) per unit volume. The *E. coli* geometric mean criteria are listed in Tables 4.2 through 4.5. Target loads for bacteria are calculated based on flow values, current and proposed WQS, and conversion factors (**Equation 4**). The more conservative monthly geometric mean criteria are utilized in TMDL calculations to provide an implicit MOS. In addition, if the single sample criteria were used as targets, the geometric mean criteria may not be reached.

C as cfu/100 mL * 1,000 mL/1 L * 1 L/ 0.264 gallons * 1,000,000 gallons/MG *Q as MG/day = cfu/day **(Eq. 4)**

Where C = water quality standard criterion for bacteria,
Q = stream flow in million gallons per day (mgd)

Under the duration curve framework, the loading capacity is essentially the curve itself. The loading capacity, which sets the target load on any given day, is determined by the flow on the particular day of interest and the numerical criterion for *E.coli*. However, a continuous curve that represents the loading capacity has some logistical drawbacks. It is often easier to communicate information with a set of fixed targets. Critical points along the curve can be used as an alternative method to quantify the loading capacity, such as the mid-point of each hydrologic zone (e.g., the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles). A unique loading capacity for each hydrologic zone allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes. The target loads (TMDLs) predicted to attain current standards were calculated using **Equation 4** and are shown in Tables 4.2 and 4.5.

Table 4.2. Calculation of Target Loads: Rio Grande (San Marcial at USGS gage to Rio Puerco)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**[(c)]
E. coli **geometric mean criterion (cfu/100mL)** [(a)]	126	126	126	126	-
Mid-point Flow (mgd)	2385	711	347	59	-
Conversion Factor[(b)]	3.79×10^7	3.79×10^7	3.79×10^7	3.79×10^7	-
TMDL (cfu/100mL/day)	$\mathbf{1.14 \times 10^{13}}$	$\mathbf{3.40 \times 10^{12}}$	$\mathbf{1.66 \times 10^{12}}$	$\mathbf{2.81 \times 10^{11}}$	**-**

(a) *Per 20.6.4.105 NMAC*
(b) Conversion factor is based on Equation 4.
(c) There are no TMDL calculations for Low flow conditions because there were no observed exceedences during this flow regime (refer to Figure 4.5).

Table 4.3. Calculation of Target Loads: Rio Grande (Rio Puerco to Isleta Pueblo bnd)

	FLOW CONDITIONS				
	High	**Moist**[(b)]	**Mid-Range**[(c)]	**Dry**	**Low**[(b)]
E. coli **geometric mean criterion (cfu/100mL)** [(a)]	126	126	-	126	-
Mid-point Flow (mgd)	2521	801	-	39	-
Conversion Factor[(b)]	3.79×10^7	3.79×10^7	-	3.79×10^7	-
TMDL (cfu/100mL/day)	$\mathbf{1.20 \times 10^{13}}$	$\mathbf{3.83 \times 10^{12}}$	**-**	$\mathbf{1.85 \times 10^{11}}$	**-**

(a) *Per 20.6.4.102 NMAC*
(b) Conversion factor is based on Equation 4.
(c) There are no TMDL calculations for Mid-Range or Low flow conditions because there were no observed exceedences during these flow regimes (refer to Figure 4.6 and Appendix D). No exceedences of the single sample criterion were observed during Moist conditions, but calculations were included to be conservative because geometric mean exceedences were observed.

Table 4.4. Calculation of Target Loads: Rio Grande (Isleta Pueblo bnd to Alameda Bridge)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
E. coli **geometric mean criterion (cfu/100mL)** [(a)]	47	47	47	47	47
Mid-point Flow (mgd)	2960	924	507	324	106
Conversion Factor[(b)]	3.79×10^{7}	3.79×10^{7}	3.79×10^{7}	3.79×10^{7}	3.79×10^{7}
TMDL (cfu/100mL/day)	$\mathbf{5.27 \times 10^{12}}$	$\mathbf{1.65 \times 10^{12}}$	$\mathbf{9.03 \times 10^{11}}$	$\mathbf{5.77 \times 10^{11}}$	$\mathbf{1.89 \times 10^{11}}$

(a) *Per Pueblo of Isleta water quality standards*
(b) Conversion factor is based on Equation 4.

Table 4.5. Calculation of Target Loads: Rio Grande (non-pueblo Alameda Bridge to Angostura Diversion)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**[(c)]	**Dry**	**Low**
E. coli **geometric mean criterion (cfu/100mL)** [(a)]	47	47	-	47	47
Mid-point Flow (mgd)	3109	905	-	328	166
Conversion Factor[(b)]	3.79×10^{7}	3.79×10^{7}	-	3.79×10^{7}	3.79×10^{7}
TMDL (cfu/100mL/day)	$\mathbf{5.54 \times 10^{12}}$	$\mathbf{1.61 \times 10^{12}}$	**-**	$\mathbf{5.84 \times 10^{11}}$	$\mathbf{2.96 \times 10^{11}}$

(a) *Per Pueblo of Sandia water quality standards*
(b) Conversion factor is based on Equation 4.
(c) There are no TMDL calculations for Mid-Range flow conditions because there were no observed exceedences during this flow regime (refer to Figure 4.8).

It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems the target load will vary based on the changing flow. Management of the load to improve stream water quality and meet water quality criteria should be a goal to be attained. Meeting the calculated TMDL may be a difficult objective.

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

There are numerous NPDES permitted facilities in the Assessment Units in the 13020203 HUC. Not all NPDES permitted facilities have been assigned a WLA for *E.coli*. The permits to which a WLA is assigned are discussed in Table 4.8 and those without a WLA are in Table 4.6. Those not assigned a WLA either do not contribute flow to the Rio Grande or have shown no reasonable potential to discharge *E.coli*.

Table 4.6. Summary of NPDES Permits in 13020203 HUC without a WLA

Assessment Unit	Permit Number	Facility	Receiving Water	*E.coli* permit limits	Design Flow (mgd)
Rio Grande (San Marcial at USGS gage to Rio Puerco)	NM0029726 (June 30, 2014 expiration)	New Mexico Firefighters Training Academy	Dry arroyo to diversion channel to Rio Grande 20.6.4.105	500 colonies/100mL 7-day and 30-day average * [1]	n/a
Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)	NM0030384 (July 31, 2009 expiration)	PNM/Person Station	AMAFCA South Diversion Channel to Rio Grande 20.6.4.105	None	n/a
	NM0030376 (July 31, 2009 expiration)	Delta-Person Generating Station	AMAFCA South Diversion channel, never reaching Rio Grande 20.6.4.105	None	0.032 facility flow
	NM0030597 (July 31, 2009 expiration)	Valero Logistics Operations	Unnamed arroyo, never reaching Rio Grande 20.6.4.105	None	Intermittent and variable flow
Rio Grande (non-pueblo Alameda Bridge to Angostura Div)	NM0000124 (June 30, 2009 expiration)	Public Service Co. of NM/Reeves Station	AMAFCA North Diversion Channel, then to Rio Grande 20.6.4.106	None	Discharge during emergency circumstances

Notes: * fecal coliform permit limit

[1] for permit expiring May 2009. Fecal limit proposed to be removed in new permit. Draft permit says "facility would have no reasonable potential to contribute *E.coli* because it ceased pumping domestic wastewater into the sedimentation ponds."

Excess bacteria levels may be a component of some storm water discharges so these discharges should be addressed. On September 29, 2006, EPA Region 6 issued general permits for discharges from regulated small municipal separate storm sewer system (sMS4s) in New Mexico and on Indian Country lands in New Mexico and Oklahoma. This permit became effective on July 1, 2007. The general permits offer coverage for discharges of storm water from sMS4s that are regulated under Phase II of the National Pollutant Discharge Elimination System (NPDES) Storm Water Program to various waters of the United States in New Mexico and Oklahoma. In New Mexico, some of the major impacts to small MS4s are as follows: operators of MS4s located in urbanized areas (UAs) must develop, implement, and enforce a storm water management program to reduce the discharge of pollutants from its MS4 to the "maximum extent practicable" and protect water quality; operators of "regulated" MS4s must obtain NPDES permit coverage; the permit application (Notice of Intent [NOI]) must include six "minimum control measures" (using Best Management Practices, or BMPs) and measurable goals; the BMPs must be fully implemented within 5 years of permit issuance; and, operators must submit yearly progress reports to EPA.

There are nine municipalities along the Rio Grande (non-Pueblo Alameda to Angostura) and Rio Grande (Isleta Pueblo bnd to Alameda Street bridge) assessment units that are eligible for coverage under the Albuquerque urbanized area, general sMS4 permit (#NMR040000). These permittees are outlined in Table 4.7. In addition to the general sMS4 permit, there are numerous NPDES permitted facilities in the region as listed in Tables 4.6 and 4.8.

Table 4.7: Phase II NPDES permittees

NPDES Tracking Number	Phase II Permittee
NM R04 A001	SSCAFCA
NM R04 A002	Town of Bernalillo[1]
NM R04 A003	Sandoval County
NM R04 A004	Corrales
NM R04 A006	Los Ranchos de Albuquerque
NM R04 A007	City of Rio Rancho
NM R04 A008	Bernalillo County
NM R04 A009	Kirtland AFB
NM R04 A0010	NM DOT Dist 3

Notes: [1] Individual small MS4 permit

The waste load allocation (WLA) for sMS4s was based on the percent jurisdictional area approach (see Appendix F). For each zone, the amount available for nonpoint source load allocations (LAs) and the sMS4 WLA was the TMDL for that zone minus the margin of safety (MOS) and the WLAs for WWTPs. In the case of the Middle Rio Grande area, both the Phase I permit and the sMS4 Phase II permittees are assigned WLAs. The total contributing area to these assessment units includes the eight 10-digit USGS HUCs displayed in Figure 4.9.

Four entities are authorized to discharge under the Phase I MS4 permit: City of Albuquerque, Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), New Mexico Department of Transportation District 3, and University of New Mexico. The Phase I permit states:

"This permit covers all areas, except agricultural lands, within the corporate boundary of the City of Albuquerque, New Mexico served by, or otherwise contributing to discharges from municipal separate storm sewers owned or operated by the permittees listed above."

Based on the square miles of the incorporated city limits of the City of Albuquerque and the contributing drainages (see Figure 4.9), 9 percent of the watershed falls within the jurisdiction of the Phase I MS4 communities in the Rio Grande (Isleta Pueblo boundary to Alameda Street Bridge) AU and 1% of the watershed falls within the jurisdiction of the Phase I MS4 communities in the Rio Grande (Alameda Street Bridge to Angostura Diversion) AU. Further details are in Appendix F.

The nine sMS4 permittees eligible for coverage under the general Phase II MS4 permit are listed in Table 4.7. The Phase II sMS4 permit (NMR040000) reads:

"This permit authorizes the discharge of storm water from small municipal separate storm sewer systems (MS4s) provided the MS4 is located fully or partially within an urbanized area as determined by the 2000 Decennial Census."

Based on the square miles of urbanized area and the contributing drainages (see Figure 4.9), 1 percent of the watershed falls within the jurisdiction of the Phase II MS4 communities in the Rio Grande (Isleta Pueblo boundary to Alameda Street Bridge) AU and 5% of the watershed falls within the jurisdiction of the Phase II MS4 communities in the Rio Grande (Alameda Street Bridge to Angostura Diversion) AU. Further details are in Appendix F.

The remaining ninety percent was designated for nonpoint sources and natural background as the LA for each zone in the Rio Grande (Isleta Pueblo boundary to Alameda Street Bridge) AU. The remaining ninety four percent was designated for nonpoint sources and natural background as the LA for each zone in the Rio Grande (Alameda Street Bridge to Angostura Diversion). Individual waste load allocations for all NPDES permits in the impaired assessment units are shown in Table 4.8.

In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges are transient because they occur during storm events. Coverage under Phase II of the NPDES Storm Water Program requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with urban activities to minimize impacts to water quality. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL. In the case of the Middle Rio Grande, compliance by those municipalities within the terms of their individual MS4 permits will fulfill any obligations they have toward implementing this TMDL.

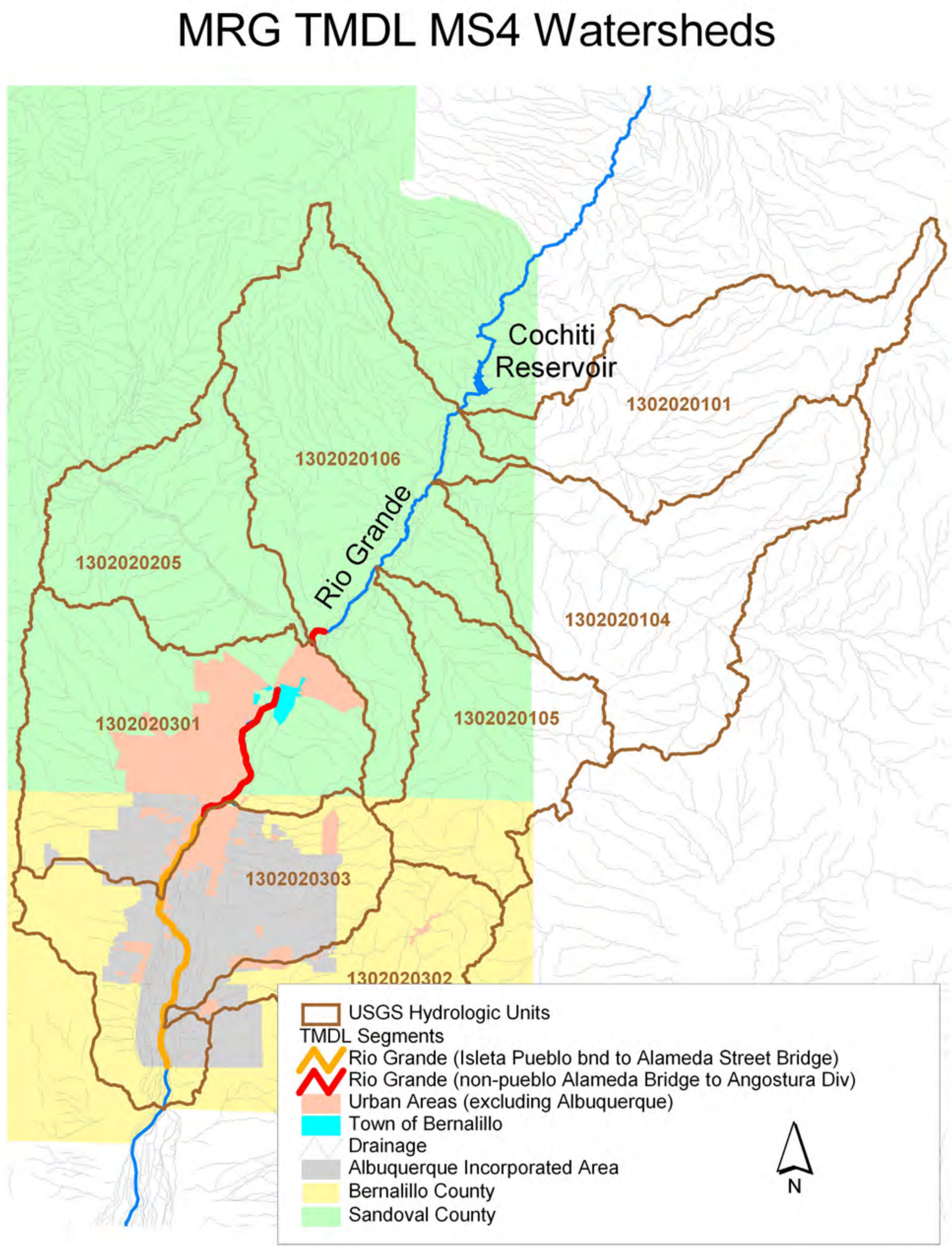

Figure 4.9. Albuquerque-area MS4 jurisdictions

Table 4.8. Waste Load Allocations for *E. coli*

Assessment Unit	Facility	Design Capacity Flow (mgd)	Proposed *E. coli* Effluent limits[(a)] (cfu/100mL)	Conversion Factor[(b)]	Waste Load Allocations (cfu/day)
Rio Grande (non-Pueblo Alameda Bridge to Angostura Div)	**NM0023485** Town of Bernalillo WWTP (January 31, 2009 expiration)	0.8	47	3.79×10^7	1.43×10^9
	NM0027987 City of Rio Rancho, No. 2 (January 31, 2009 expiration)	5.5	47	3.79×10^7	9.80×10^9
	NM0029602 City of Rio Rancho, No. 3 (January 31, 2009 expiration)	0.85	47	3.79×10^7	1.51×10^9
	NMS000101 Albuquerque Phase I MS4 (November 30, 2008 expiration)	--	--	--	Variable[(c)]
	NMR040000 Phase II MS4s (June 30, 2012 expiration)	--	--	--	Variable[(c)]
Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)	**NM0022250** Albuquerque Bernalillo County Water Utility Authority (April 30, 2010 expiration)	76	47	3.79×10^7	1.35×10^{11}
	NM0027863 Sandia Peak Ski Company (February 28, 2010 expiration)	0.0075--	47	3.79×10^7	1.34×10^7
	NMS000101 Albuquerque Phase I MS4	--	--	--	Variable[(c)]
	NMR040000 Phase II MS4s (June 30, 2012 expiration)		--	--	Variable[(c)]

Assessment Unit	Facility	Design Capacity Flow (mgd)	Proposed *E. coli* Effluent limits[(a)] (cfu/100mL)	Conversion Factor[(b)]	Waste Load Allocations (cfu/day)
Rio Grande (Rio Puerco to Isleta Pueblo bnd)	**NM0020150** City of Belen WWTP (September 30, 2009 expiration)	1.2	126	3.79×10^7	5.73×10^9
	NM0020303 Village of Los Lunas WWTP (June 30, 2012 expiration)	0.9	126	3.79×10^7	4.30×10^9
	NM0027782 NM Water Service Co/Rio Communities (October 31, 2012 expiration)	0.3	126	3.79×10^7	1.43×10^9
	NM0028851 NMCD/Central NM Correctional Facility WWTP (January 31, 2010 expiration)	0.285	126	3.79×10^7	1.36×10^9
	NM0030279 Village of Bosque Farms (March 31, 2012 expiration)	0.5	126	3.79×10^7	2.39×10^9
	NM0030414 NM Water Service Co./Rio del Oro WWTF (October 31, 2009 expiration)	0.3	126	3.79×10^7	1.43×10^9
Rio Grande (San Marcial at USGS gage to Rio Puerco)	**NM0028835** City of Socorro WWTP (December 31, 2009 expiration)	1.3	126	3.79×10^7	6.21×10^9

Notes:

(a) Based on current in-stream New Mexico WQS for segment 20.6.4.105 and 20.6.4.106 NMAC as well as the Pueblo of Sandia and Pueblo of Isleta WQS.

(b) Based on equation 4.

(c) The waste load allocation for the storm water MS4 permit was based on the percent jurisdictional area approach. Thus, the MS4 waste load allocation is a percentage of the available allocation for each hydrologic zone, where the available allocation = TMDL – WLA – MOS. See Tables 4.11 and 4.12 for details and Appendix F for details.

4.4.2 Load Allocation

In order to calculate the LA, the WLAs listed in table 4.8 and the MOS were subtracted from the target capacity (TMDL), as shown below in **Equation 2**.

$$WLA + LA + MOS = TMDL \qquad \textbf{(Eq. 5)}$$
$$or, \quad LA = TMDL - WLA - MOS$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors (see Section 4.7 for details). Results are presented in Tables 4.9-4.12.

Table 4.9. TMDLs for *E. coli*: Rio Grande (San Marcial at USGS gage at Rio Puerco)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**1.14×10^{13}**	**3.40×10^{12}**	**1.66×10^{12}**	**2.81×10^{11}**	**-**
Load Allocation	**7.72×10^{12}**	**2.16×10^{12}**	**1.10×10^{12}**	**2.61×10^{11}**	**-**
Waste Load Allocation [(a)]	**6.21×10^{9}**	**6.21×10^{9}**	**6.21×10^{9}**	**6.21×10^{9}**	**-**
Margin of Safety	**3.67×10^{12}**	**1.23×10^{12}**	**5.56×10^{11}**	**1.40×10^{10}**	**-**

(a) WLA for NM0028835

Table 4.10. TMDLs for *E. coli*: Rio Grande (Rio Puerco to Isleta Pueblo bnd)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**1.20×10^{13}**	**3.83×10^{12}**	**-**	**1.85×10^{11}**	**-**
NM0020150	5.73×10^{9}	5.73×10^{9}	-	5.73×10^{9}	-
NM0020303	4.30×10^{9}	4.30×10^{9}	-	4.30×10^{9}	-
NM0027782	1.43×10^{9}	1.43×10^{9}	-	1.43×10^{9}	-
NM0028851	1.36×10^{9}	1.36×10^{9}	-	1.36×10^{9}	-
NM0030279	2.39×10^{9}	2.39×10^{9}	-	2.39×10^{9}	-
NM0030414	1.43×10^{9}	1.43×10^{9}	-	1.43×10^{9}	-
Total Waste Load Allocation	**1.66×10^{10}**	**1.66×10^{10}**	**-**	**1.66×10^{10}**	**-**
Load Allocation	**9.00×10^{12}**	**2.47×10^{12}**	**-**	**1.59×10^{11}**	**-**
Margin of Safety	**3.02×10^{12}**	**1.34×10^{12}**	**-**	**9.26×10^{9}**	**-**

Table 4.11. TMDLs for *E. coli*: Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**5.27×10^{12}**	**1.65×10^{12}**	**9.03×10^{11}**	**5.77×10^{11}**	**1.89×10^{11}**
NM0022250	1.35×10^{11}	1.35×10^{11}	1.35×10^{11}	1.35×10^{11}	1.35×10^{11}
NM0027873	1.34×10^{7}	1.34×10^{7}	1.34×10^{7}	1.34×10^{7}	1.34×10^{7}
NMS000101	3.36×10^{11}	8.41×10^{10}	5.66×10^{10}	2.09×10^{10}	4.67×10^{9}
NMR040000	3.73×10^{10}	9.35×10^{9}	6.29×10^{9}	2.32×10^{9}	5.19×10^{8}
Total Waste Load Allocation	**5.08×10^{11}**	**2.28×10^{11}**	**1.98×10^{11}**	**1.58×10^{11}**	**1.40×10^{11}**
Load Allocation	**3.36×10^{12}**	**8.41×10^{11}**	**5.66×10^{11}**	**2.09×10^{11}**	**4.86×10^{10}**
Margin of Safety	**1.40×10^{12}**	**5.77×10^{11}**	**1.38×10^{11}**	**2.10×10^{11}**	**1.89×10^{9}**

Table 4.12. TMDLs for *E. coli*: Rio Grande (non-Pueblo Alameda Bridge to Angostura Div)

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
TMDL	**5.54×10^{12}**	**1.61×10^{12}**	**-**	**5.85×10^{11}**	**2.96×10^{11}**
NM0023485	1.43×10^{9}	1.43×10^{9}	-	1.43×10^{9}	1.43×10^{9}
NM0027987	9.80×10^{9}	9.80×10^{9}	-	9.80×10^{9}	9.80×10^{9}
NM0029602	1.51×10^{9}	1.51×10^{9}	-	1.51×10^{9}	1.51×10^{9}
NMS000101	5.25×10^{10}	1.52×10^{10}	-	5.43×10^{9}	2.80×10^{9}
NMR040000	2.62×10^{11}	7.59×10^{10}	-	2.71×10^{10}	1.40×10^{10}
Total Waste Load Allocation	**3.28×10^{11}**	**1.04×10^{11}**	**-**	**4.53×10^{10}**	**2.95×10^{10}**
Load Allocation	**4.93×10^{12}**	**1.43×10^{12}**	**-**	**5.10×10^{11}**	**2.63×10^{11}**
Margin of Safety	**2.77×10^{11}**	**8.06×10^{10}**	**-**	**2.92×10^{10}**	**2.96×10^{9}**

The extensive data collection and analyses necessary to determine background *E. coli* loads for the Middle Rio Grande watershed were beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

4.5 Identification and Description of Pollutant Sources

Based on measured loads and potential contributions from existing point sources, probable point and nonpoint pollutant sources that may be contributing to observed *E. coli* loads are displayed in Table 4.13.

Table 4.13. Pollutant Source Summary for *E. coli*

Pollutant Sources	Magnitude (cfu/day)	Assessment Unit	Probable Sources[(a)]
<u>*Point*</u>*:* [(b)]	6.21×10^{9}	Rio Grande (San Marcial at USGS gage to Rio Puerco)	Municipal Point Sources Discharges
	1.66×10^{10}	Rio Grande (Rio Puerco to Isleta Pueblo bnd)	Municipal Point Sources Discharges
	5.08×10^{11} – 3.66×10^{10}	Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)	Municipal Point Sources Discharges
	2.65×10^{11} - 5.91×10^{10}	Rio Grande (non-pueblo Alameda Bridge to Angostura Diversion)	Municipal Point Sources Discharges
<u>*Nonpoint*</u>*:*		Rio Grande (San Marcial at USGS gage to Rio Puerco)	Avian Sources (waterfowl and/or other), Impervious surface/parking lot runoff, municipal (urbanized high density area), natural sources, wastes from pets, On-site Treatment Systems (septic systems and similar decentralized systems).
		Rio Grande (Rio Puerco to Isleta Pueblo bnd)	Avian Sources (waterfowl and/or other), Impervious surface/parking lot runoff, municipal (urbanized high density area), wastes from pets, On-site Treatment Systems (septic systems and similar decentralized systems).
		Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge)	Avian sources (waterfowl and/or other), Impervious surface/parking lot runoff, municipal (urbanized high density area), source unknown, wastes from pets, On-site Treatment Systems (septic systems and similar decentralized systems).
		Rio Grande (non-pueblo Alameda Bridge to Angostura Diversion)	Avian sources (waterfowl and/or other), Impervious surface/parking lot runoff, municipal (urbanized high density area), source unknown, wastes from pets, On-site Treatment Systems (septic systems and similar decentralized systems).

(a) From the 2008-2010 Integrated CWA 303(d)/305(b) Report (NMED/SWQB 2008a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed or quantified at this time.

(b Current probable point source contributions (based on WLA calculations from NPDES permits)

4.6 Linkage Between Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment. The Source Documentation Sheet provides a visual analysis of a pollutant source along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of probable sources of impairment in this watershed. Table 4.17 (Pollutant Source Summary) identifies and quantifies probable sources of nonpoint source impairments along the reach as determined by field reconnaissance and assessment.

Among the probable sources of bacteria are municipal point sources discharges such as wastewater treatment facilities and storm water systems, poorly maintained or improperly installed (or missing) septic tanks, impervious surface/parking lot runoff, livestock grazing of valley pastures and riparian areas, upland livestock grazing, in addition to wastes from pets, waterfowl, and other wildlife. Very high *E. coli* concentrations have been measured in water sampled from SWQB monitoring stations along the Middle Rio Grande. Howell et. al. (1996) found that bacteria concentrations in underlying sediment increase when cattle (*Bos taurus*) have direct access to streams, such as may be the case in parts of the Middle Rio Grande valley. Natural sources of bacteria are also present in the form of other wildlife such as waterfowl, elk, deer, and any other warm-blooded mammals. *E. coli* concentrations may be subject to elevated levels as a result of re-suspension of bacteria laden sediment during storm events. Temperature can also play a role in *E. coli* concentrations. Howell et. al. (1996) observed that bacteria re-growth increases as water temperature increases.

E. coli Data

E. coli data used during the development of this TMDL are shown in Appendix D. Rainfall measurements collected at the NOAA stations at South Bosque del Apache, Los Lunas, Albuquerque, NM were used to identify trends between elevated *E. coli* levels and rainfall. The Pearson correlation coefficient was used to assess whether a statistical association existed between *E. coli* and rainfall. The Pearson correlation coefficient, denoted by *r*, measures the strength and direction of a *linear* relationship between *X* and *Y* variables. Higher r-values indicate stronger correlations between the variables compared.

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

The available data for the Rio Grande (San Marcial at USGS gage to Rio Puerco), shows no relationship between *E. coli* and rainfall events (Figure 4.5, r = -0.01). Data in Table D.4 of Appendix D that show elevated *E. coli* levels occur during both rainfall and non-rainfall events. In fact, of the 63 water quality samples collected in this AU, rainfall was only recorded on four days. On two of those four days, the *E.coli* concentrations were 1000 cfu/100 mL and 520 cfu/100 mL, respectively.

The available data (Table D.3 of Appendix D) for the Rio Grande (Rio Puerco to Isleta Pueblo bnd) shows a positive association between *E. coli* and rainfall events (r = 0.47). This potentially shows that along this segment of the Rio Grande sources of bacteria are delivered to the river partially during rainfall events.

No rainfall was recorded for the day preceding the sampling events in the Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge) AU. The four exceedences of the single sample criteria, ranging from 730-1553 cfu/100 mL, all occurred during non-rainfall events. See Table D.2 of Appendix D for the associated data.

The available data (Table D.1 of Appendix D) for the Rio Grande (non-pueblo Alameda to Angostura Diversion) shows a positive association between *E. coli* and rainfall events (r = 0.77). This potentially shows that along this segment of the Rio Grande sources of bacteria are delivered to the river partially during rainfall events. The highest exceedence of the single sample *E.coli* criteria was 5300 cfu/100 mL and occurred on the one day when rainfall was recorded for the available samples.

SWQB collected *E.coli* samples from seven WWTPs that discharge into the Middle Rio Grande area from July – November 2005. Data in Appendix D show that there were no exceedences of the single sample *E.coli* criterion, except in October and November at Bosque Farms WWTP in the Rio Grande (Rio Puerco to Isleta bnd) AU.

Discussion

The bacteria loading probably originates from a combination of drought-related impacts, municipal wastewater treatment facilities, septic systems and similar decentralized systems, and livestock and wildlife wastes that are transported downstream during runoff events. Additonally, recent national studies show that bacteria concentrations in stormwater runoff are often above the contact recreation standard regardless of the land use in the watershed (Clary *et. al.*, 2008).

The duration curve method, by itself, is limited in the ability to track individual source loadings or relative source contributions within a watershed. Additional analysis is needed to identify pollutant contributions from different types of probable sources and activities (i.e., construction zone versus agricultural area) or individual sources of a similar source category (i.e., WWTF #1 versus WWTF #2). Practitioners interested in more precise source characterization should consider supplementing the duration curve framework with a separate analysis. An added analytical tool might aid in evaluating allocation scenarios and tracking individual sources or source categories. This could allow for improved targeting of restoration activities.

One method of characterizing sources of bacteria is a Bacterial Source Tracking (BST) study. In 2002 a BST study (Parsons, 2005), jointly funded by NMED, Bernalillo County, and Albuquerque Metropolitan Arroyo Flood Control Authority was conducted in the MRG basin from the Angostura Diversion to the Isleta Diversion Dam. The results of the extensive study showed that avian sources were the largest contributor to bacteria in this portion of the Rio Grande, followed by dogs and cats, other wildlife, humans, and livestock. This study has led agencies in the area to fund bacterial remediation projects, such as outreach campaigns designed to encourage pet owners to properly discard of pet waste and storm water quality projects.

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and explicit allocations. Therefore, this MOS is the sum of the following two elements:

Implicit Margin of Safety

Treating *E. coli* as a relatively conservative pollutant, that is a pollutant that does not readily degrade in the environment, was used as a conservative assumption in developing these loading limits.

A more conservative limit of the geometric mean value, rather than the current single sample criterion which allows for higher concentrations in individual grab samples, was used to calculate loading values.

Explicit Margin of Safety

Using a duration curve framework, an explicit MOS can be identified for each listed reach and corresponding set of flow zones. In this TMDL, the MOS was based on the difference between the loading capacity as calculated at the mid-point of each flow zones and the loading capacity calculated at the minimum flow in each zone. Given that the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point, a substantial MOS is provided. This explicit MOS ensures that allocations will not exceed the load associated with the minimum flow in each zone (USEPA 2006).

In some cases, the MOS for the dry and low flow zones was determined using a different method because the lowest flow recorded were very close to zeo. If the MOS was calculated as described above, the MOS would constitute the majority of the target load. In other words, there would not be enough load to allocate to point and nonpoint sources under this flow regime. In particular, this was the case with all flow regimes in the Rio Grande (non-pueblo Alameda Street Bridge to Angostura Diversion) assessment unit. Similar to previous SWQB bacteria TMDLs which were based on 4Q3 low-flows, there is inherent error in all flow measurements. A conservative MOS of **5 percent** was therefore explicitly allocated to the low flow hydrologic zone.

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc). As new information becomes available, this unallocated capacity may be attributed to nonpoint sources including tributary streams (which could then be added to the load allocation); or it may be attributed to point sources (and become part of the waste load allocations).

4.8 Consideration of Seasonal Variability

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Seasonal variation was accounted for in these TMDLs by using 25 years of USGS flow records when estimating flows to develop flow exceedence percentiles.

During the 2004 water quality survey, bacteria exceedences occurred during spring, summer, and fall months. Higher flows may flush more nonpoint source runoff containing *E. coli*. It is also possible the water quality criterion may be exceeded under a low flow condition when there is insufficient dilution of a point source. The use of duration curves provides a technical framework for identifying *"daily loads"* in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates during different seasons. Allocations within the TMDL are set in a way that reflects dominant concerns associated with appropriate hydrologic conditions.

4.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2035. Table 4.14 shows the population estimates for the counties discussed in this TMDL.

Table 4.14 Population Estimates by County

County	2007*	2015	2025	2035	% Increase (2007-2035)
Sandoval	123,694	144,087	182,592	217,806	43
Bernalillo	644,023	811,861	993,650	1,166,590	45
Valencia	75,807	89, 045	107,294	123,212	38
Socorro	18,788	20,012	21, 167	21,837	14

**estimate revised 11/2008*

The MRG AUs experienced impacts from both point and nonpoint sources depending on the flow conditions. Estimates of future growth are not anticipated to lead to a significant increase in bacteria concentrations that cannot be controlled with BMP implementation and appropriate NPDES permit limits in this watershed. However, it is imperative that BMPs continue to be utilized and improved upon in this watershed while continuing to improve watershed conditions and adhering to SWPPP requirements related to construction and industrial activities covered under the general permit. The existing Middle Rio Grande-Albuquerque Reach Watershed Restoration Action Strategy (Middle Rio Grande-Albuquerque Reach Watershed Group, 2008) defines framework for design, implementation, and maintenance of BMPs in the northern portion of the watershed addressed by this TMDL. Section 6.0 provides details on this WRAS.

5.0 MONITORING PLAN

Pursuant to Section 106(e)(1) of the Federal CWA, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State.

The monitoring strategy establishes methods for 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: to develop 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 monitored each year with an established return frequency of approximately every eight years. Based on an 8-year rotation throughout the state, the next tentatively scheduled monitoring date for the Middle Rio Grande watershed is 2013. The SWQB maintains current quality assurance and quality control plans for the respective sample year to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6. In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program. Current priorities for monitoring in the SWQB are driven by the CWA Section 303(d) list of streams requiring TMDLs. Short-term efforts were directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997), however NMED/SWQB completed the final remaining TMDL on the consent decree in December 2006 and USEPA approved this TMDL in August 2007. The U.S. District Court dismissed the Consent Decree on April 21, 2009.

Once assessment monitoring is completed, those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, water quality surveys of priority assessment units (including biological assessments), and compliance monitoring of industrial, federal, and municipal dischargers, as specified in the SWQB assessment protocols (NMED/SWQB 2008b).

Long-term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which is revisited approximately every eight years. This information will provide time relevant information for use in CWA Section 303(d) listing and 305(b) report assessments and to support the need for developing TMDLs. The approach provides:

- a systematic, detailed review of water quality data which 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 which allows for enhanced coordinated efforts with other programs; and
- program efficiency and improvements in the basis for management decisions.

SWQB routinely develops a 10-year monitoring strategy and submits it to USEPA. The strategy details both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. According to the rotational cycle, which assumes the existing level of resources, the next time SWQB will sample the Middle Rio Grande watershed is during 2013.

It should be noted that a watershed would not be ignored during the years in between sampling. The rotating basin program will be supplemented with other data collection efforts such as the funding of long-term USGS water quality gaging stations for long-term trend data, and on-going studies being performed by USGS and USEPA. Data will be analyzed and field studies will be conducted to further characterize acknowledged problems and TMDLs will be developed and implemented accordingly. Both long-term monitoring and short-term water quality surveys can both contribute to the State's Integrated §303(d)/§305(b) listing process for waters requiring TMDLs.

6.0 IMPLEMENTATION OF TMDLS

6.1 WRAS and BMP Coordination

Watershed public awareness and involvement will be crucial to the successful implementation of these plans to improve water quality. Staff from SWQB have worked with stakeholders to develop a WRAS for the Middle Rio Grande Watershed north of Isleta Pueblo (MRG-Albuquerque Reach Watershed Group, 2008). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It details opportunities for private landowners and public agencies to reduce and prevent impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving constituent levels consistent with New Mexico's WQS, and will be used to prevent water quality impacts in the watershed. The WRAS is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WRAS leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

Specifically, a watershed group was formed consisting of technical experts, traditional, rural and urban water users, and members of surface water regulatory agencies. The watershed group utilized the *Middle Rio Grande Microbial Source Tracking Study* (Parsons, 2005) as a key reference in the planning and writing of the WRAS. Two other surface water quality studies utilized include the *Middle Rio Grande Total Maximum Daily Load (TMDL) for Fecal Coliform in Storm Water* (NMED/SWQB, 2002), and the *City of Albuquerque Antibiotic Resistance Analysis of Contamination in Storm Water Final Report* (City of Albuquerque, 2002).

The Watershed Group, using these studies and input from a broad range of stakeholders, developed a multi-phased and multi-tiered approach to reduce non-point source storm water pollution. The approach consists of a framework of four goals, listed below:

1. The 2002 TMDL for fecal coliform in storm water for the Albuquerque reach of the Rio Grande is being addressed through education, engineering, and enforcement.
2. There is increased public understanding of watershed approaches and increased participation in water quality improvement activities.
3. Water quality data is shared across jurisdictions to facilitate project implementation.
4. Regulations and local policies support watershed improvement initiatives.

The Watershed Group and NMED are developing a new 319-funded project that includes, among other tasks, revision of the WRAS to utilize information developed for this revised TMDL, and to more clearly address the planning elements identified by EPA in the *Nonpoint Source Program and Grants Guidelines for States and Territories* (EPA, 2003) . SWQB staff will continue to assist with technical assistance such as selection and application of BMPs and estimating load reductions associated with BMPs needed to meet WRAS goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholders in this process will include SWQB as well as land owners, and other agencies in the implementation of this TMDL.

Implementation of BMPs within the watershed to reduce pollutant loading from nonpoint sources will be encouraged. Any reductions from point sources will be addressed in revisions to NPDES discharge permits. SWQB will communicate to designated federal land management agencies the intent of the TMDL and desire that BMPs be developed through the above coordination process.

6.2 Clean Water Act §319(h) Funding Opportunities

The Watershed Protection Section of the SWQB manages a grant program of CWA §319(h) funding to assist in planning and implementation of BMPs to address water quality problems on reaches listed as Category 4 or 5 waters (ie: impaired waters) on the Integrated CWA §303(d)/§305(b) list. These monies are available to all private, for profit and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: municipalities, counties, tribal entities, Federal agencies, or agencies of the State. Proposals are submitted by applicants at least once a year through a Request for Proposal (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is available for both projects to develop watershed plans and on-the-ground projects to implement those plans.

South of Isleta Pueblo, the Watershed Protection Section will begin with initial outreach to inform stakeholders of the significance of the TMDL, and will include the affected assessment units among eligible stream reaches in RFPs for watershed planning projects. Once a watershed plan meeting the nine elements identified in the *Nonpoint Source Program and Grants Guidelines for States and Territories* (USEPA, 2003) has been developed, projects to address the load allocation portions of the TMDL will be eligible for funding with Section 319 funds.

Further information on New Mexico's Nonpoint Source Management Program and funding from the CWA §319 (h) can be found at the SWQB website: http://www.nmenv.state.nm.us/swqb.

6.3 Other Funding Opportunities and Restoration Efforts in the Middle Rio Grande Basin

Development of a watershed plan is expected to increase eligibility for other funding sources as well. The New Mexico Nonpoint Source Management Program utilizes locally-driven stakeholder processes to develop watershed plans, and as such implementation of the watershed plan should have the support of staff of agencies and organizations with specific relevant responsibilities in the area. Several other sources of funding exist to address impairments discussed in this TMDL document. NMED's Construction Programs Bureau assists communities in need of funding for WWTP upgrades and improvements to septic tank configurations (such as the design of cluster systems). The Construction Programs Bureau can also provide matching funds for appropriate CWA §319(h) projects using state revolving fund monies. The United States Department of Agriculture (USDA) Environmental Quality Incentive Program (EQIP) program can provide assistance to agricultural producers in the basin. The Bureau of Land Management and USDA Forest Service align their missions to protect lands they manages with the TMDL process, and are additional potential sources of assistance.

Note: *Section 6.4 is standardized language regarding MS4 allocations and MS4 permits added at the request of EPA Region 6. It is the responsibility of EPA Permit Writers to develop a permit that complies with the allocations provided in the TMDL. The exact manner in which this in implemented (specific BMPs, numeric effluent limits etc.) to achieve this goal is up to the discretion of the EPA permit writer and need not follow this implementation guidance.*

6.4 Storm water permitting Requirements and Presumptive Best Management Practices (BMPs) Approach

A. Background

The National Pollutant Discharge Elimination System (NPDES) permitting program for stormwater discharges was established under the Clean Water Act as the result of a 1987 amendment. The Act specifies the level of control to be incorporated into the NPDES stormwater permitting program depending on the source (industrial versus municipal). These programs contain specific requirements for the regulated communities/facilities to establish a comprehensive stormwater management program (SWMP) or storm water pollution prevention plan (SWPPP) to implement any requirements of the total maximum daily load (TMDL) allocation. [See 40 CFR §130.]

Storm water discharges are highly variable both in terms of flow and pollutant concentration, and the relationships between discharges and water quality can be complex. For municipal stormwater discharges in particular, the current use of system-wide permits and a variety of jurisdiction-wide BMPs, including educational and programmatic BMPs, does not easily lend itself to the existing methodologies for deriving numeric water quality-based effluent limitations. These methodologies were designed primarily for process wastewater discharges which occur at predictable rates with predictable pollutant loadings under low flow conditions in receiving waters. EPA has recognized these problems and developed permitting guidance for stormwater permits. (USEPA, 1996)

Due to the nature of storm water discharges, and the typical lack of information on which to base numeric water quality-based effluent limitations (expressed as concentration and mass), EPA recommends an interim permitting approach for NPDES storm water permits which is based on BMPs. "The interim permitting approach uses best management practices (BMPs) in first-round storm water permits, and expanded or better-tailored BMPs in subsequent permits, where necessary, to provide for the attainment of water quality standards." (*ibid.*)

A monitoring component is also included in the recommended BMP approach. "Each storm water permit should include a coordinated and cost-effective monitoring program to gather necessary information to determine the extent to which the permit provides for attainment of applicable water quality standards and to determine the appropriate conditions or limitations for subsequent permits." (*ibid.*) This approach was further elaborated in an EPA guidance memo (USEPA, 2002): "The policy outlined in this memorandum affirms the appropriateness of an iterative, adaptive management BMP approach, whereby permits include effluent limits (e.g., a combination of structural and nonstructural BMPs) that address storm water discharges, implement mechanisms to evaluate the performance of such controls, and make adjustments (i.e., more stringent controls or specific BMPs) as necessary to protect water quality. …… If it is determined that a BMP approach (including an iterative BMP approach) is appropriate to meet the storm water component of the TMDL, EPA recommends that the TMDL reflect this." This BMP-based approach to stormwater sources in TMDLs is also recognized and described in the most recent EPA guidance (USEPA, 2008).

This TMDL adopts the EPA recommended approach and relies on appropriate BMPs for implementation. No numeric effluent limitations are required or anticipated for municipal stormwater discharge permits.

B. SPECIFIC SWMP/SWPPP REQUIREMENTS

As noted in Section 4.0 of the TMDL, National Pollutant Discharge Elimination System (NPDES)-permitted facilities and non-point sources (e.g., wildlife, agricultural activities and domesticated animals, urban runoff, failing onsite wastewater disposal system, and domestic pets) could contribute to exceedences of the water quality criteria. In particular, stormwater runoff from the Phase 1 and II municipal separate storm sewer systems (MS4s) is likely to contain elevated bacteria concentrations. Permits for these discharges must comply with the provisions of this TMDL. Table 4.7 provides a list of Phase 1 and II MS4s that are affected by this TMDL.

Agricultural activities and other nonpoint sources of bacteria are unregulated. Voluntary measures and incentives should be used and encouraged wherever possible and such sources should strive to attain the loads established in this TMDL.

To ensure compliance with the TMDL requirements under the permit, stormwater permittees must develop strategies designed to achieve progress toward meeting the loads established in the TMDL. Relying primarily upon a Best Management Practices (BMP) approach, permittees should take advantage of existing information on BMP performance and select a suite of BMPs appropriate to the local community that are expected to result in progress toward meeting the loads established in the TMDL. The permittee should provide guidance on BMP installation and maintenance, as well as a monitoring and/or inspection schedule.

After EPA approves the final TMDL, existing MS4 permittees will be notified of the TMDL provisions and schedule. Industrial stormwater permittees are not expected to be a significant source of bacteria but if any are identified, similar actions will be required. Compliance with the following provisions will constitute compliance with the WLA requirements of this TMDL.

1. Develop A Bacteria Reduction Plan

Permittees should consider submitting an approvable Bacteria Reduction Plan to the EPA within 12 months of notification. Unless disapproved within 60 days of submission, the plan should be approved then implemented by the permittee. This plan shall, at a minimum, include the following:

a. Consideration of ordinances or other regulatory mechanisms to require bacteria pollution control, as well enforcement procedures for noncompliance;
b. Evaluation of the existing SWMP in relation to TMDL loads;
c. An evaluation to identify potential significant sources of bacteria entering your MS4.
d. Develop (or modify an existing program as necessary) and implement a program to reduce the discharge of bacteria in municipal storm water contributed by any other significant source identified in the source identification evaluation
e. Educational programs directed at reducing bacterial pollution. Implement a public education program to reduce the discharge of bacteria in municipal storm water contributed (if applicable) by pets, recreational and exhibition livestock, and zoos;
f. Investigation and implementation of BMPs that prevent additional storm water bacteria pollution associated with new development and re-development;
g. Develop (or modify an existing program as necessary) and implement a program to reduce the discharge of bacteria in municipal storm water contributed by areas within your MS4 served by on-site wastewater treatment systems
h. Implementation of BMPs applicable to bacteria. EPA can provide summary information on some BMPs that should be considered. Permittees are not limited to BMPs on this list and should select BMPs appropriate to the local community that are expected to result in progress toward meeting the loads established in the TMDL.
i. Modifications to the dry weather field screening and illicit discharge detection and elimination provisions of the SWMP to consider storm water sampling and other measures intended to specifically identify bacterial pollution sources and high priority areas for bacteria reductions.
j. Periodic evaluation of the effectiveness of the bacteria reduction plan to ensure progress toward attainment of water quality standards.
k. An implementation schedule leading to modification of the SWMP and full implementation of the plan within 3 years of notification.

2. Develop Or Participate In A Bacteria Monitoring Program

Permittees may participate in a coordinated regional bacteria monitoring program or develop their own individual program. The monitoring program should be designed to establish the effectiveness of the selected BMPs and demonstrate progress toward achieving the loads of the TMDL and eventual attainment of water quality standards.

a. Within 18 months of notification, the permittee should prepare and submit to the EPA either a TMDL monitoring plan or a commitment to participate in a coordinated regional monitoring program. Unless disapproved by the Director within 60 days of submission, the plan should be approved then implemented by the permittee. The plan or program should include:
b. A detailed description of the goals, monitoring, and sampling and analytical methods;
c. A list and map of the selected TMDL monitoring sites;
d. The frequency of data collection to occur at each station or site;

e. The parameters to be measured, as appropriate for and relevant to the TMDL;
f. A Quality Assurance Project Plan that complies with EPA requirements (EPA, 2001)
g. The monitoring program should be fully implemented within 3 years of notification.

3. Annual Reporting

The permittee should include a TMDL implementation report as part of their annual report. The TMDL implementation report should include the status and actions taken by the permittee to implement the Bacteria Reduction Plan and monitoring program. The TMDL implementation report should document relevant actions taken by the permittee that affect MS4 storm water discharges to the waterbody segment that is the subject of the TMDL. This TMDL implementation report also should identify the status of any applicable TMDL implementation schedule milestones.

7.0 ASSURANCES

New Mexico's Water Quality Act (Act) authorizes the WQCC to "promulgate and publish regulation to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. (§74-6-10(A) NMSA 1978) Several statutory provisions on nuisance law could also be applied to nonpoint source water pollution. The Water Quality Act 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 Subsection C of 20.6.4.62) (NMAC 2007) state:

> *Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to 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 319 Program has been developed in a coordinated manner with the State's 303(d) process. All 319 watersheds that are targeted in the annual RFP process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a nonpoint source. Proving causation by a nonpoint source of a violation of a water quality standard would be very difficult, and to date NMED has not brought an enforcement action on this basis. Instead, the NMED nonpoint source water quality management program has historically strived for and will continue to promote voluntary compliance to nonpoint source water pollution concerns by utilizing a voluntary, cooperative approach. NMED believes this is the best and most effective approach to addressing impairment of streams as a result of nonpoint source issues. The State provides technical support and grant monies for implementation of BMPs and other nonpoint source prevention mechanisms through §319 of the Clean Water Act. Since portions of this TMDL will be implemented through nonpoint source control mechanisms, the New Mexico Watershed Protection Program will target its efforts towards this and other watersheds with TMDLs.

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

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate includes watershed projects that may not be starting immediately, and also contemplates response to earlier projects. This timeframe is intended to provide some measure of watershed response to projects but is not intended to be a fixed goal. Stakeholders in this process will include SWQB, and other stakeholders involved with the development and implementation of the WRAS. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

8.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL (Figure 8.1). The draft TMDL will be made available for a 45-day comment period on September 16, 2009. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to the Albuquerque Journal, Santa Fe New Mexican, and El Defensor Chieftain. TMDL staff presented the TMDL to the Middle Rio Grande Water Quality Workgroup on Tuesday, September 22, 2009 at 9am. A public meeting was be held on Tuesday, September 29, 2009 in Albuquerque, NM at the NMED District 1 Offices from 6-8pm. Eight sets of comments were received and the Response to Comments are included as Appendix E of this document.

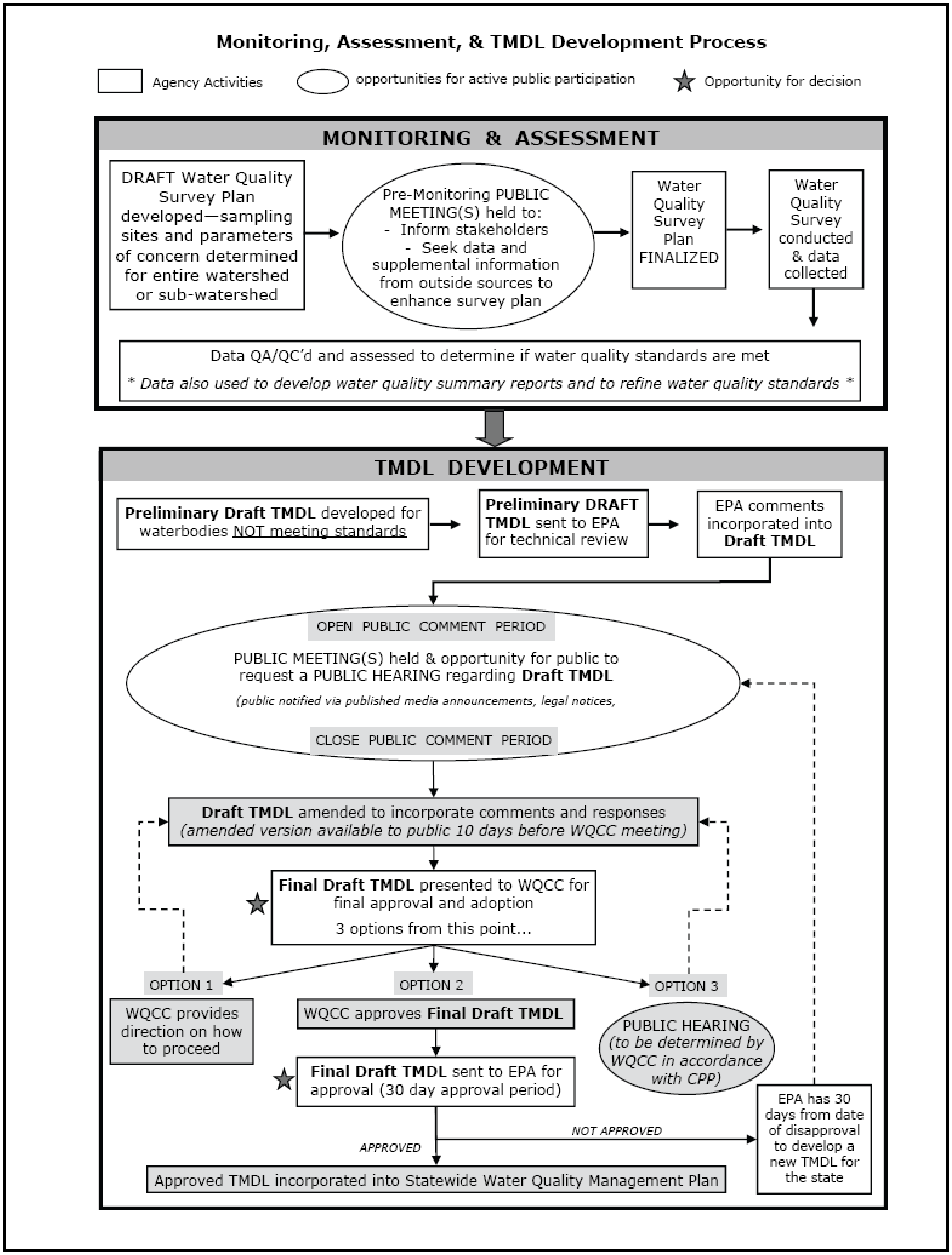

Figure 8.1. SWQB TMDL Public Participation Process

9.0 REFERENCES

Chronic, Halka. 1987. Roadside Geology of New Mexico. Mountain Press Publishing Company, Missoula.

City of Albuquerque, 2002. Antibiotic Resistance Analysis of Contamination in Stormwater Final Report. Prepared by CDM.

Clary, J., J.E. Jones, B.R. Urbonas, M.M. Quigley, E. Strecker, T. Wagner. 2008. *Can Stormwater BMPs Remove Bacteria?* Stormwater Journal. May 2008.

Cleland, B.R. November 2003. *TMDL Development from the "Bottom Up" -- Part III: Duration Curves and Wet-Weather Assessments*. National TMDL Science and Policy 2003 -- WEF Specialty Conference. Chicago, IL.

Howell, J.M., M.S. Coyne and P.L. Cornelius. 1996. Effect of sediment particle size and temperature on fecal bacteria mortality rates and the fecal coliform/fecal streptococci ratio. Journal Environmental Quality 25:1216-1220.

Middle Rio Grande-Albuquerque Reach Watershed Group. 2008. Middle Rio Grande-Albuquerque Reach Watershed Restoration Action Strategy (WRAS). ftp://ftp.nmenv.state.nm.us/www/swqb/WPS/WRAS/MiddleRioGrandeWRAS12-2008.pdf

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP). July 2004. *Water* Acquisition and Management Subcommittee Position Paper: Supplementing Middle Rio Grande Flows through Pumping from the Low Flow Conveyance Channell (LFCC). Online: http://www.middleriogrande.com/LinkClick.aspx?fileticket=N%2Brw1KXbMh8%3D&tabid=276&mid=688

New Mexico Environment Department/Surface Water Quality Bureau (NMED/SWQB). 2002. Middle Rio Grande TMDL for Fecal Coliform. Santa Fe, NM.

———. 2007. *TMDL for the Rio Puerco Watershed- Part 2*. Surface Water Quality Bureau. Santa Fe, NM. http://www.nmenv.state.nm.us/SWQB/RioPuerco2/index.html

———. 2008a. *State of New Mexico 2008-20010 Integrated Clean Water Act §303(D)/ §305(B) List of Assessed Waters*.

———. 2008b. *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report*. January.

———. 2009a. Quality Assurance Project Plan for Water Quality Management Programs. Surface Water Quality Bureau. Santa Fe, NM.

———. 2009b. Water Quality Monitoring of the Middle Rio Grande: 2000-2007 Surface Water Quality Bureau. Santa Fe, NM.

New Mexico Administrative Code (NMAC). August 2007. *State of New Mexico Standards for Interstate and Intrastate Surface Waters*. 20.6.4. New Mexico Water Quality Control Commission.

Parsons Water & Infrastructure, Inc, 2005. Middle Rio Grande Microbial Source Tracking Assessment Report. Available online: http://www.nmenv.state.nm.us/swqb/Rio_Grande/Middle/MST/index.html

Price, L.G, P.S. Johnson, and D. Bland. 2007. *Water Resources of the Middle Rio Grande-San Acacia to Elephant Butte.* Proceedings, Decision-Makers Field Conference, 2007.

Pueblo of Isleta. 2002. *Pueblo of Isleta Surface Water Quality Standards.* Amended March 2002 (Tribal Resolution 02-064), USEPA approval July 2005. Online: http://www.epa.gov/waterscience/standards/wqslibrary/tribes/isleta_6_wqs.pdf

Pueblo of Sandia. 2008. *Pueblo of Sandia Water Quality Standards*. Revised January 31, 2008.

Rivera, Jose A. 1999. *Water Democracies on the Upper Rio Grande: 1598-1998*. Proceedings from Rio Grande Ecosystems: Linking Land, Water, and People RMRS-P-7.

Scurlock, Dan. 1998. From the Rio to the Sierra: An Environmental History of the Middle Rio Grande Basin. USDA General Technical Report RMRS-GTR-5, Fort Collins, Colorado. 440pp.

U.S. District Court for the District of New Mexico. 1997. *Forest Guardians and Southwest Environmental Center (Plaintiffs) v. Carol Browner, in her official capacity as Administrator, EPA (Defendant): Joint Motion for Entry of Consent Decree*. April 29. Online at www.nmenv.state.nm.us/swqb/CDNM.html.

U.S. Bureau of Reclamation (USBR). May 2007. *Middle Rio Grande River Maintenance Plan: Part 1 Report.* Online at: http://www.usbr.gov/uc/albuq/envdocs/reports/mrgRivMaint/MaintenancePlan-Pt1-Report.pdf

U.S. Environmental Protection Agency (USEPA). 1996. Interim Permitting Approach for Water Quality-Based Effluent Limitations in Stormwater Permits (EPA-833-D-96-00).

———. 1999. Draft Guidance for Water Quality-based Decisions: The TMDL Process (Second Edition). EPA 841-D-99-001. Office of Water, Washington, D.C. August.

———. 2001. EPA Requirements for Quality Assurance Project Plans (EPA/240/B-01/003).

———. 2002. Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit requirements Based on Those WLAs.

———. 2003. Nonpoint Source Program and Grants Guidelines for States and Territories. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2003_register&docid=fr23oc03-39.pdf.

———. 2006. *DRAFT:* An Approach for Using Load Duration Curves in Developing TMDLs. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, D.C.

———. 2007. An Approach for Using Load Duration Curves in the Development of TMDLs. (EPA 841-B-07-006) http://www.epa.gov/OWOW/TMDL/duration_curve_guide_aug2007.pdf

———. 2008. TMDLs To Stormwater Permits Handbook" (DRAFT).

———. 2009. "Procedures for Implementing National Pollutant Discharge Elimination System Permits in New Mexico", July 23, 2009. Prepared by Permits Section, NPDES Permits Branch, Water Quality Protection Division, EPA Region 6. In consultation with the Surface Water Quality Bureau, New Mexico Environment Department.

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APPENDIX A
CONVERSION FACTOR DERIVATION

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Flow (as million gallons per day [MGD]) and concentration values (milligrams per liter [mg/L]) must be multiplied by a conversion factor in order to express the load in units "pounds per day." The following expressions detail how the conversion factor was determined:

TMDL Calculation:

$$Flow\left(MG/day\right)\times Concentration\left(\frac{mg}{L}\right)\times CF\left(\frac{L-lb}{MG-mg}\right)=Load\left(\frac{lb}{day}\right)$$

Conversion Factor Derivation:

$$CF = 10^{6}\ gal/MG\times\frac{3.785\,L}{gal}\times\frac{1\,lb}{454{,}000\,mg}=8.34\,\frac{L-lb}{MG-mg}$$

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APPENDIX B
SELECTIONS FROM 2008-2010 CWA §303 (d)/305(b) List

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Rio Grande (non-pueblo Alameda Bridge to Angostura Div) Rio Grande-Albuquerque

Assessment Unit ID:	Size (mi or ac):	WQS reference:	Monitoring Schedule:	Cycle Last Assessed:	IR Category:
NM-2105.1_00	11.66	20.6.4.106	2013	2008	5/5C

Use Information:

Designated Use (s):	Attainment:
Irrigation	Fully Supporting
Livestock Watering	Fully Supporting
Marginal Warmwater Aquatic Life	Not Supporting
Secondary Contact	Not Supporting
Wildlife Habitat	Fully Supporting

Assessment Information:

Probable Causes of Impairment:	TMDL Schedule:
Ambient Bioassays – Acute Aquatic Toxicity	2009
E. coli	2009
Oxygen, Dissolved	2009

Probable Sources of Impairment:

Avian Sources (waterfowl and/or other)
Impervious Surface/Parking Lot Runoff
Municipal (Urbanized High Density Area)
Municipal Point Source Discharges
On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
Source Unknown
Wastes from Pets

Assessment Unit Comments:

TMDL for fecal coliform. De-listed for fecal coliform because this criteria was replaced with E. coli during the 2005 trienniel. The dissolved oxygen impairment may indicate excessive nutrients. Protocols for nutrients in large rivers are under development.

NOTE (2/13/09): EPA's Record of Decision states that "EPA concludes that the *public participation process* regarding the listing of two assessment units/dissolved oxygen pollutant combinations, i.e., NM-2105_50 and NM-2105.1_00, is inconsistent with federal requirements and the New Mexico Water Quality Control Commission Continuing Planning Process (CPP) and Water Quality Management Plan (WQMP). ...Consequently, EPA is taking a disapproval action and de-listing these assessment units/dissolved oxygen pollutant-combinations." EPA requested that NMED Public Notice the addition of these assessment units/dissolved oxygen pollutant-combination to the New Mexico § 303(d) List during either an addendum to the 2008 Integrated List or during the New Mexico 2010 Integrated List submission.

Assessment Unit ID:	Size (mi or ac):	WQS reference:	Monitoring Schedule:	Cycle Last Assessed:	IR Category:
NM-2105_50	20.4	20.6.4.105	2013	2008	5/5B

Use Information:

Designated Use (s):	Attainment:
Irrigation	Fully Supporting
Livestock Watering	Fully Supporting
Marginal Warmwater Aquatic Life	Not Supporting
Secondary Contact	Not Supporting
Wildlife Habitat	Fully Supporting

Assessment Information:

Probable Causes of Impairment:	TMDL Schedule:
E. coli	2009
Oxygen, Dissolved	2009

Probable Sources of Impairment:

Avian Sources (waterfowl and/or other)
Impervious Surface/Parking Lot Runoff
Municipal (Urbanized High Density Area)
Municipal Point Source Discharges
On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
Source Unknown
Wastes from Pets

Assessment Unit Comments:

TMDL for fecal coliform. De-listed for fecal coliform because this criteria was replaced with E. coli during the 2005 triennel. The dissolved oxygen impairment may indicate excessive nutrients. Protocols for nutrients in large rivers are under development.

NOTE (2/13/09): EPA's Record of Decision states that "EPA concludes that the *public participation process* regarding the listing of two assessment units/dissolved oxygen pollutant combinations, i.e., NM-2105_50 and NM-2105.1_00, is inconsistent with federal requirements and the New Mexico Water Quality Control Commission Continuing Planning Process (CPP) and Water Quality Management Plan (WQMP). ...Consequently, EPA is taking a disapproval action and de-listing these assessment units/dissolved oxygen pollutant-combinations." EPA requested that NMED Public Notice the addition of these assessment units/dissolved oxygen pollutant-combination to the New Mexico § 303(d) List during either an addendum to the 2008 Integrated List or during the New Mexico 2010 Integrated List submission.

Rio Grande (Rio Puerco to Isleta Pueblo bnd) — Rio Grande-Albuquerque

Assessment Unit ID:	Size (mi or ac):	WQS reference:	Monitoring Schedule:	Cycle Last Assessed:	IR Category:
NM-2105_40	35.4	20.6.4.105	2013	2008	5

Use Information:

Designated Use (s):	Attainment:
Irrigation	Fully Supporting
Livestock Watering	Fully Supporting
Marginal Warmwater Aquatic Life	Fully Supporting
Secondary Contact	Not Supporting
Wildlife Habitat	Fully Supporting

Assessment Information:

Probable Causes of Impairment:	TMDL Schedule:
E. coli	2009

Probable Sources of Impairment:

Avian Sources (waterfowl and/or other)
Impervious Surface/Parking Lot Runoff
Municipal (Urbanized High Density Area)
Municipal Point Source Discharges
On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
Wastes from Pets

Assessment Unit Comments:

Rio Grande (San Marcial at USGS gage to Rio Puerco) — Rio Grande-Albuquerque

Assessment Unit ID:	Size (mi or ac):	WQS reference:	Monitoring Schedule:	Cycle Last Assessed:	IR Category:
NM-2105_10	59.39	20.6.4.105	2013	2008	5

Use Information:

Designated Use (s):	Attainment:
Irrigation	Fully Supporting
Livestock Watering	Fully Supporting
Marginal Warmwater Aquatic Life	Not Supporting
Secondary Contact	Not Supporting
Wildlife Habitat	Fully Supporting

Assessment Information:

Probable Causes of Impairment:	TMDL Schedule:
Aluminum	2009
E. coli	2009

Probable Sources of Impairment:

Avian Sources (waterfowl and/or other)
Impervious Surface/Parking Lot Runoff
Municipal (Urbanized High Density Area)
Municipal Point Source Discharges
Natural Sources
On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
Wastes from Pets

Assessment Unit Comments:

APPENDIX C
Aluminum Data

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Table F.1- Rio Grande (San Marcial to Rio Puerco)

Station	Date	Result (mg/L)	Flow (cfs) [1]
32RGrand323.4	3/30/2005	0.02	608
32RGrand341.2	3/30/2005	0.03	608
32RGrand292.1	3/30/2005	0.02	608
32RGrand341.2	4/28/2005	0.06	3880
32RGrand323.4	4/28/2005	**0.21**	3880
32RGrand292.1	4/28/2005	**0.16**	3880
32RGrand323.4	5/17/2005	0.09	4190
32RGrand341.2	5/17/2005	**0.13**	4190
32RGrand292.1	5/18/2005	0.02	4170
32RGrand292.1c	5/18/2005	0.07	4170
32RGrand258.0	6/21/2005	0.06	3290
32RGrand292.1	6/21/2005	0.07	3290
32RGrand292.1c	6/21/2005	**0.1**	3290
32RGrand323.4	6/21/2005	0.08	3290
32RGrand341.2	6/22/2005	**1.7**	3200
32RGrand292.1	7/26/2005	0.01	0.0001
32RGrand292.1c	7/26/2005	0.01	0.0001
32RGrand323.4	7/26/2005	<0.01	0.0001
32RGrand341.2	7/26/2005	**0.2**	0.0001
32RGrand258.0	8/23/2005	**0.8**	108
32RGrand323.4	8/23/2005	<0.01	108
32RGrand341.2	8/23/2005	0.01	108
32RGrand292.1	9/27/2005	<0.01	0.001
32RGrand323.4	9/27/2005	<0.01	0.001
32RGrand341.2	9/27/2005	<0.02	0.001
32RGrand258.0	10/25/2005	**1.5**	188
32RGrand323.4	10/25/2005	0.02	188
32RGrand341.2	10/25/2005	0.01	188

Red values indicate those above the water quality standard.
[1] USGS Gage 8358400-Rio Grande Floodway at San Marcial, NM

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APPENDIX D
***E.coli* Data**

Table D.1- Rio Grande (non-Pueblo Alameda Bridge to Angostura Diversion)

Station	Date	Result (cfu/100mL)	Flow (cfs)[1]	Rainfall (inches)[2]
USGS 8329918	2/18/2004	**480**	408	0
USGS 8329918	4/26/2004	**110**	953	0
USGS 8329918	7/20/2004	**50**	528	0
USGS 8329918	11/9/2004	**>5300**	504	0.03
30RGrand473.7	3/23/2005	10.8	928	0
32RGrand464.2	3/23/2005	11	928	0
32RGrand458.0	3/23/2005	13.4	928	0
32RGrand445.4	3/23/2005	41.4	928	0
USGS 8329918	5/5/2005	<8	4070	0
30RGrand473.7	5/26/2005	27.5	5580	0
32RGrand464.2c	5/26/2005	32.7	5580	0
32RGrand464.2	5/26/2005	42.8	5580	0
32RGrand458.0	5/26/2005	42.6	5580	0
32RGrand445.4c	5/26/2005	40.4	5580	0
32RGrand445.4	5/26/2005	47.3	5580	0
30RGrand473.7	6/23/2005	13.4	4300	0
32RGrand464.2c	6/23/2005	23.1	4300	0
32RGrand464.2	6/23/2005	22.6	4300	0
32RGrand458.0	6/23/2005	35	4300	0
32RGrand445.4c	6/23/2005	81.3	4300	0
32RGrand445.4	6/23/2005	**249.5**	4300	0
30RGrand473.7	7/27/2005	**98.5**	463	0
32RGrand464.2	7/27/2005	**488.4**	463	0
32RGrand464.2c	7/27/2005	**325.5**	463	0
32RGrand458.0	7/27/2005	41.1	463	0
32RGrand445.4	7/27/2005	62.2	463	0
32RGrand445.4c	7/27/2005	41.7	463	0
USGS 8329918	8/24/2005	<100	474	0
30RGrand473.7	8/24/2005	52.1	474	0
32RGrand464.2c	8/24/2005	50.4	474	0
32RGrand458.0	8/24/2005	7.2	474	0
32RGrand445.4c	8/24/2005	77.6	474	0
32RGrand445.4	9/28/2005	**149.7**	541	0
32RGrand458.0	9/28/2005	**90.9**	541	0
32RGrand464.2	9/28/2005	**95.9**	541	0
30RGrand473.7	9/28/2005	**90.9**	541	0
32RGrand445.4	10/26/2005	**231**	299	0
32RGrand458.0	10/26/2005	**133.4**	299	0
32RGrand464.2	10/26/2005	**153.9**	299	0
30RGrand473.7	10/26/2005	63.1	299	0
USGS 8329918	12/12/2005	**1000**	518	0
USGS 8329918	4/25/2006	**670**	555	0
USGS 8329918	8/15/2006	**4100**	1980	0
USGS 8329918	12/5/2006	<1	825	0
USGS 8329918	5/4/2007	**>180**	2280	0

Red values indicate those above the State and Tribal water quality standard.
Blue values indicate those above the Tribal water quality standards.
[1] USGS gage 0829928
[2] Angostura NMSU weather site. Rainfall data for the previous day was used.

Table D.2- Rio Grande (Isleta Pueblo bnd to Alameda Bridge)

Station	Date	Result (cfu/100mL)	Flow (cfs)[1]	Rainfall (inches)[2]
USGS 8330000	12/8/2004	**1000**	859	0
32RGrand419.7	3/23/2005	43.5	873	0
USGS 8330000	4/8/2005	<47	1100	0
32RGrand419.7	5/26/2005	40.4	5610	0
32RGrand419.7	6/22/2005	**1553.1**	4230	0
USGS 8330000	7/7/2005	20	1290	0
32RGrand419.7	7/27/2005	**245.3**	392	0
USGS 8330000	8/12/2005	**1000**	486	0
32RGrand419.7	8/24/2005	**290.9**	363	0
32RGrand419.7	9/28/2005	**275.5**	393	0
32RGrand419.7	10/26/2005	**290.9**	281	0
USGS 8330000	2/22/2006	>2	570	0
USGS 8330000	5/17/2006	28	554	0
USGS 8330000	7/19/2006	>1	498	0
USGS 8330000	5/8/2007	**120**	2530	0
USGS 8330000	6/25/2007	**730**	674	0

Red values indicate those above the State and Tribal water quality standard.
Blue values indicate those above the Tribal water quality standards.

[1] USGS gage 08330000

[2] Albuquerque International Airport weather site. Rainfall data for the previous day was used

Table D.3- Rio Grande (Rio Puerco to Isleta Pueblo bnd)

Station	Date	Result (cfu/100mL)	Flow (cfs)[1]	Rainfall (inches)[2]
32RGrand385.5	3/23/2005	143.9	983	0
32RGrand361.7	3/23/2005	101.4	983	0
32RGrand394.8	3/24/2005	41	895	0
32RGrand394.8	5/25/2005	44.3	5500	0
32RGrand361.7	5/25/2005	59.1	5500	0
32RGrand385.5c	5/25/2005	64.5	5500	0
32RGrand385.5	5/25/2005	26.6	5500	0
32RGrand394.8c	5/26/2005	38.4	5650	0
32RGrand361.7	6/21/2005	52.1	3790	0
32RGrand385.5c	6/22/2005	118.7	3520	0.24
32RGrand385.5	6/22/2005	116.2	3520	0.24
32RGrand394.8	6/22/2005	**1413.6**	3520	0.24
32RGrand385.5c	7/26/2005	47.6	97	0
32RGrand394.8	7/26/2005	34.1	97	0
32RGrand394.8c	7/26/2005	25.6	97	0
32RGrand361.7	7/27/2005	9.7	87	0
32RGrand361.7	8/23/2005	115.3	133	0
32RGrand385.5c	8/24/2005	143.9	99	0.01
32RGrand394.8c	8/24/2005	71.7	99	0.01
32RGrand361.7	9/27/2005	101.7	42	0
32RGrand385.5	9/28/2005	261.3	41	0.02
32RGrand394.8	9/28/2005	133.4	41	0.02
32RGrand361.7	10/25/2005	285.1	263	0
32RGrand385.5	10/26/2005	**461.1**	210	0
32RGrand394.8	10/26/2005	**613.1**	210	0

Red values indicate those above the water quality standard.
[1] USGS gage 08358900
[2] Los Lunas NMSU weather site. Rainfall data for the previous day was used.

Table D.4- Rio Grande (San Marcial to Rio Pueco)

Station	Date	Result (cfu/100mL)	Flow (cfs)[1]	Rainfall (inches)[2]
USGS 8354900	11/14/2002	370	350	0
USGS 8358400	12/2/2002	200	278	0.01
USGS 8354900	3/25/2003	<6	306	0
USGS 8358400	4/24/2003	130	237	0
USGS 8354900	4/28/2003	**620**	210	0
USGS 8358400	6/4/2003	270	228	0
USGS 8354900	7/14/2003	53	23	0
USGS 8358400	7/16/2003	>60	19	0
USGS 8358400	12/17/2003	<17	342	0
USGS 8354900	12/19/2003	>4	309	0
USGS 8358400	4/15/2004	**3200**	2320	0
USGS 8354900	4/16/2004	**>16000**	1710	0
USGS 8358400	6/17/2004	300	47	0
USGS 8354900	6/18/2004	**>5300**	44	0
USGS 8354900	8/5/2004	**1000**	155	0
USGS 8358400	8/5/2004	130	155	0
USGS 8358400	12/2/2004	**700**	603	0
USGS 8354900	12/7/2004	**1000**	511	0.22
32RGrand258.0	3/24/2005	61.3	720	0
32RGrand292.1	3/24/2005	64.4	720	0
32RGrand323.4	3/24/2005	93.4	720	0
USGS 8354900	4/6/2005	76	445	0
USGS 8358400	4/21/2005	<16	2320	0.12
32RGrand292.1c	5/25/2005	214.3	4380	0
32RGrand292.1	5/25/2005	214.3	4380	0
32RGrand323.4	5/25/2005	**816.4**	4380	0
32RGrand341.2	5/25/2005	18.5	4380	0
32RGrand292.1	6/21/2005	70.3	3290	0
32RGrand292.1c	6/21/2005	48.8	3290	0
32RGrand323.4	6/21/2005	62	3290	0
32RGrand341.2	6/22/2005	63.1	3200	0
USGS 8354900	7/8/2005	83	698	0
USGS 8358400	7/14/2005	14	261	0
32RGrand292.1	7/26/2005	59.8	0.001	0
32RGrand292.1c	7/26/2005	55.6	0.001	0
32RGrand323.4	7/26/2005	16.9	0.001	0
32RGrand341.2	7/26/2005	83.9	0.001	0
32RGrand258.0	8/23/2005	218.7	108	0
32RGrand292.1c	8/23/2005	206.4	108	0
32RGrand323.4	8/23/2005	27.9	108	0
32RGrand341.2	8/23/2005	178.2	108	0
USGS 8354900	9/27/2005	77	0.001	0
32RGrand292.1	9/27/2005	201.4	0.001	0
32RGrand323.4	9/27/2005	191.8	0.001	0
32RGrand341.2	9/27/2005	**461.1**	0.001	0
USGS 8358400	10/12/2005	**1700**	168	0
32RGrand258.0	10/25/2005	**920.8**	188	0
32RGrand292.1	10/25/2005	172.7	188	0

Station	Date	Result (cfu/100mL)	Flow (cfs)[1]	Rainfall (inches)[2]
32RGrand323.4	10/25/2005	233.3	188	0
32RGrand341.2	10/25/2005	**517.2**	188	0
USGS 8358400	11/30/2005	**>4000**	437	0
USGS 8358400	2/13/2006	32	425	0
USGS 8354900	2/14/2006	220	412	0
USGS 8358400	3/14/2006	110	230	0
USGS 8354900	5/12/2006	<6	34	0
USGS 8358400	5/23/2006	>1	30	0
USGS 8354900	7/10/2006	**4000**	1330	0
USGS 8354900	8/29/2006	**5100**	1440	0
USGS 8358400	11/13/2006	**620**	1180	0
USGS 8358400	2/12/2007	**520**	658	0.03
USGS 8354900	4/26/2007	46	481	0
USGS 8358400	5/22/2007	340	2260	0
USGS 8354900	6/19/2007	150	343	0

Red values indicate those above the water quality standard.

[1] USGS gage 08358400

[2] South Bosque del Apache NMSU weather station. Rainfall data for the previous day was used.

Table E.5- MRG WWTP samples

WWTP Station	Date	Result (cfu/100mL)
Albuquerque	7/27/2005	38.4
Belen	7/26/2005	131.4
Bernalillo	7/27/2005	6.3
Bosque Farms	7/27/2005	25.9
Los Lunas at Rio Grande	7/26/2005	52.8
Los Lunas WWTP	7/26/2005	7.5
Rio Rancho #2 at Rio Grande	7/27/2005	127.4
Rio Rancho #2 WWTP	7/27/2005	2
Socorro	none	none
Albuquerque	8/24/2005	28.8
Belen	8/23/2005	140.1
Bernalillo	8/24/2005	2
Bosque Farms	8/24/2005	81.3
Los Lunas at Rio Grande	8/23/2005	23.5
Los Lunas WWTP	8/23/2005	167
Rio Rancho #2 at Rio Grande	8/24/2005	307.6
Rio Rancho #2 WWTP	8/24/2005	2
Socorro	8/23/2005	1
Albuquerque	9/28/2005	48
Belen	9/27/2005	40.2
Bernalillo	9/28/2005	193.5
Bosque Farms	none	none
Los Lunas at Rio Grande	9/27/2005	59.8
Los Lunas WWTP	9/27/2005	30.1
Rio Rancho #2 at Rio Grande	9/28/2005	28.8
Rio Rancho #2 WWTP	9/28/2005	1
Socorro	9/27/2005	45.7
Albuquerque	10/26/2005	24.1
Belen	10/25/2005	9.7
Bernalillo	10/26/2005	19.2
Bosque Farms	10/26/2005	**1986.3**
Los Lunas at Rio Grande	10/25/2005	52
Los Lunas WWTP	10/25/2005	10.8
Rio Rancho #2 at Rio Grande	10/26/2005	11
Rio Rancho #2 WWTP	10/26/2005	3.1
Socorro	10/25/2005	35.5
Albuquerque	11/30/2005	6.3
Belen	11/29/2005	15.8
Bernalillo	11/30/2005	365.4
Bosque Farms	11/30/2005	**>2419.6**
Los Lunas at Rio Grande	11/29/2005	166.4
Los Lunas WWTP	11/29/2005	28.8
Rio Rancho #2 at Rio Grande	11/30/2005	5.2
Rio Rancho #2 WWTP	11/30/2005	1
Socorro	11/29/2005	110.6

Red values indicate those above the State water quality standard.

APPENDIX E
RESPONSE TO COMMENTS

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SWQB hosted a public meeting in Albuquerque, NM on September 29, 2009 to discuss the Public Comment Draft Middle Rio Grande Watershed TMDL. The following changes were made to the Final Draft document in response to public comment received at the meeting and afterwards:

1. Questions were raised during the public meeting regarding the references to the State water quality standards in Section 2.3. SWQB agreed to simplify Section 2.3 so that it only lists the water quality standards directly related to the TMDL, specifically dissolved aluminum and *E.coli*.

2. Questions were raised by a number of MS4 permittees during the public meeting regarding the strict language in Section 6.4. Comment Sets A, D, F, and G also questions the use of the chosen language. SWQB had discussions with EPA R6 following the public meeting and agreed to change the language from phrases such as "shall" to "should" and "should consider."

3. EPA R6 requested that flows be provided in Table 2.3 for USGS gages upstream of the study area.

4. Appendix F was added based on public comment.

Written comments received during the 45-day public comment period:

A. Bernalillo County Public Works
B. Andy Smith
C. Pueblo of Sandia
D. City of Albuquerque Aviation Department
E. Southern Sandoval County Arroyo Flood Control Authority
F. Albuquerque Metropolitan Arroyo Flood Control Authority
G. Middle Rio Grande Stormwater Quality Team

Written comments received after the 45-day public comment period:

H. Pueblo of Santa Ana

Comment Set A:

County of Bernalillo
State of New Mexico

BOARD OF COUNTY COMMISSIONERS
ALAN B. ARMIJO, CHAIR
DISTRICT 1,
ART DE LA CRUZ, VICE CHAIR
DISTRICT 2
MAGGIE HART STEBBINS, MEMBER
DISTRICT 3
MICHAEL C. WIENER, MEMBER
DISTRICT 4
MICHAEL BRASHER, MEMBER
DISTRICT 5
THADDEUS LUCERO, COUNTY MANAGER

Bernalillo County Public Works
2400 Broadway S.E.
Albuquerque, NM 87102
505-848-1500
Fax 505-848-1510

KAREN L. MONTOYA, ASSESSOR
MAGGIE TOULOUSE OLIVER, CLERK
MERRI RUDD, PROBATE JUDGE
DARREN P. WHITE, SHERIFF
PATRICK J. PADILLA, TREASURER

September 29, 2009

Ms. Heidi Henderson, TMDL Coordinator
New Mexico Environment Department
Surface Water Quality Bureau
1190 St. Francis Drive
Santa Fe, NM 87505

Re: Comments about public comment draft, TMDL for the Middle Rio Grande Watershed

Dear Ms. Henderson:

The Bernalillo County Public Works Division, Water Resources Program, has reviewed the September 16, 2009 Public Comment Draft of the Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed, and submits the following comments.

In general, Bernalillo County applauds the Environment Department for their use of the flow duration approach to evaluating pollutant loads. The approach effectively addresses the difficulty of determining target and actual pollutant loads over the broad range of streamflow regimes observed for surface water bodies in New Mexico.

Bernalillo County has particular concerns about the projection in Section 4.4.2 that the *E. coli* load for the Rio Grande (Isleta Pueblo bnd to Alameda Street bridge) assessment unit (AU) must be reduced by more than 80% to achieve the target load under most flow conditions. This level of reduction is nearly impossible, given that over 46% of fecal bacteria originate from wildlife beyond human control.

Further, we are concerned about the comparison of arithmetic means for measured *E. coli* loads against geometric means from *E. coli* water quality criteria in Section 4.4.2, possibly overestimating measured loads and needed reductions to achieve target loads.

Finally, we are concerned about the inclusion in Section 6.4 of proscriptive language that appears to impose regulatory requirements under this TMDL for stormwater discharge permittees in the watershed.

Please see our specific comments about these issues below.

The following are specific comments from Bernalillo County, arranged by section of the draft TMDL.

- **Executive Summary, Page 1, Paragraph 1.** For clarity we recommend appending the following formula to the end of the paragraph: "[TMDL = WLA + LA + MOS]". MKM

SWQB Response: *Thank you for the comments. The addition has been made to the document.*

- **Executive Summary, TMDL summary sheets**
  - Page numbers for the summary sheets are out of order with the remainder of the document.
  - For each assessment unit, the scope/size of the sub-watershed shown on the summary sheet (>17,000 mi^2) exceeds the size of the entire watershed (3,204 mi^2 for USGS HUC 13020203) cited in *Description and Land Ownership* (Page 3, Section 2.1, Paragraph 2). Please clarify this apparent discrepancy.
  - For each assessment unit, the percent forest shown under the Land Use/Cover heading (>90%) exceeds the percent forest for the entire watershed (9%) cited in *Description and Land Ownership* (Page 3, Section 2.1, Paragraph 2). Please clarify this apparent discrepancy.

SWQB Response: *It is noted that the page numbers are incorrect and will be addressed in the final version of the TMDL document. The entire watershed described in the Executive Summary tables for each Assessment Unit (AU) is calculated as the watershed from the most downstream point of the AU to the Rio Grande headwaters. The values in Section 2.1 describe only the USGS HUC 13020203. It is for these reasons that the percent forest land cover differs as well. Clarifying language has been added to make clear were values apply to the entire upstream watershed versus the 8-digit HUC watershed.*

- **Section 2.0 Background**
  - The "2005 MRG Tributary study" is mentioned in the first paragraph on Page 3, but is not included in the References (Section 9.0). Is the "MRG Tributary study" different from the March to October 2005 watershed sampling performed by NMED? If so, is a copy of the "MRG Tributary study" available for review?

SWQB Response: *SWQB sampled both the mainstem of the Middle Rio Grande as well as tributaries to the Middle Rio Grande in 2005. The MRG tributary report is not yet available. However, the results of water quality assessments performed following the MRG tributary survey are available on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List.*

- **Section 2.1 Description and Land Ownership**
  - In Paragraph 3 of Section 2.1 on Page 3, Natural Heritage New Mexico is cited, but the role of this agency in the preparation of the TMDL is not defined. What was their role?

SWQB Response: *A statement has been added to this section of the document to clarify the citation of Natural Heritage New Mexico.*

- **Section 2.2 History and Geology**
  - In Paragraph 2 of Section 2.2 on Page 4, it is stated that the Sandia Mountains "reach to over 11,000 feet," while the highest point in the Sandia Mountains is Sandia Peak at 10,378 feet.

SWQB Response: *The citation is from Roadside Geology of New Mexico (Chronic, 1987). Upon further research, a number of values were found that describe the highest point of the Sandia Mountains. To be conservative, the statement has been changed to "reach over 10,000 feet".*

- **Section 2.3 Water Quality Standards**
  - ➢ In the fourth paragraph on Page 10, it is stated that "The appropriate tribal WQS will be used in the TMDL calculations in this document." Please expand this statement to clarify that the appropriate state OR tribal WQS is used for TMDL calculations, depending on the affected assessment unit, and the rationale for using different standards for different assessment units.

SWQB Response: *Per oral public comment at the TMDL public meeting on September 29, 2009, SWQB agreed to remove discussions of Water Quality Standards (WQS) other than those directly related to the TMDL document, ie: dissolved aluminum and E.coli. These changes have been made to Section 2.3. Language has also been added to the end of Section 2.3 to clarify the use of Tribal WQS.*

- **Section 2.4.1 Survey Design**
  - ➢ In Paragraph 1 of Section 2.4.1 on Page 11, it is stated that "Surface water grab samples were analyzed for a variety of chemical/physical parameters." In Table 2.2 of Section 2.4.1 on Page 11, footnote (a) cites "Grab and composite samples collected throughout 2005." Please clarify or correct this apparent discrepancy.
  - ➢ Please provide a list of the chemical/physical parameters for which water samples were analyzed (perhaps as an appendix to the TMDL).

SWQB Response: *Both grab and composite samples were collected and analyzed during the 2005 water quality survey. The statement in Section 2.4.1 has been clarified. A list of the water chemistry parameters that were sampled for in 2005 is listed in Section 4.0 of Water Quality Monitoring of the Middle Rio Grande, 2000-2007 Annual Report (NMED/SWQB, 2008) available online at: http://www.nmenv.state.nm.us/swqb/Rio_Grande/Middle/2008Report.pdf*

- **Section 2.4.2 Hydrologic Conditions**
  - ➢ In Table 2.3 of Section 2.4.2 on Page 13, please indicate which of the listed USGS gages were used to determine streamflows in TMDL calculations.
  - ➢ In Figure 2.7 of Section 2.4.2 on Page 15, there is a nearly 10-year gap in streamflow data. We are concerned about the reliability of the streamflow data used for TMDL calculations in this assessment unit. Please add language addressing this concern.

SWQB Response: *Table 2.3 is included in order to present all active gages in the MRG area; Figures 2.4-2.7 represent the flow for the four USGS gages used in the load duration curves in the TMDL. SWQB has confirmed with USGS staff that there is no flow data available for USGS Gage 08329928 from October 1995 to June 2003 due to lack of funding for data collection at that site. According to An Approach for Using Load Duration Curves in the Development of TMDLs (USEPA, 2007),*

> *"The lack of instream flow data at most water quality monitoring locations would typically be identified as a significant data gap for application of watershed and water quality models. However, since the incremental watershed LDC approach makes use of drainage area ratio-based flow estimates, the lack of flow information at these locations is not limiting."*

There were also no E.coli sampling events used in this TMDL prior to 2004 and therefore there were flow data available at this gage for all of the E.coli samples.

- **Section 3.1 Target Loading Capacity** *(for aluminum)*
  - In Paragraph 2 of Section 3.1 on Page 16 it is stated that "The chronic criterion was exceeded 4 of 8 times on the Rio Grande (San Marcial at USGS gage to Rio Puerco) AU." In contrast, Table C.1 of Appendix C shows that the chronic criterion for dissolved aluminum was exceeded in 8 of 28 samples taken in the Rio Grande (San Marcial at USGS gage to Rio Puerco) AU. Please explain or correct this apparent discrepancy.

SWQB Response: . *The impairments addressed in this TMDL document are included on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. The determination of these impairments was based on the application of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008). Section 3.0 of the 2008 AP reads:*

> *"When data from multiple stations are used to assess a single AU, the data should be from stations and sampling events that are 1) spatially independent (generally more than 200 meters apart), and 2) temporally independent (generally collected at least seven days apart). If one or both of these conditions are not met, the data from the non-independent stations should be averaged before application of the assessment procedures."*

Thus, the samples that were not spatially or temporally independent were averaged. The Assessment Protocols were then applied to the averaged value. The statement in the TMDL regarding 4 of 8 exceedences reflects the fact that averaging of the non-independent samples occurred. Details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List public record. A statement of clarification has been added to Sections 3.1 and 4.1.

- **Section 3.2 Flow** *(for aluminum)*
  - In Figure 3.1 of Section 3.2 on Page 17, please identify the USGS gage by number in the figure. In addition, the term "moist conditions" is a misnomer for conditions in which streamflow exceeds the "mid-range flows" condition. Perhaps the terms "moist conditions" and "mid-range flows" can be reversed throughout the TMDL document for better reader understanding.
  - In the second paragraph on Page 17, it will be helpful to include a more detailed explanation of the computational method used to produce the Aluminum Load Duration Curve in Figure 3.2 on Page 18. Assuming that the Aluminum Loading Duration Curve (Figure 3.2) was produced with values from the Flow Duration Curve (Figure 3.1) and a water quality standard for aluminum from 20.6.4.900 NMAC, please indicate whether the acute or the chronic WQS for dissolved aluminum was used in the calculations.

SWQB Response: *The USGS Gage number was added to the title of Figure 3.1. SWQB staff attended a training with Bruce Cleland and EPA R6 in February 2007. The development of the flow and load duration curves in this TMDL was based on this training as well as a research article by Bruce Cleland and guidance from the EPA Office of Wetlands, Oceans, and Watersheds. The use of "moist" and "mid-range" in the TMDL is consistent with the literature research. Language was added to Section 3.2 regarding the use of the chronic dissolved aluminum WQS in the development of the load duration curve. References to the EPA document have been added to Section 3.2 as well as Section 9.0. The Cleland (2003) reference remains in Section 3.2. Both references provide detailed explanations of both flow and load duration curve development.*

- **Section 3.3 Calculations** *(for aluminum)*
  - ➢ In Equation 1 of Section 3.3 on Page 19, we recommend inserting the units "(MG/gal)" after the 10^{-6} factor, and revising the units of "flow" to "(MGD)".
  - ➢ In Equation 2 of Section 3.3 on Page 19, we recommend revising the units of "critical flow" to "(MGD)".
  - ➢ In Table 3.1 of Section 3.3 on Page 19, we recommend indicating that the cited chronic water quality criterion is for *dissolved* aluminum.
  - ➢ In Table 3.1 of Section 3.3 on Page 19, the superscripts and footnotes use different conventions.

<u>SWQB Response:</u> *The requested changes have been made to Section 3.3.*

- **Section 3.4.1 Waste Load Allocation** *(for aluminum)*
  - ➢ In Paragraph 1 of Section 3.4.1 on Page 19, we recommend inserting the word "dissolved" between "chronic" and "aluminum" in the fifth sentence.
  - ➢ In Paragraph 1 of Section 3.4.1 on Page 20, we recommend inserting the words "based on design flow and the chronic water quality standard for dissolved aluminum from 20.6.4.900 NMAC" after the word "assigned" in the last sentence.
  - ➢ In Paragraph 2 of Section 3.4.1 on Page 20, we recommend inserting the words "based on design flow and the chronic water quality standard for dissolved aluminum from 20.6.4.900 NMAC" after the word "assigned" in the last sentence.

<u>SWQB Response:</u> *The requested changes have been made to Section 3.4.1.*

- **Section 3.4.2 Load Allocation** *(for aluminum)*
  - ➢ The reference to "table 4.4" in the first sentence of Paragraph 1 in Section 3.4.2 on Page 21 is apparently a typographical error. Perhaps the reference should be to Table 3.2.
  - ➢ Equation 3 should be rearranged as follows to correspond with the computational method described in the preceding sentence: LA = TMDL – WLA – MOS.

<u>SWQB Response:</u> *The reference to Table 4.4 was corrected and a statement of clarification was added to Equation 3.*

➢ In Table 3.2 of Section 3.4.2 on Page 21, the preface "WLA:" should be added to each NPDES permit cited, so that the summation in the "Total Waste Load Allocation" row is clearly understood. In addition, we recommend moving the "Load Allocation" row to the bottom of Table 3.2 to better correspond with the computational method described in the first sentence of Section 3.4.2. Finally the word "Dissolved" should be inserted before "Aluminum" in the title of Table 3.2.

<u>SWQB Response:</u> *The "Load Allocation" row was moved and the word "dissolved" was inserted into the title of Table 3.2.*

- We recommend creating a new **Section 3.4.3** entitled **Load Reductions Computation,** beginning with the last sentence of the first paragraph on Page 22.
- In Table 3.3 of Section 3.4.2 (future Section 3.4.3) on Page 22, we recommend inserting the units abbreviation "(lbs/day)" after "Measured Loads" and "Target Loads" labels in the table. In addition, footnote (a) to Table 3.3 does not clearly describe which measured values (all values vs. values exceeding WQS) were used to compute the arithmetic mean of Measured Aluminum concentration. Please clarify.
- At the end of Section 3.4.2 (future Section 3.4.3), please add a statement (similar to the one included for *E. coli* in Section 4.4.2 on Page 45) regarding the application of calculated percent reduction values for aluminum.

SWQB Response: *In reviewing this section in response to this comment as well as the comments of others NMED recognizes that for this TMDL calculating a percent reduction is particularly challenging. This is largely for the reasons noted in the comments above – the samples collected and the impairment determinations are based on exceedences of the State's single sample criterion and the TMDL is written to the address the monthly geometric mean standard of Sandia and Isleta Pueblos. As such any simple comparison of these numbers is fraught with challenge and, in this case, will result in an over estimation of the actual reduction necessary.*

Furthermore, neither Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of percent reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the "percent reduction" value is can both be calculated in multiple ways and as a result can often misinterpreted. This is clearly the case in this situation. Table 3.3 and the associated discussion have been removed.

- **Section 3.5 Identification and Description of Pollutant Source(s)** *(for aluminum)*
  - In Table 3.4 of Section 3.5 on Page 23, the magnitude of aluminum discharges from nonpoint sources is shown to be 590-9150 lbs/day. In contrast, Table 3.2 in Section 3.4.2 on Page 21 shows calculated Load Allocations (from nonpoint sources) of 38.8 – 1171 lbs/day for aluminum. Please explain or correct this apparent discrepancy.

SWQB Response: *The values listed in Table 3.4 are the values for "measured load" presented in Table 3.3. The references to these values have been removed from Table 3.4.*

- **Section 3.6 Linkage of Water Quality and Pollutant Sources***(for aluminum)*
  - We recommend revising the last sentence of Paragraph 3 in Section 3.6 on Page 24 to read "The February 2005 sample exceeds the chronic WQS of 0.87 mg/l for dissolved aluminum."
  - In order for the reader to be able to corroborate the last sentence of Paragraph 4 in Section 3.6 on Page 24, Appendix C of the TMDL must be revised to include streamflows measured when samples for aluminum analysis were collected.

SWQB Response: *The last sentence in Paragraph 3 was edited based on your suggestion. Additionally, streamflow from USGS gage 08358400 has been added to Appendix C.*

- **Section 3.7 Margin of Safety** *(for aluminum)*
  - ➢ In the second paragraph under the heading *"Explicit Margin of Safety"* in Section 3.7 on Page 25, it is not clear if the alternative MOS of 5 percent was applied to the dry flow hydrologic zone (as stated in the first sentence) or to the low flow hydrologic zone (as stated in the last sentence). Please clarify.

SWQB Response: *The language in Section 3.7 was changed to reflect that the paragraph should discuss "dry flow" rather than "low flow."*

- **Section 3.9 Future Growth** *(for aluminum)*
  - ➢ In Paragraph 2 of Section 3.9 on Page 26 it is stated that "According to the calculations, the overwhelming source of aluminum loading is from nonpoint sources." In fact, it is not intuitively obvious which calculations support this statement. Please include a reference to Table 3.2 to assist the reader in evaluating the comparative load calculations.
  - ➢ We recommend adding the following sentences to the end of Paragraph 2 of Section 3.9 on Page 26: "The existing Middle Rio Grande-Albuquerque Reach Watershed Restoration Action Strategy (Albuquerque Reach Watershed Group, 2008) defines a framework for design, implementation and maintenance of BMPs in the northern portion of the watershed addressed by this TMDL. See Section 6.0 for details."

SWQB Response: *A reference to Table 3.2 has been added to Section 3.9 along with the suggested language regarding the MRG-Albuquerque Reach WRAS.*

- **Section 4.0 Bacteria**
  - ➢ Paragraph 4 of Section 4.0 on Page 27 seems like a generic statement that would be better placed in the Introduction to the TMDL.
  - ➢ In Table 4.1 of Section 4.0 on Page 27, three of the four exceedence frequencies shown for *E. coli* do not correspond to the monitoring data provided in Appendix D. Table D.1 of Appendix D for Rio Grande (non-Pueblo Alameda to Angostura Diversion) shows 6 exceedences over 45 samples, while Table 4.1 shows 6 exceedences over 17 samples for the same AU. Table D.3 of Appendix D for Rio Grande (Rio Puerco to Isleta Pueblo bnd) shows 3 exceedences over 25 samples, while Table 4.1 shows 2 exceedences over 7 samples for the same AU. Table D.4 of Appendix D for Rio Grande (San Marcial at USGS gage to Rio Puerco) show 17 exceedences over 63 samples, while Table 4.1 shows 14 exceedences over 35 samples for the same AU. Please explain or correct these apparent discrepancies.

SWQB Response: *The statement referred to in the first comment has been moved into the first paragraph of Section 4.0. The impairments addressed in this TMDL document are included on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. The determination of these impairments was based on the application of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008). Section 3.0 of the 2008 AP reads:*

> *"When data from multiple stations are used to assess a single AU, the data should be from stations and sampling events that are 1) spatially independent (generally more than 200 meters apart), and 2) temporally independent (generally collected at least seven days apart). If one or both of these conditions are not met, the data from the non-independent stations should be averaged before application of the assessment procedures."*

Thus, the samples that were not spatially or temporally independent were averaged. The Assessment Protocols were then applied to the averaged value. The statement in the TMDL regarding exceedences reflects the fact that averaging of the non-independent samples occurred.

Details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List public record. A statement of clarification has been added to Sections 3.1 and 4.1.

- **Section 4.1 Target Loading Capacity** *(for bacteria)*
  - In Paragraph 2 of Section 4.1 on Page 28, we recommend adding language explaining the Clean Water Act requirement for protecting downstream water quality standards that is the basis for the decision to use Pueblo of Sandia or Pueblo of Isleta WQS in certain AUs.

SWQB Response: *The regulations concerning the protection of downstream water quality criteria and designated uses is found in 40 CFR §131.10(b). It reads:*

> *(b) In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters.*

Additionally, 40 CFR §122.4(d) prohibits the issuance of NPDES permits that do no comply with the affected States' water quality standards. It reads:

> *No permit may be issued:…(d)When the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States.*

The State of New Mexico, the Pueblo of Sandia, and the Pueblo of Isleta have water quality standards for E.coli and the Tribal standards are lower than the State of New Mexico water quality standards. The regulations in 40 CFR §131.10(b) require the development of the TMDL using the tribal standards in order to be protective of the downstream standards. The regulations in 40 CFR §122.4(d) require allocations and effluent limits to be developed using the tribal standards in order to be protective of the downstream waters. A statement addressing this issue has been added to Section 2.3.

- **Section 4.2 Flow** *(for bacteria)*
  - For Figures 4.5 - 4.7 in Section 4.2 on Pages 31-33, a more detailed explanation of the methodology used to produce the criterion curves would be helpful. (The last paragraph on Page 33 provides a good starting point.)

SWQB Response: *Just as in Section 3.2, references to the EPA document have been added to Section 4.2 as well as Section 9.0. The Cleland (2003) reference remains in Section 4.2. Both references provide detailed explanations of both flow and load duration curve development.*

- **Section 4.3 Calculations** *(for bacteria)*
  - We recommend inserting the words "geometric mean" before the words "*E. coli*" in the second sentence of Paragraph 1 of Section 4.3 on Page 33. Please replace the word "and" with the word "through" between the words "Tables 4.2" and "4.5" in the same sentence.
  - We recommend revising Equation 1 of Section 4.3 on Page 33 as follows: "C as cfu/100mL * 1,000 mL/L * 1 L/0.264 gallons * 10^6 gallons/MG * Q as MG/day = cfu/day"
  - For internal consistency, Equation 1 of Section 4.3 on Page 33 should be renumbered throughout the TMDL document as Equation 4.
  - In Paragraph 2 of Section 4.3 on Page 33, we recommend inserting the phrase "and the numerical criterion for *E. coli*" at the end of the second sentence.
  - In Tables 4.2 – 4.5 of Section 4.3 on Pages 34-35, we recommend adding footnotes indicating the specific WQS from which the *E. coli* geometric mean criterion for each table was drawn.
  - In Table 4.3 of Section 4.3 on Page 34, the statement made in footnote (b) cannot be corroborated from the monitoring results provided in Table D.3 of Appendix D. Measured flows should be added to Table D.3 of Appendix D to permit corroboration by the reader.

SWQB Response: *The requested changes have been made to Section 4.3.*

- **Section 4.4.1 Waste Load Allocation** *(for bacteria)*
  - In Table 4.6 of Section 4.4.1 on Page 36, footnotes (1) and (2) have no corresponding superscripts in the table.
  - In Table 4.7 of Section 4.4.1 on Page 37, NM DOT Dist 3 is listed as a Phase II Permittee, although NM DOT Dist 3 is one of four agencies jointly issued a Phase I Stormwater Discharge Permit by EPA Region 6. We recommend removing NM DOT Dist 3 from Table 4.7. In addition, Kirtland AFB is misspelled in Table 4.7.
  - In the third sentence of the last paragraph on Page 38 of Section 4.4.1, we recommend removing the phrase "In addition, the current" from the beginning of the sentence.
  - In Table 4.8 of Section 4.4.1 on Page 40, it appears that Waste Load Allocations have been omitted for Rio Grande (Rio Puerco to Isleta Pueblo bnd) and Rio Grande (San Marcial at USGS gage to Rio Puerco). Further, the (a), (b) and (c) superscripts do not match any footnotes in Table 4.8. Finally, the WLA results for permit NM0027863 should be moved down two lines to match the row header. (It should be noted that Page 41 is missing, suggesting that part of Table 4.8 has been omitted from the document.)
  - In Table 4.8 of Section 4.4.1 on Page 40, we question the classification of discharges under Phase I and Phase II stormwater permits as "point sources" to which waste load allocations can be assigned. Please clarify the regulatory justification for this approach.

SWQB Response: *The suggested grammatical changes have been made to Section 4.4.1. Unfortunately, a page was omitted in the Public Comment Draft of the TMDL document and a portion of Table 4.8 was indeed missing. The comments regarding Table 4.8 are clarified when the entire table is included.*

As stated in Section 4.4.1, the Phase 1 permit covers all areas within the incorporated limits of the City of Albuquerque and the permittees include the City of Albuquerque, UNM, AMAFCA, and NM Department of Transportation District 3. Per EPA, NM DoT District 3 is also a Phase 2 *permittee and would also be responsible for those areas outside the incorporated limits of the City of Albuquerque under the Phase 2 permit.*

In November 2002, the EPA Office of Wetlands, Oceans, and Watersheds and the Office of Wastewater Management issued a memo to all the Regional Water Division Directors (available online: http://www.epa.gov/npdes/pubs/final-wwtmdl.pdf) that specifically addressed the issue of the assignment of WLA to storm water discharges. The memo states that NPDES-regulated storm water discharges must be addressed by the wasteload allocation component of a TMDL (40 CFR §130.2(h)). The memo also states that storm water discharges that are regulated under Phase 1 and Phase II of the NPDES storm water program are point sources that must be included in the WLA portion of the TMDL (40 CFR §130.2(h)).

- **Section 4.4.2 Load Allocation** *(for bacteria)*
  - ➢ We recommend that Equation 2 of Section 4.4.2 on Page 42 be reformatted as follows, to better correlate with the explanatory text preceding it: LA = TMDL – WLA – WOS. In addition, for internal consistency, Equation 2 should be renumbered as Equation 5 throughout the document.
  - ➢ In Table 4.9 of Section 4.4.2 on Page 42, the NPDES permit cited in footnote (a) is not shown in Table 4.8 of Section 4.4.1 on Page 40. Please correct or clarify this apparent discrepancy.
  - ➢ In Table 4.10 of Section 4.4.2 on Page 42, we recommend adding the preface "WLA:" before each NPDES permit number so that the Total Waste Load Allocation summation is easily understood. Also, none of the NPDES permits cited in Table 4.10 are shown in Table 4.8 of Section 4.4.1 on page 40. Please correct or clarify this apparent discrepancy.
  - ➢ In Table 4.11 of Section 4.4.2 on Page 43, we recommend adding the preface "WLA:" before each NPDES permit number so that the Total Waste Load Allocation summation is easily understood. In addition, it is not clear how the WLA values for NPDES permits NMS000101 and NMR040000 were determined. WLAs for these permits are shown as "Variable" in Table 4.8 of Section 4.4.1 on Page 40. Please clarify.
  - ➢ In Table 4.12 of Section 4.4.2 on Page 43, we recommend adding the preface "WLA:" before each NPDES permit number so that the Total Waste Load Allocation summation is easily understood. In addition, it is not clear how the WLA values for NPDES permits NMS000101 and NMR040000 were determined. WLAs for these permits are shown as "Variable" in Table 4.8 of Section 4.4.1 on Page 40. Please clarify.
  - ➢ In Tables 4.9 – 4.12 of Section 4.4.2, we recommend moving the Load Allocation row to the bottom of each table to better correlate with the explanation of LA derivation at the beginning of the Section.

SWQB Response: *The suggested grammatical changes have been made to Section 4.4.2. The footnote below Table 4.9 and the permits in Table 4.10 are referenced in Table 4.8, which as noted previously was unfortunately missing from the Public Comment Draft of the TMDL document. The WLA for the NMR040000 and NMS000101 permits is listed as "variable" for the sake of space in Table 4.8. The details of the WLA for these permits are detailed in Tables 4.11 and 4.12. A footnote has been added to Table 4.8 for clarification. The location of the LA rows in Tables 4.10-4.12 has been moved.*

- Beginning with the last paragraph of Section 4.4.2 on Page 43, we recommend starting a new **Section 4.4.3** entitled **Load Calculations**. In this last paragraph, it is not clear which specific measured E. coli concentrations were used in Equation 1 (future Equation 4) to determine actual loading. Please add an explanatory statement similar to the one included for aluminum in the first paragraph on Page 22 of Section 3.4.2 (future Section 3.4.3).
- In Tables 4.13 – 4.16 of Section 4.4.2 (future Section 4.4.3) on Pages 44-45, we recommend citing the applicable Appendix D table number in the appropriate footnote for each table. In addition, each table in Appendix D should be expanded to include measured flows, to allow reader corroboration of mean *E. coli* concentration for each flow condition shown in Tables 4.13 – 4.16 with raw data in Appendix D. Finally, we recommend adding the units abbreviation "(cfu/day)" after "Measured Loads" and "Target Loads" in each table.
- In Tables 4.13 – 4.16 of Section 4.4.2 (future Section 4.4.3) on Pages 44-45, we are concerned that **arithmetic** means for measured *E. coli* concentrations are compared against **geometric** means for *E. coli* water quality criteria when determining load reduction percentages. Because arithmetic means are generally higher than geometric means for *E. coli*, we are concerned that using arithmetic means for measured *E. coli* concentrations may overestimate measured loads, resulting in higher computed percent reductions needed to achieve target loads. Please provide justification for using arithmetic rather than geometric means for measured *E. coli* concentrations in these computations.
- Bernalillo County has particular concerns about the projection in Table 4.15 of Section 4.4.2 on Page 45 that the *E. coli* load for the Rio Grande (Isleta Pueblo bnd to Alameda Street bridge) AU must be reduced by more than 80% to achieve the target load under most flow conditions. This level of reduction is nearly impossible, given the finding from the October 2005 *Middle Rio Grande Microbial Source Tracking Report* that 46.4% of fecal bacteria present in the Rio Grande originate from wildlife beyond human control. We request that NMED add a statement acknowledging this reality to the last paragraph in Section 4.4.2 on Page 45, similar to the statement included for aluminum in Section 3.3 on Page 19.

SWQB Response: *In reviewing this section in response to this comment as well as the comments of others NMED recognizes that for this TMDL calculating a percent reduction is particularly challenging. This is largely for the reasons noted in the comments above – the samples collected and the impairment determinations are based on exceedences of the State's single sample criterion and the TMDL is written to the address the monthly geometric mean standard of Sandia and Isleta Pueblos. As such any simple comparison of these numbers is fraught with challenge and, in this case, will result in an over estimation of the actual reduction necessary.*

Furthermore, neither Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of percent reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the "percent reduction" value is can both be calculated in multiple ways and as a result can often misinterpreted. This is clearly the case in this situation.

For these reasons Tables 4.13-4.16 and the associated discussion have been removed. Statements in Section 3.3 have been duplicated in Section 4.3.

- **Section 4.5 Identification and Description of Pollutant Sources** *(for bacteria)*
  - For Point pollutant sources in Table 4.17 of Section 4.5 on Page 46, the computation methodology for the magnitude (cfu/day) for each AU is not clearly defined. Please clarify how these values were determined.
  - In Table 4.17 of Section 4.5 on Page 46, footnote (a) discusses point source and nonpoint source percentage calculations, although the table itself shows no percentages for point and nonpoint sources. Please clarify.

<u>SWQB Response:</u> *The magnitude values in Table 4.17 (now Table 4.13) were derived from the measured load values displayed in Tables 4.12-4.16. These values have been removed from Table 4.17 (now Table 4.13). The Point Source values are derived from the NPDES permits. Clarification has been added to footnote (a) and footnote (c) has been removed.*

- **Section 4.6 Linkage Between Water Quality and Pollutant Sources** *(for bacteria)*
  - We recommend adding the following statement at the end of the first paragraph in the subsection entitled "*E. coli Data*" in Section 4.6 on Page 47: "Higher r-values indicate stronger correlations between the variables compared."
  - In the second sentence of the second paragraph in the subsection entitled "*E. coli Data*" in Section 4.6 on Page 47, we recommend adding the words "Table D.4 of" after the words "Data in". In the same sentence, the statement that "elevated E. coli levels occur during both rainfall and non-rainfall events" cannot be corroborated by the reader from information presented in Table D.4 of Appendix D. Appendix D should be expanded to include measured rainfall associated with each sampling event.
  - In the third sentence of the second paragraph in the subsection entitled "*E. coli Data*" in Section 4.6 on Page 47, the described number of samples collected (43) in the Rio Grande (San Marcial gage to Rio Puerco) does not correspond to the number of samples shown in Table D.4 of Appendix D (63) for the same AU. Please clarify or correct this apparent discrepancy.
  - For the first through third paragraphs on Page 48 in Section 4.6, we recommend providing citations to the applicable Appendix D table in each paragraph, showing the actual correlation computations, and clearly identifying which samples were used to determine the correlation between rainfall and *E. coli* concentration for each AU.
  - In the third paragraph on Page 48 in Section 4.6, a correlation coefficient of r = 0.77 is described although the paragraph states that, in the Rio Grande (non-pueblo Alameda to Angostura Diversion) AU, the "highest exceedence … occurred on **the one day** when rainfall was recorded …". We are concerned about the determination of a correlation between rainfall and *E. coli* concentration for this AU based on a single observation. Please explain.

<u>SWQB Response:</u> *The suggested grammatical changes have been made to Section 4.6. The notation in Section 4.6 about 43 E.coli samples has been corrected to read 63. Rainfall data has been added to the tables in Appendix D.*

The Pearson correlation coefficient was calculated using all available data as provided in Appendix D. The observation made regarding the exceedences in the Rio Grande (non-pueblo Alameda to Angostura Diversion) assessment unit merely intends to point out that the highest exceedence (5300 cfu/100 mL) occurred on the only sampling event where rainfall occurred the previous day.

- **Section 4.9 Future Growth** *(for bacteria)*
  - We recommend adding the following sentences at the end of the final paragraph on Section 4.9 on Page 50: "The existing Middle Rio Grande-Albuquerque Reach Watershed Restoration Strategy (Albuquerque Reach Watershed Group, 2008) defines a framework for design, installation and maintenance of BMPs in the northern portions of this watershed. See Section 6.0 for details."

SWQB Response: *The suggested grammatical changes have been made to Section 4.9.*

- **Section 6.2 Clean Water Act §319(h) Funding Opportunities**
  - We recommend adding the word "(impaired)" after the words "category 4 or 5" in Paragraph 1 of Section 6.2 on Page 54.

SWQB Response: *The suggested grammatical changes have been made to Section 6.2.*

- **Subsection 6.4(B) Specific SWMP/SWPP Requirements**
  - In Paragraph 4 of Subsection 6.4(B) on Page 56, it is stated that "Compliance with the following provisions will constitute compliance with the requirements of this TMDL." According to the NMED website (http://www.nmenv.state.nm.us/swqb/TMDL/),"TMDLs are not regulatory documents, but they can be used to issue or modify permits for point sources." Because TMDLs are non-regulatory, it concerns us that there is a reference to "the requirements of this TMDL" in the document. Please clarify.
  - In Item 1 of Subsection 6.4(B) on Page 56, it is stated that "Permittees **shall** submit an approvable Bacteria Reduction Plan to the EPA within 12 months of notification [that the TMDL has been approved by EPA]." In Item 2 of Subsection 6.4(b) on Page 57, it is stated that "Within 18 months of notification [that the TMDL has been approved by EPA], the permittee **shall** prepare and submit to the EPA either a TMDL monitoring plan or a commitment to participate in a coordinated regional monitoring plan." Including such mandatory language leaves the impression that the TMDL itself creates regulatory requirements for NPDES permitees in the watershed, which conflicts with the non-regulatory nature of TMDLs as described by NMED. Please correct or clarify this apparent discrepancy.

SWQB Response: *The abbreviation "WLA" has been added to the statement in Paragraph 4 of Subsection 6.4(B) in order to clarify that "requirements" referred to are in reference specifically to the WLAs assigned in the TMDL. The term "shall" in Items 1 and 2 of Subsection 6.4(B) has been replaced with the terms "should" and "should consider." As noted in the paragraph immediately preceding Subsection 6.4, the language in Subsection 6.4 was submitted for inclusion by EPA R6 and the ultimate decision about TMDL implementation will be decided during the NPDES permit process. EPA does not have the authority to approve Implementation Plans in TMDLs and states that fact in every TMDL approval letter we receive from EPA R6. For example, the approval letter for the Jemez River TMDLs (September 2009) reads:*

> *"Included in this TMDL submittal was a TMDL Implementation Plan. Presently, EPA has no duty to approve or disapprove implementation plans under Section 303(d) of the Clean Water Act (CWA). Therefore, EPA is taking no action to approve or disapprove the TMDL Implementation Plan submitted by NMED."*

The Implementation Section is merely a suggested guide for future permit development or other relevant watershed activities.

- **Appendix A: Conversion Factor Derivation**
  - ➢ We recommend revising the calculations shown in Appendix A to read as follows:

    Flow (MG/day) x Concentration (mg/L) x CF (L – lb/MG – mg) = Load (lb/day)

    CF = 10^6 gal/MG x 3.785 L/gal x 1 lb/454,000 mg = 8.34 L – lb/MG – mg

SWQB Response: *The suggested changes have been made to Appendix A.*

- **Appendix C: Aluminum Data**
  - ➢ Table C.1 of Appendix C should be expanded to include a streamflow measurement for each sampling event, to allow reader corroboration of statements made in the TMDL.

- **Appendix D: E. coli Data**
  - ➢ Tables D.1, D.2, D.3 and D.4 should be expanded to include a streamflow measurement and a rainfall measurement for each sampling event, to allow reader corroboration of statements made in the TMDL.
  - ➢ Table D.4 should be reformatted to fit on a single page or relabeled to clarify that it is continued on a second page.

SWQB Response: *Flow data have been added to Appendix C and Appendix D now includes both flow and rainfall data.*

Thank you for this opportunity to review and comment on the "Public Comment Draft Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed." Please contact me at (505) 848-1507 with questions or comments.

Best regards,

Mary Murnane
Program Manager
Water Resources Program
Public Works Division

CC: Tom Zdunek, Deputy County Manager for Public Works
Steve Miller, Director, Infrastructure Planning and Geo-Resources Department

Comment Set B:

From: Andy Smith [cofam5@yahoo.com]
Sent: Tuesday, October 20, 2009 3:53 PM
To: Henderson, Heidi, NMENV
Subject: TMDL Comments

COMMENTS ON THE TMDL DRAFT, SUBMITTED 20 OCTOBER 2009, IN RESPONSE TO THE NMED REQUEST

The quality and depth of the draft TMDL are appreciated and it is good to see the attention NMED is paying to our drinking water quality and to see excellent young people getting involved in the crusade.

The TMDL purpose was well stated in the introductory letters and it includes identifying possible pollutants and sources and finding ways to limit the extents of any releases. However, the limited scope of this draft is of great concern, because the Middle Rio Grande river is now being used as a drinking water (DW) source for about a half-million people. Of greatest concern is the fact that most of the 70 or so potential drinking water pollutants which are listed by the EPA are not addressed. This may be because the river is not yet classified by the State as such a major DW source and because the existing Source Water Assessment document does not include this use.

Micro-organisms

Of special concern is the large number of micro-organisms that are recognized by the EPA and are not covered. Most are much smaller than the E-coli, which is covered. In addition, the Rio Rancho and other city waste water treatment plant discharge pipes are just upstream of the intake to our drinking water plant and those discharges include a wide variety of industrial, agricultural, medical and other possible chemical, biological and other pollutants. All of these possible pollutants should be addressed to properly characterize the source water and because the drinking water treatment plant seems to have limited filtration capabilities (in the nano-meter to pico-meter range) because it only uses particle flocculation and charcoal filtration.

For disinfection, it uses ozone and chlorine and some of the potential emerging biological contaminants may be practically indestructable (highly resistant to heat, chemicals, etc.). The prions, that cause brain disintegration, are a good example of such pollutants and they are now being studied as possible water pollutants, because their infections have been found among some of the game animals. Conversations with Stanley Prusiner, who received the Nobel Prize for his contributions to the prion discovery, made this disinfection resistance point very clear and all of the subsequent disinfection tests have proven this disturbing fact to be true. The prion is a deformed protein which the body can reproduce. It is chemically identical to one of our natural chemicals but it is configured differently and the difference is deadly.

Emerging Pollutants

In addition to the prion, there are a number of emerging pollutants that should be addressed, by us, even though they are not yet on the main EPA list, because we and the public are becoming increasingly aware of their danger. An ongoing new news feature, in the New York Times, is evidence of this, as it addresses some of the hazardous materials that are now present in our treated drinking water. A good example of that group of newly recognized contaminants is the pharmaceuticals. The NM Amigos Bravos group and many others have expressed concerns about these. Also, we have a few unique contaminant candidates, in this New Mexico area, which should be considered, by all of us, because we are downstream of the large national nuclear research and production labs. Plutonium is on this list and one of our community volunteer study groups (AVAT) has suggested that the protection limits should be lower that they presently are, based on the outstanding work that has been done by Arjun Makhijani.

The NMED is at the center of the activities of concern to many of us, as they are related to our drinking water quality, and we would appreciate a priority effort aimed at the updating of the MRG Source Water Assessment, the expansion of this and other TMDL documents to include these potential hazards and the correction of the NM Surface Water Quality Standards (NMAC 20.6.4), to reflect the present and extremely important new use of this water, for drinking. Perhaps our greatest concern, with these documents is the lack of proper attention to the possible biological contaminants, as discussed, and the detailed and frequent sampling and testing that they require.

Albuquerque has enjoyed some of the purest drinking water in the World, for most of its history, and this water quality may, in some way, have contributed to the fact that we have among the lowest rates of heart disease, cancer and stroke in the country. Test data has shown us to have only small fractions of many of the allowable concentrations of the EPA pollutants, in the past - and many were never found in our deep-well water. Our new addition of river water to the DW mix has changed all of that and it is important for us to upgrade our standards, testing , treatment, etc. to properly meet this new challenge and we hope that the NMED and the DoH will do all they can to help us.

We recognize that the important effort expansions, in this area, may require additional NMED funding and we will be happy to do all we can to encourage our legislators to support such targeted increases. We will also be happy to urge EPA support, so that the needed tests, data, standards, etc. can be provided. We would like to see a complete EPA baseline chemical, biological and radiological contaminant profile of the river water, as soon as possible.

Andy Smith
Public Health Advocate

<u>SWQB Response:</u> *Thank you for the comments and your continued interest in the water quality of the Middle Rio Grande. SWQB recognizes your concern for the drinking water supply of the Albuquerque area.*

The impairments addressed in this TMDL are included on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. Water quality data collected during SWQB surveys is compared to the existing Standards for Interstate and Intrastate Surface Waters (NMAC, 2007). Determination of impairment of a waterbody is based on the application of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008). As you noted, there are currently no existing surface water quality standards for some chemicals. SWQB cannot assess impairment of a waterbody for a certain chemical if there is no water quality standard to which it can be compared.

The NMED Department of Energy-Oversight Bureau is currently collecting radionuclide samples in the Rio Grande. The data available for the development of the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List indicated no impairment for radionuclide parameters.

NMED has proposed to add the public water supply use to the Albuquerque reach of the Rio Grande and radionuclide criteria for an upstream reach of the Rio Grande in the current triennial review rulemaking. The Department's proposal would not add criteria for other pollutants at this time.

Bacterial criteria are established under the Clean Water Act for recreational contact, but not for drinking water. As for other emerging contaminants, such as pharmaceuticals and personal care products (PPCPs), EPA has not yet recommended water quality criteria at the national level, though monitoring and research are ongoing. EPA discusses PPCPs on its website at <u>http://www.epa.gov/ppcp/faq.html</u>. The risks posed by low levels of these contaminants in water to aquatic life and human health remain uncertain.

Most of SWQB's surface water quality efforts, such as monitoring, certifying NPDES permits, establishing TMDLs, and implementing restoration efforts, are triggered by the water quality standards. Developing water quality criteria is a scientifically rigorous process that culminates in a formal rulemaking. Any person may petition to amend the water quality standards with documentation to support new or revised criteria.

Comment Set C:

Joe M. Lujan
Governor

E. Scott Paisano
Lt. Governor

PUEBLO of SANDIA
481 Sandia Loop
Bernalillo, New Mexico 87004

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October 20, 2009

RECEIVED
OCT 26 2009
SURFACE WATER QUALITY BUREAU

Heidi Henderson, TMDL Coordinator
NEW MEXICO ENVIRONMENT DEPARTMENT
Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502

RE: Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed

Dear Ms. Henderson:

On behalf of the Pueblo of Sandia, please extend our appreciation to the New Mexico Environment Department for acknowledging our tribal waters in the development of the Middle Rio Grande Watershed Total Maximum Daily Load (TMDL).

Our environment department has reviewed the TMDL and has the following comments and/or insertions:

1. The Executive Summary states that an "A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standard". The Pueblo of Sandia would like to have the following inserted "or a tribe's water quality standard".

2. The Executive Summary states that a "pre-survey public meeting in Albuquerque" was held. The Pueblo of Sandia would like to have the date of this meeting inserted into the text. This would benefit anyone who would like to reference this public meeting.

3. The 1.0 Introduction states that an "A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standard". The Pueblo of Sandia again, would like to have the following inserted "or a tribe's water quality standard".

4. The Pueblo of Sandia would like to request a copy of the 2005 survey data for the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) that was collected for dissolved aluminum even though it was determined not to be an impairment for this stretch.

Once again, thank you for the continued consultation with our environment department and assistance on this project. If you have any questions or concerns, please contact Frank Chaves, environment director, or Scott Bulgrin, water quality manager of my staff at (505) 867-4533.

Sincerely,

Joe M. Lujan

Joe M. Lujan
Governor

SJB/

cc: Curry Jones, USEPA Region 6TMDL Team Leader
Linda Adams, USEPA Region 6NM TMDL Coordinato,
Marcy Leavitt. NMED Water & Wastewater Division Director
Glenn Saums, NMED Acting Surface Water Bureau Chief
Frank Chaves, Pueblo of Sandia Environment Department
Scott Bulgrin, Pueblo of Sandia Environment Department
File

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SWQB Response: *Thank you for the comments and your continued support of SWQB sampling efforts in the Middle Rio Grande. The requested changes have been made to the Executive Summary and Section 1.0. Per your request, the dissolved aluminum data for the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) was submitted to Mr. Joe Lujan, Mr. Scott Bulgrin, and Mr. Milton Bluehouse on October 29, 2009.*

Comment Set D:

CITY OF ALBUQUERQUE

October 27, 2009

Martin J. Chávez
Mayor

Nicholas S. Bakas
Director of Aviation

Heidi Henderson
New Mexico Environment Department
Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM, 87502

Re: Comments on the Draft Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed, September 16, 2009

Dear Ms. Henderson,

The City of Albuquerque Aviation Department is pleased to have an opportunity to comment on the Public Comment Draft Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed (September 16, 2009).

- Table 2-2: The TMDL should include a map showing the individual segments and the locations of the 2005 surface water sampling stations within those segments. The maps of the entire middle Rio Grande good for an overview, but not useful on a segment-specific basis to see where sampling stations were located.

- Page 37-38: The application of the "jurisdictional approach" should be more comprehensively described. While it is clear that the area of the watershed is being divided by segment, it is not clear how that is applied in terms of discharging storm water. Is the percentage of the jurisdiction used to determine a volume of discharge or responsible for a reduction of *e coli*?

- Page 56: The TMDL states "*After EPA approves the final TMDL, existing MS4 permittees will be notified of the TMDL provisions and schedule. Industrial stormwater permittees are not expected to be a significant source of bacteria but if any are identified, similar actions will be required.*" The industrial storm water permittees that are located within the MS4 should not be individually responsible for developing a Bacterial Reduction Plan, developing or participating in a bacterial monitoring plan, and annual reporting. If necessary, the MS4 permittee should have the responsibility of working with industrial storm water permittees for these requirements. To require that individual industrial storm water permittees complete the same requirements as the MS4 could result in expensive duplicative efforts that do not provide appreciable benefit to reducing the impairment.

If you have any questions about these comments, please contact me at 244-7836 (office) or email me at calbrecht@cabq.gov.

Sincerely,

Christopher P. Albrecht, Environmental Manager
City of Albuquerque Aviation Department
Planning and Development

P.O. Box 9948
Albuquerque
New Mexico
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www.cabq.gov

SWQB Response: *Thank you for the comments.*

Comment 1:

Figures 2.1-2.3 display each Assessment Unit as well as the enumerated sampling locations as detailed in Table 2.2. SWQB can provide detailed to information to interested parties regarding specific site locations. Additionally, the NMED –New Mexico Atlas website (http://www.nmenv.state.nm.us/NMAtlas/index.html) is a useful tool for mapping sites of environmental interest, including SWQB sampling locations state-wide.

Comment 2:

Details of the jurisdictional area approach were removed from the main document for simplicity and readability of the document. SWQB developed the MS4 portion of the WLA based on discussions with EPA R6, recommendations from the TMDLs to Stormwater Permits Handbook (USEPA, 2008), and previously developed SWQB MS4 TMDLs. Section 4.4.1 of the TMDLs to Stormwater Handbook discusses the approach used in the Draft Middle Rio Grande TMDL, i.e. aggregated WLA for all stormwater sources. Section 4.3.2.2 discussed the Load Duration Approach and states:

> *"TMDLs developed using the load duration approach most often identify the portion of the loading capacity for the stormwater WLA(s) on the basis of jurisdictional area… Because a load duration curve establishes a flow-variable loading capacity, the framework allows for source-specific allocations to be adjusted by flow zone. To target loading controls and put the load duration results in a more digestible format, the load duration curve is usually divided into different flow zones representing different conditions (e.g., low flow, high flow)."*

For the Draft MRG TMDL, separate WLA were assigned to both the Phase I and Phase II permittees. These allocations were further divided between the two affected Assessment Units; Rio Grande (Isleta Pueblo boundary to Alameda Street Bridge) and Rio Grande (non-Pueblo Alameda to Angostura Diversion). First, the contributing watershed was determined to begin at Cochiti Reservoir as displayed in Figure 4.9. Second, the watershed area from the Isleta Pueblo boundary to Cochiti Reservoir was determined along with the watershed area from Alameda Street Bridge to Cochiti Reservoir. The jurisdictional area of the Phase I permit encompasses the incorporated areas of the City of Albuquerque, however this incorporated area falls within both affected Assessment Units. As a result, the incorporated area of the City of Albuquerque was divided at the Alameda Street Bridge in order to account for the Assessment Unit break at the bridge. The percentage of the incorporated area of the City of Albuquerque that fell into each AU was then determined to be a percentage of the whole watershed. The Phase I WLA percentages are discussed in Section 4.4.1 of the Draft TMDL. A similar approach was taken for the Phase II permittees. The percentage of urbanized areas (as described in the Phase II permit) were similarly determined as a percentage of the whole watershed. The Phase II WLA percentages are also discussed in Section 4.4.1.

Appendix F was also added to the Final TMDL for further explanation of this approach.

Comment 3:

The Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) became effective on September 29, 2008. This permit authorizes operators of stormwater discharges associated with industrial activity located in an area where EPA is the permitting authority to discharge to waters of the United States.

> *Section 2.2.1 of the MSGP reads:*
> *"If at any time you become aware, or EPA determines, that your discharge causes or contributes to an exceedance of applicable water quality standards, you must take corrective action as required in Part 3.1, document the corrective actions as required in Parts 3.4 and 5.4, and report the corrective actions to EPA as required in Part 7.2."*
>
> *Section 2.2.2.1 of the MSGP reads:*
> *"Existing Discharge to an Impaired Water with an EPA Approved or Established TMDL. If you discharge to an impaired water with an EPA approved or established TMDL, EPA will inform you if any additional limits or controls are necessary for your discharge to be consistent with the assumptions of any available wasteload allocation in the TMDL, or if coverage under an individual permit is necessary in accordance with Part 1.6.1."*

As noted in the paragraph immediately preceding Section 6.4 in the Public Comment Draft TMDL, the language in Section 6.4 was provided to SWQB by EPA R6. This language was provided so that the permittees have an opportunity to be aware of potential future permit requirements. As stated in the Public Comment Draft TMDL:

> *"It is the responsibility of EPA Permit Writers to develop a permit that complies with the allocations provided in the TMDL. The exact manner in which this in implemented (specific BMPs, numeric effluent limits etc.) to achieve this goal is up to the discretion of the EPA permit writer and need not follow this implementation guidance."*

Comment Set E:

Southern Sandoval County Arroyo Flood Control Authority

October 27, 2009

NOV 0 2 2009

Heidi Henderson
New Mexico Environment Department SWQB
P.O. Box 5469
Santa Fe, New Mexico 87502

Subject: SSCAFCA Review of Public Comment Draft - TMDL of the Middle Rio Grande Watershed

Dear Ms. Henderson:

I am in receipt of the proposed TMDL for the middle Rio Grande and appreciate the ability to comment. Thank you.

In reviewing this information, SSCAFCA is struck by the potential impacts that may result and the uncertainty that we have in the information provided. We have explored other information that appears to contradict or negate some of the information that is contained in the document. One example of our uncertainty is the variability of the results as seen in Table D.1. Specifically, the testing data for 7/27/05 in the upper reach of the Rio Grande between the Alameda Bridge and Angostura Diversion shows that the variation in the reported information is from 488.4 to 41.1 cfu/100 ml. Said another way, the variation is from non-compliance to compliance. Two samples appear to be analyzed at Hwy 550 with two different results; one out of compliance with a result of 488.4 cfu's/100 ml and one in compliance with a result of 325.5 cfu's/100 ml. Two other samples taken at the Alameda Bridge on the same day have similar regulatory outcomes of compliance with results of 41.7 cfu's/ml and 62.2 cfu's/ml respectively. Given the potential impact of this rule, this variation is unacceptable. Rather than proceed down a path of uncertainty, I would ask that you withdraw this proposed TMDL and allow further scientific investigation to flush out technical uncertainties and irregularities. This further investigation should include addressing additional technical comments provided by the Storm Water Quality Team of which SSCAFCA is a signatory. It has been my experience that cooperative partnerships work when addressing tough issues. SSCAFCA is willing to form a cooperative partnership to address this issue of bacteria in the Rio Grande.

SSCAFCA is committed to doing our part in protecting the environment. We have established regulatory requirements for all development to treat the "first flush" of storm water run-off. We are designing and constructing storm water quality facilities in every

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facility that we have. We are extremely proud of our wetlands water quality facility in Haynes Park and our recently completed water quality facilities located in the Venada Arroyo (at the Rio Grande in the Rio Rancho Bosque), in the Black Arroyo (located in AMAFCA's Black Dam) and in the Montoyas Arroyo (located in the Sportsplex Dam).

If you have any questions or comments, please call me.

Sincerely,

David Stoliker, PE
Executive Engineer

<u>SWQB Response:</u> *Thank you for the comments.*

That E.coli data available in Appendix D shows results ranging from 41.1 cfu/100 mL to 488.4 cfu/100 mL. These samples were collected throughout the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) by SWQB staff operating under the NMED/SWQB Standard Operating Procedures for Data Collection. There were two discrete samples each taken at the Highway 550 bridge (32RGrand464.2) and Alameda Bridge (32RGrand445.4) sites on July 27, 2005. The samples denoted with a "c" following the STORET ID indicate a composite sample that was collected using the method described in Section 7.6 of the 2007 NMED/SWQB Standard Operating Procedures for Data Collection and the samples without a "c" indicate a grab sample.

SWQB recognizes that the data is variable due to the dynamic nature of the Rio Grande and is also typical of E coli impairments throughout the state. The data collected in this Assessment Unit was applied to the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008) and based on the application of this protocol, the Assessment Unit was determined to be impaired for E.coli and is included on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. This AU had been continuously listed for fecal coliform at least prior to the 1998-2000 CWA §303(d)/§305(b) Integrated List. SWQB developed a fecal coliform TMDL for this AU in 2002.

As discussed in Sections 3.3 and 4.3, the TMDL is calculated by multiplying the applicable water quality standard, the flow, and a conversion factor. Water quality data is not used in the calculation of the TMDL. Water quality data is used in the determination of impairment during the development of the CWA §303(d)/§305(b) Integrated List. 40 CFR 130.7 requires states to develop TMDLs for impaired, or water quality-limited, segments. SSCAFCA comments relate to the development of Watershed Based Plans that could include tools such as source identification to implement this TMDL.

SWQB is in receipt of the comments submitted by the Mid Rio Grande Storm Water Quality Team and has responded to those comments in Comment Set G. SWQB appreciates SSCAFCA's continued efforts to improve water quality through numerous structural and wetland projects in the Middle Rio Grande watershed.

Comment Set F:

John P. Kelly, P.E.
Executive Engineer

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
2600 Prospect N.E., Albuquerque, NM 87107
Phone: (505) 884-2215 Fax: (505) 884-0214

October 27, 2009

Heidi Henderson
Surface Water Quality Bureau, NM Environment Department
P.O. Box 5469
Santa Fe, NM, 87502

Subject: Comments on Draft TMDL for the Middle Rio Grande Watershed

Dear Ms. Henderson:

This letter contains comments on the Draft Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed that are being submitted by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) as requested in your Notice of a 45-Day Public Comment Period and Community Meeting. Briefly, AMAFCA objects to the proposed TMDL for E coli in the Middle Rio Grande for the following reasons:

1. There is a large natural source of E coli bacteria in the river as documented by New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) monitoring data.

2. No data or information has been presented to show that a high natural concentration of E coli bacteria has impacted the river or human health in any way.

3. An alternative calculation of E coli concentrations in the proposed TMDL suggests that the NMED has overstated the degree of non-compliance with the stream standard, supports the position that the coliform loads are due to natural phenomenon and leads to questions regarding load calculations in the document.

Our concerns are discussed below. Because the North Diversion Channel (NDC) joins the river upstream from the Alameda Bridge, our comments are principally focused on the reach of the river from the Alameda Bridge to the Angostura dam.

<u>Point 1 – Large Natural Sources of Coliform Are Present.</u>
Our most strident objection to the TMDL deals with the lack of recognition of natural sources of E coli bacteria in the river. Figure 4.8 in the TMDL appears to show that the highest exceedance of the stream standard for E coli above the Alameda Bridge occurs during low flow conditions. The document attributes high concentrations of E coli under low flow conditions to point sources (page 21).

Above the Alameda Bridge, there are only three small permitted discharges: one for the town of Bernalillo and two for Rio Rancho. The permit conditions for point sources in the middle Rio Grande for flow and coliform criteria are summarized in Table 1. Your monitoring data showed that these discharges are in compliance with their permit criteria. During the "Dry Conditions" (Q < 647 cfs) and "Low Flow Conditions" (Q < 359 cfs) the principal source of coliforms must therefore be attributed to natural sources. We examined the monitoring data from the TMDL report (Appendix D) and noted numerous instances of high E coli concentrations at sampling locations above the NDC on days with little or no flow in this channel (Q ≤ 2 cfs) and presumably little or no rainfall in the watershed.

Table 1. NPDES permit values for flow and coliform bacteria for discharges to the Middle Rio Grande.

Wastewater Treatment Plant	Qmax (Mgal/d & cfs))	Parameter	30 d Average	Daily Maximum
Albuquerque	76 (118)	F. coli	100	200
Belen	1.2 (1.86)	E. coli	126	410
Bernalillo	0.8 (1.24)	F. coli	100	200
Los Lunas	0.9 (1.39)	E. coli	126	410
Rio Rancho Plt 2	5.5 (8.51)	F. coli	100	200
Rio Rancho Plt. 3	.85 (1.32)	F. coli	100	200
Bosque Farms	.5 (.77)	E. coli	126	410
Socorro	-	E. coli	126	410

The NMED coliform data supports the conclusion that natural sources are the principal cause of high concentrations of E coli in the river under low flow conditions. There is a large and growing body of literature on natural sources of E coli that include mammalian and avian populations, sediments, and even regrowth of coliform organisms in sediments and soils in warm climates. Based on our observation of large permanent populations of water fowl (especially geese and ducks) and aquatic mammals (beaver and muskrat), we believe that these organisms are the most likely sources of E coli in this reach of the river, and therefore, high concentrations should be considered to be natural.

SWQB Response: *Thank you for your comments.*

Section 3.2 of the Draft MRG TMDL states:

> *"The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left generally reflect probable nonpoint source contributions."*

This statement is included as a general statement related to load duration curves. Figure 4.8 shows exceedences of both the single sample and geometric mean criterion across most flow regimes. The TMDL does not negate the non-point source contribution of E.coli bacteria nor does it attempt to explain each E.coli exceedence noted in the water quality monitoring data. The fact that these data seem to contradict a general rule of load duration curve interpretation is an issue to be addressed during permit implementation.

SWQB recognizes that there are natural sources of E.coli bacteria in the Middle Rio Grande watershed (Parsons, 2005). However, the fact that NPDES and MS4 permitees discharge to the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) AU, requires SWQB to assign a WLA to those permittees, regardless of whether they are contributing to the impairment of the waterbody or not.

40 CFR § 130.2(i) defines a TMDL as follows:

> *"Total maximum daily load (TMDL). The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure…"*

40 CFR § 130.2(h) defines a WLA as follows:

> *"Wasteload allocation (WLA). The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation."*

The limited monitoring results in Appendix E.5 for the facilities in the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) may not indicate a permit violation, however, it should be noted that a number of samples exceed the Pueblo of Sandia single sample E.coli criterion.

<u>Point 2 – Impact of High Coliform Concentrations.</u>

The NMED data shows that coliform bacteria are consistently present in the Middle Rio Grande above the Alameda Bridge. The geometric mean concentration for the data reported in the proposed TMDL was 72 cfu/100 mL for E coli. AMAFCA is not aware of any data or studies that have shown impairment of the river or human health problems as a result of these high concentrations. While AMAFCA recognizes that E coli is a very useful indicator of the possible presence of pathogenic bacteria in drinking water, we believe it is a very poor indicator of potential threats to the environment or human health in the Middle Rio Grande where it is clear that natural sources of E coli and related bacteria are present. Before a costly TMDL is issued, AMAFCA insists that the NMED justify its implementation by demonstrating this impairment or threat.

SWQB Response: *States are required to develop TMDLs for segments that do not meet applicable water quality standards.*

40 CFR § 130.7(c)(1) reads:

> *"Each State shall establish TMDLs for the water quality limited segments identified in paragraph (b)(1) of this section, and in accordance with the priority ranking. For pollutants other than heat, TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. Determinations of TMDLs shall take into account critical conditions for stream flow, loading, and water quality parameters."*

40 CFR § 130.7(c)(1)(ii) reads:

> *"TMDLs shall be established for all pollutants preventing or expected to prevent attainment of water quality standards as identified pursuant to paragraph (b)(1) of this section…"*

*NMED proposed water quality standards for Escherichia coli (E.coli) during the 2005 Triennial Review. E.coli water quality standards were approved by the WQCC and EPA and have been effective since August 2007. The rationale for the establishment of these E.coli standards is based on the Final EPA Rule- Water Quality Standards for Coastal and Great Lakes Recreation Waters (40 CFR § 131)***.** *40 CFR § 131 states that the recommended values apply to enterococci regardless of origin unless a sanitary survey shows that sources of the indicator bacteria are non-human and an epidemiological study shows that the indicator densities are not indicative of a human health risk.*

The Executive Summary of <u>Implementation Guidance for Ambient Water Quality Criteria for Bacteria</u> (EPA, 2004) states:

> *"Although there have been few studies investigating the impact of fecal contamination from animal source, it is inappropriate to conclude that these sources present no risk to human health from waterborne pathogens, particularly when the animals in question are likely to have had frequent contact with humans and may harbor and shed human pathogens."*

Additionally, Section 3.2 discusses recent evidence that warm-blooded animals other than humans may be responsible for transmitting pathogens capable of causing illness in humans.

Point 3 – Alternative Analysis of E coli Concentrations.

The waste loads presented in the TMDL for the river above the Alameda Bridge are calculated using flows measured at the Alameda Bridge. However, during the SWQB study E coli concentrations were measured at several locations upstream from this point. Under low flow conditions there are no significant tributaries above this point (the aggregate maximum flows from the Rio Rancho and Bernalillo wastewater treatment plants represent less than 3% of the minimum flow in the river during any of the sampling events for the study), hence, this assumption is reasonable and introduces little error. Therefore, AMAFCA believes that the same reasoning can be applied to the E coli data, so that instead of calculating loads based on individual coliform concentrations, the mean geometric concentration should be used in the load calculations. This is justified because there are no point sources between the uppermost sampling point (the Angostura dam) and the Alameda bridge under low flow conditions except the three wastewater plants which contribute a negligible load (less than 3 %). We also argue that geometric means of E coli concentrations are justified when Rio Grande flows are high but NDC flows are negligible ($\leq$ 2 cfs), as again, the sole sources of coliform bacteria are natural sources and the three permitted point source discharges.

The events in which multiple E coli samples were collected are presented in Table 2 (page 5) along with the daily mean flows of the Rio Grande at the Alameda bridge and in the NDC. This data shows that the geometric mean E coli concentrations for each of the multiple sampling events was less than the NM state stream standard of 126 cfu/100 mL except the samples collected on 10/28/5 which slightly exceeded the standard at 131 cfu/100 mL.

Examination of this data shows no apparent relationship between E coli concentrations in the river and sample location. On some days (i.e. 7/27/5), the highest E coli concentrations are near the upper end of the reach while on others (i.e. 10/26/5) they are at the lowest end of the reach. This observation is consistent with AMAFCA's interpretation that the sources of coliform bacteria in this reach of the river are primarily natural.

Finally, an even closer examination of the data suggests a possible error in NMED's analysis. Reference to Figure 4.8 in the draft TMDL document shows a sequence of samples collected under very low flow conditions, Q < 359 cfs. However, according to USGS data, the lowest daily average flows measured at the Alameda Bridge during any of the sampling events was 383 cfs on 10/26/5. Use of erroneously low flow values will result in correspondingly low loads. The NMED should explain the source of flow data used in their load calculations.

AMAFCA is deeply committed to protection of the environment and human health. In the past 10 years we have spent more than $20,000,000 to achieve this goal on projects that have resulted in cleaner urban runoff, development of environmental sanctuaries for wildlife and plants, and providing open space for public use and recreation. We support the objective of the TMDL process which states that "Management of the load to improve stream water quality should be a goal to be attained." However, the proposed TMDL and supporting data does not:

1. Demonstrate that there is any environmental impairment of the middle reach of the Rio Grande by enteric coliform bacteria.

2. Document that elevated concentrations of this parameter is caused by anthropogenic activities.

Furthermore, because the high concentrations of E coli appear to be caused by natural sources, we do not believe there are any control strategies that can be undertaken to reduce their concentrations. Therefore, we strongly object to implementation of this TMDL.

AMAFCA looks forward to working with the NMED on all of its projects to protect the water quality of the Middle Rio Grande. Please contact us if you would like to discuss this or other topics.

Sincerely,
AMAFCA

Jerry M. Lovato, P.E.
Drainage Engineer

Cc: Roland Penttila, City of Albuquerque
Kathy Trujillo, New Mexico Department of Transportation
Vern Hershberger, University of New Mexico
AMAFCA File 028 060000

Table 2. Summary of E coli and flow data for days in which multiple samples were collected on the Rio Grande upstream from the Alameda Bridge.

		E coli (cfu/100mL)		Q (cfs)		
Location	Date	Data	G. Mean	Alameda	NDC	Load (cfu/d)
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	3/23/2005	10.8		963	2	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	3/23/2005	11		963	2	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	3/23/2005	13.4		963	2	
Rio Grande above Alameda Bridge - 32RGrand445.4	3/23/2005	41.4	16.0	963	2	5.84E+11
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	5/26/2005	27.5		5730	2.8	
Rio Grande abv Hwy 550 Bridge - c - 32RGrand464.2c	5/26/2005	32.7		5730	2.8	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	5/26/2005	42.8		5730	2.8	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	5/26/2005	42.6		5730	2.8	
Rio Grande above Alameda Bridge - c - 32RGrand445.4c	5/26/2005	40.4		5730	2.8	
Rio Grande above Alameda Bridge - 32RGrand445.4	5/26/2005	47.3	38.3	5730	2.8	8.30E+12
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	6/23/2005	13.4		4430	1.4	
Rio Grande abv Hwy 550 Bridge - c - 32RGrand464.2c	6/23/2005	23.1		4430	1.4	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	6/23/2005	22.6		4430	1.4	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	6/23/2005	35		4430	1.4	
Rio Grande above Alameda Bridge - c - 32RGrand445.4c	6/23/2005	81.3		4430	1.4	
Rio Grande above Alameda Bridge - 32RGrand445.4	6/23/2005	249.5	41.3	4430	1.4	6.93E+12
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	7/27/2005	98.5		481	0.38	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	7/27/2005	488.4		481	0.38	
Rio Grande abv Hwy 550 Bridge - c - 32RGrand464.2c	7/27/2005	325.5		481	0.38	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	7/27/2005	41.1		481	0.38	
Rio Grande above Alameda Bridge - 32RGrand445.4	7/27/2005	62.2		481	0.38	
Rio Grande above Alameda Bridge - c - 32RGrand445.4c	7/27/2005	41.7	108.9	481	0.38	1.98E+12
USGS 8329918-Rio Grande at Alameda Bridge	8/24/2005	100		472	2	
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	8/24/2005	52.1		472	2	
Rio Grande abv Hwy 550 Bridge - c - 32RGrand464.2c	8/24/2005	50.4		472	2	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	8/24/2005	7.2		472	2	
Rio Grande above Alameda Bridge - c - 32RGrand445.4c	8/24/2005	77.6	43.0	472	2	7.69E+11
Rio Grande above Alameda Bridge - 32RGrand445.4	9/28/2005	149.7		553	92	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	9/28/2005	90.9		553	92	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	9/28/2005	95.9		553	92	
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	9/28/2005	90.9	104.4	553	92	2.19E+12
Rio Grande above Alameda Bridge - 32RGrand445.4	10/26/2005	231		383	1.2	
Rio Grande above Rio Rancho WWTF #3 - 32RGrand458.0	10/26/2005	133.4		383	1.2	
Rio Grande abv Hwy 550 Bridge - 32RGrand464.2	10/26/2005	153.9		383	1.2	
Rio Grande Below Angostura Diversion Works - 30RGrand473.7	10/26/2005	63.1	131.5	383	1.2	1.91E+12

<u>SWQB Response:</u> *Section 3.0 of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008) discusses the use of spatially and temporally independent samples; samples that are not spatially or temporally independent are averaged. Details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List public record. SWQB generally does not have enough independent samples to calculate a monthly geometric mean for assessment purposes. Section 3.3 and Table 3.7 of the Assessment Protocol addresses the procedure for assessing primary and secondary contact uses. Additionally, 20.6.4.14 NMAC reads:*

> *B. Bacteriological Surveys: The monthly geometric mean shall be used in assessing attainment of criteria when a minimum of five samples is collected in a 30-day period.*

Therefore, at this time, SWQB can only apply the single sample E.coli criterion to the available E.coli data for assessment purposes. .

As displayed in Figure 2.7 and Figure 4.4, USGS gage 08329928 was used for the development of the flow and load duration curves. The flow at the Rio Grande near Alameda (08329928) USGS gage was 299 cfs on 10/26/2005. Figure E.1 displays the data downloaded from the USGS website for this gage and date. AMAFCA correctly notes the discharge from USGS gage 08329918 (Rio Grande at Alameda Bridge) was 383 cfs on 10/26/2005. The title of Figure 4.4 has been edited to clarify which USGS gage data was used.

SWQB appreciates the continued work by AMAFCA toward improved water quality in the Middle Rio Grande watershed. However, regardless of whether the sources are anthropogenic or natural, SWQB is obligated to develop a TMDL for impaired waterbodies per federal regulations.

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# ---------------------------------- WARNING ----------------------------------------
# The data you have obtained from this automated U.S. Geological Survey database
# have not received Director's approval and as such are provisional and subject to
# revision.  The data are released on the condition that neither the USGS nor the
# United States Government may be held liable for any damages resulting from its use.
# Additional info: http://waterdata.usgs.gov/nwis/help/?provisional
#
# File-format description:  http://waterdata.usgs.gov/nwis/?tab_delimited_format_info
# Automated-retrieval info: http://waterdata.usgs.gov/nwis/?automated_retrieval_info
#
# Contact:   gs-w_support_nwisweb@usgs.gov
# retrieved: 2009-03-16 15:36:04 EDT
#
# Data for the following site(s) are contained in this file
#    USGS 08329928 RIO GRANDE NR ALAMEDA, NM
# -----------------------------------------------------------------------------------
#
# Data provided for site 08329928
#    DD parameter statistic   Description
#    02   00060      00003     Discharge, cubic feet per second (Mean)
#
# Data-value qualification codes included in this output:
#     A  Approved for publication -- Processing and review completed.
#     P  Provisional data subject to revision.
#     e  Value has been estimated.
#
agency_cd       site_no datetime        02_00060_00003  02_00060_00003_cd
5s      15s     16d     14n     10s
USGS    08329928        10/24/2005      365     A
USGS    08329928        10/25/2005      313     A
USGS    08329928        10/26/2005      299     A
USGS    08329928        10/27/2005      292     A
USGS    08329928        10/28/2005      296     A
USGS    08329928        10/29/2005      380     A
```

Figure E.1 Selected USGS discharge data for USGS gage 08329928

Comment Set G:

Mid Rio Grande Stormwater Quality Team
www.keeptheriogrand.org

STORMWATER QUALITY TEAM PARTNERS
Albuquerque Metropolitan Arroyo Flood Control Authority • Bernalillo County
City of Albuquerque • Ciudad Soil & Water Conservation District • NM Department of Transportation
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October 28, 2009

New Mexico Environment Department
P.O. BOX 5469
Santa Fe, NM 87502
Attn: Heidi Henderson, TMDL Coordinator

RE: Comments to the ***Public Comment Draft TMDL for the Middle Rio Grande Watershed*** dated September 16, 2009

Dear Ms. Henderson,

This letter is an official public comment to the ***Public Comment Draft TMDL for the Middle Rio Grande Watershed*** dated September 16, 2009. These comments are the combined efforts of the joint members of the Mid Rio Grande Stormwater Quality Team which represent the technical and educational outreach organization in the Middle Rio Grande watershed. We appreciate the opportunity to comment on this very important issue. The signatures of the representatives of the respective contributing organizations are at the end of this letter.

Collectively, we have significant concerns regarding both the technical basis and philosophical approach of the proposed E.coli TMDL for the Middle Rio Grande. We understand that establishing TMDLs is not easy, and we believe that bacterial TMDLs may be particularly complex. In our experience based on USGS data for the Rio Grande, the proposed TMDL will be impossible for MS4 permittees to consistently meet, regardless of the amount of money or effort expended. Much of what controls enteric bacterial concentrations in the river we cannot alter, and stormwater often has little to no predictable effect upon.

Variables including sampling locations in a shifting river, weather, water temperature, solar radiation, sediment scour/turbidity levels, sample handling & storage, imprecise lab analytical techniques and the level of wildlife populations are some of the host of factors creating unpredictable effects on the enteric bacterial concentrations. Since adopted TMDLs get incorporated into NPDES permit conditions, we feel we have a significant stake in this matter. Our concerns are at such level that we feel the NMED needs to withdraw the pending TMDL proposal for re-evaluation. In this letter we will attempt to identify many of our concerns below.

General Comments

We have graphically compared bacterial densities of E.coli and fecal coliform from 180 storm samples, 9 samples at Rio Grande at Central Bridge, 9 samples at Rio Grande at Alameda Bridge, 15 samples at Rio Grande at San Felipe, and 96 samples at the Rio Grande at Otowi Bridge. None of these comparisons show more than a very loose correlation between the two indicator bacteria. This is disturbing considering that E. coli densities should theoretically be less than fecal coliform densities from the same sample. We believe that this means the test methods currently being employed are inaccurate enough to be unusable in this investigation. See Attachment 1: "Comparisons of E.coli to Fecal Coliform Analyzed from the Same Sample"

Tests taken by USGS at the Otowi bridge since 1997 show that river water is already over the TMDL standard before the water gets to the Middle Rio Grande MS4 outfalls. The impairment of the river occurs before any effect of stormwater from the Urban Area. See Attachment 2: "Otowi E.coli Exceedences".

SWQB Response: *Thank you for your comments. First, SWQB feels many of the general concerns expressed by the MRG Stormwater Quality Team are outside of the scope of the TMDL development process. Many of the concerns should be addressed during the NPDES permit process and permit implementation.*

SWQB E.coli samples were collected by SWQB staff operating under the NMED/SWQB Standard Operating Procedures for Data Collection and analyzed per IDEXX Laboratories, Inc and Colilert®-18 procedures as described in Standard Methods for the Examination of Water and Wastewater, protocol 8310 B. The USGS E.coli data were collected by USGS staff operating under the National Field Manual for the Collection of Water-Quality Data (Chapter A.7). The data from both agencies is publically available and collected with EPA-approved methods and is therefore eligible to be included in water quality assessments.

The E.coli data available from the Rio Grande at Otowi Bridge, NM USGS gage (8313000) show results that range from 1800 cfu/100 mL to less than 1 cfu/100 mL from May 1997 to November 2009. The sources of the bacteria contributions to this watershed have not been quantified, however, the source of impairment in a waterbody is irrelevant when it comes to the requirement for the development of a TMDL (40 CFR § 130.7).

In a comparison of E.coli versus storm flows in the North Diversion Channel, there seems to be no relation between storm discharges and bacteria densities. There seems to be evidence that stormwater runoff from impervious surfaces (parking lot runoff), municipal, urbanized high-density areas, municipal point source discharges, onsite treatment systems (septic systems and similar decentralized systems) and waste from pets is not a significant cause of the bacterial impairment in the Middle Rio Grande. See Attachment 3: "Bacterial Densities at Alameda versus flows in the North Diversion Channel"

Most days of higher flows in the Rio Grande at Alameda do not correlate with storm flows. Dam discharges from Cochiti as well as other influences such as Jemez River have a greater influence on river flows than stormwater. Therefore, it would be incorrect to correlate bacteria counts to high flows and then make the conclusion that this is related to stormwater contributions. See Attachment 4 (a modification of NMED's Table D.1 by AMAFCA): "Summary of E.coli and Flow Data" and "Rio Grande Flows at Alameda versus North Diversion Channel inflows"

SWQB Response: *SWQB does not assert to what extent storm flows contribute to the flow volume or E.coli concentations of the Rio Grande. The list of sources listed in the MRG Stormwater Quality Team comments reflect a list of probable sources noted by field staff during water quality surveys and merely serves to present a list of sources that could be contributing to the impairment of the waterbody. The Probable Source list is included on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List and has not been quantified. The compiled data in Attachment 3 and 4 could be useful during the NPDES permit process.*

Are the samples being taken at the same place in the river each time? For instance, samples taken in the shallows might produce markedly different bacterial results than samples taken the middle of the river. This could explain the differences between the SWQB samples and the USGS samples. We request that the sampling methodology be standardized to properly represent the river should the NMED go forward with a modified TMDL.

SWQB Response: *SWQB samples denoted with a "c" following the STORET ID indicate a composite sample that was collected using the method described in Section 7.6 of the 2007 NMED/SWQB Standard Operating Procedures for Data Collection while those without a "c" are grab samples. The location of grab sample collection generally did not vary between sampling events. The USGS data collections were collected by USGS staff operating under the National Field Manual for the Collection of Water-Quality Data (Chapter A.4). The site selection and data collection by both agencies conforms with EPA approved methods and is therefore sufficient in order that the data can be used for the water quality assessments.*

Figure 3.1 **Flow Duration Curve**; *USGS Rio Grande Floodway at San Marcial, New Mexico 1974-2009* (Page 17) - For categories of the flow duration analysis, the two classifications of moist conditions and dry conditions should be changed. A flow duration curve does not relate to dry and wet (or moist) years. The correct terminology is high or low flows.

SWQB Response: *SWQB staff attended a training with Bruce Cleland and EPA R6 in February 2007. The development of the flow and load duration curves in this TMDL was based on this training as well as a research article by Bruce Cleland and guidance from the EPA Office of Wetlands, Oceans, and Watersheds. The use of "moist" and "dry" in the TMDL is consistent with the literature research. References to the EPA document have been added to Section 3.2, 4.2 and Section 9.0. The Cleland (2003) reference remains in Sections 3.2 and 4.2. Both references provide detailed explanations of both flow and load duration curve development.*

Section 4.4.2 **Load Allocation** (pages 44 and 45) – It should be noted that using an arithmetic mean for E.coli densities may overstate loading. The geometric mean is more appropriate as it is the basis for the criterion for the river. NMED should consider using the geometric mean of measured loads to compare against stream criteria when calculating load reduction targets.

SWQB Response: *Section 3.0 of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008) discusses the use of spatially and temporally independent samples; samples that are not spatially or temporally independent are averaged. Details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List public record. SWQB generally does not have enough independent samples to calculate a geometric mean for assessment purposes. Section 3.3 and Table 3.7 of the Assessment Protocol addresses the procedure for assessing primary and secondary contact uses. Additionally, 20.6.4.14 NMAC reads:*

> *B. Bacteriological Surveys: The monthly geometric mean shall be used in assessing attainment of criteria when a minimum of five samples is collected in a 30-day period.*

Therefore, at this time, SWQB can only apply the single sample E.coli criterion to the available E.coli data for assessment purposes.

As far as the calculation of measured loads in the TMDL, in reviewing this section in response to this comment as well as the comments of others, NMED recognizes that for this TMDL calculating a percent reduction is particularly challenging. This is largely because the samples collected and the impairment determinations are based on exceedences of the State's single sample criterion and the TMDL is written to the address the monthly geometric mean standard of Sandia and Isleta Pueblos. As such any simple comparison of these numbers is fraught with challenge and, in this case, will result in an over estimation of the actual reduction necessary.

Furthermore, neither Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of percent reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the "percent reduction" value is can both be calculated in multiple ways and as a result can often misinterpreted. This is clearly the case in this situation.

For these reasons Tables 4.13-4.16 and the associated discussion have been removed. Statements in Section 3.3 have been duplicated in Section 4.3.

<u>Section 4.6</u> **Linkage between Water Quality and Pollutant Sources** (Page 47 and 48) - We believe that it is statistically incorrect to apply the Pearson Coefficient to data that is not normally distributed (i.e. there is no correlation between rainfall and bacterial densities). We would like the NMED to provide the Kurtosis of the data to support the assumption of "normality" of the data.

<u>Section 4.6</u> **Linkage Between Water Quality and Pollutant Sources** *Discussion* (Page 48) - Regarding the Bacterial Source Tracking Study, it should be noted that the consultant that created the study used wastewater inflows to the treatment plant as the model for their "human" contribution. As these inflows include many other sources than solely human sewage, only a portion of that 16% human can be reduced by best management practices.

<u>SWQB Response:</u> *SWQB TMDL documents commonly discuss the Pearson Coefficient as it relates to data in the TMDL. The Kurtosis of the data has also been calculated and the results for each of the four Assessment Units are positive, indicating a relatively peaked distribution.*

Thank you for the clarification regarding the <u>Middle Rio Grande Microbial Source Tracking Study</u> (Parsons, 2005). The TMDL document does not indicate the magnitude of E.coli loadings that may be addressed through Best Management Practices. However, this information may be useful during the NPDES permit process.

<u>Section 4.7</u> **Margin of Safety (MOS)** (Page 49) - E.coli bacteria is not a "conservative" pollutant that does not degrade readily in the environment. Day-after reductions in densities in stormwater in a Texas study showed bacterial reductions in the original 15,000 colonies per 100 milliliters of 27%, 88%, and 96% in successive days after the storm. Lower water temperatures have lower bacterial densities but daily reductions are also less dramatic. Although bacterial densities can be used to compute loading, at worst, the loading is only temporary. This also makes bacteria different in terms of loading. In the normal mixing with the receiving water, the lower densities of the falling storm flows, and the naturally occurring die-off for several days after the storm rainfall, all tend to naturally reduce the impact to the receiving water in a short period of time. (See "Bacteria Die-Off Study" by Houston-Galveston Area Council dated August 31, 2005 and "Persistence of enteric bacteria in alluvial streams" by R.C. Jamieson et al published in the Journal of Environmental and Engineering Science dated May 14, 2004.)

<u>SWQB Res ponse:</u> *SWQB appreciates the references to bacteria studies in relation to the longevity of bacteria in the environment. Language reflecting this distinction has been added to Section 4.7.*

Section 6.4 **Stormwater Permitting Requirements and Presumptive Best Management Practices Approach** (pages 55 to 58) - NMED has stated that the TMDL is not a regulatory document. Therefore, the word "shall" should not be used anywhere in the TMDL document. However, the Middle Rio Grande MS4 permittees are concerned that TMDL "goals" will be converted into hard "maxima" and placed in our compliance requirements for future permits. In addition, the EPA cannot approve a permit that negatively impacts either cultural resources or listed species. This means that if, for example, AMAFCA reduces flows to the river because it's treating bacteria, USF&WS could argue that this contributes to decline of the endangered RGSM or Southwestern Willow Flycatcher. This could limit the actions of the permittees under the TMDL.

Any reduction in runoff to the river could impact the permittees obligations under the biological opinion of USF&WS. It could also impact compliance with Office of State Engineer Interstate Stream Commission obligations under the RG Compact.

SWQB Response: *Based on numerous public comments, the term "shall" in Items 1 and 2 of Subsection 6.4(B) has been replaced with the terms "should" and "should consider." As noted in the paragraph immediately preceding Subsection 6.4, the language in Subsection 6.4 was submitted for inclusion by EPA R6 and the ultimate decision about TMDL implementation will be decided during the NPDES permit process. EPA does not have the authority to approve Implementation Plans in TMDLs and states that fact in every TMDL approval letter we receive from EPA R6. For example, the approval letter for the Jemez River TMDLs (September 2009) reads:*

> *"Included in this TMDL submittal was a TMDL Implementation Plan. Presently, EPA has no duty to approve or disapprove implementation plans under Section 303(d) of the Clean Water Act (CWA). Therefore, EPA is taking no action to approve or disapprove the TMDL Implementation Plan submitted by NMED."*

The Implementation Section is merely a suggested guide for future permit development or other relevant watershed activities. Considerations regarding Endangered Species issues, Rio Grande Compact obligations, and other permit requirements will be addressed during the NPDES permit process.

Appendix D **E.coli Data** (Table D.1) – In this reach of "non-Pueblo Alameda Bridge to Angostura Diversion", samples were collected by both the NMSWQB and USGS. The densities of E.coli sampled by NMSWQB were significantly different than the densities in samples collected by the USGS. It should be noted that there was only 1 exceedence in 36 samples (3%) collected by the NMSWQB versus 5 exceedences in the 9 samples (56%) collected by the USGS. These were evaluated by the Mann-Whitney rank order test. Can NMED explain this variation in these diverse results? According to page 28 of the TMDL, "Overall, the target values for the bacteria TMDLs will be determined...(3) the ability to easily monitor and produce quantifiable and reproducible results."

Table D.2 shows only the exceedences of the State standards. This table should be corrected to show exceedences for Pueblo standards for the appropriate reaches. (See also Tables 4.4 and 4.5 as well as Figures 4.7 and 4.8 on pages 34 and 35.)

Sincerely,

Roland Penttila

Roland Penttila, P.E.
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Water Resources Program Manager
Bernalillo County

Tom Allen, Vice-Chair
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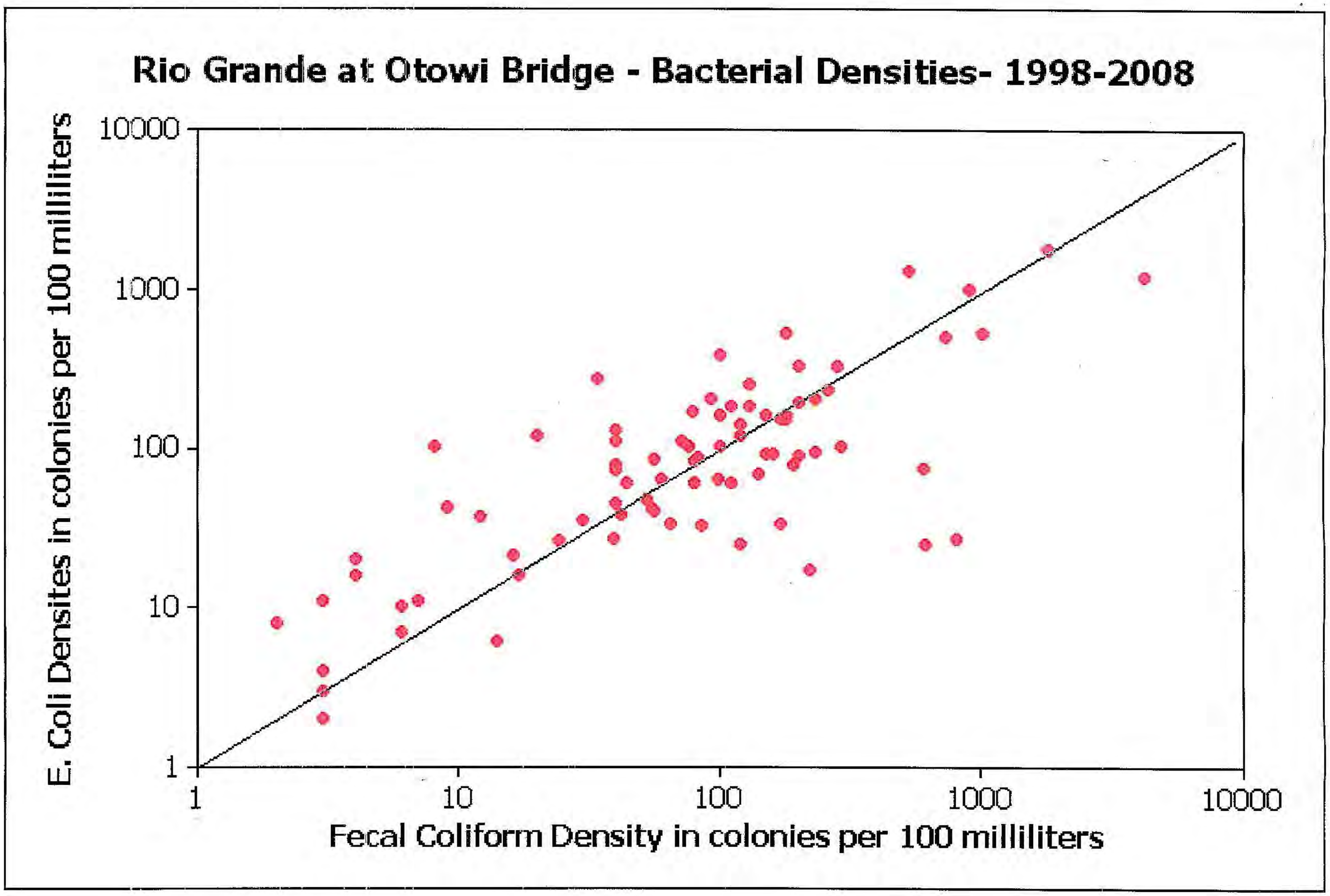
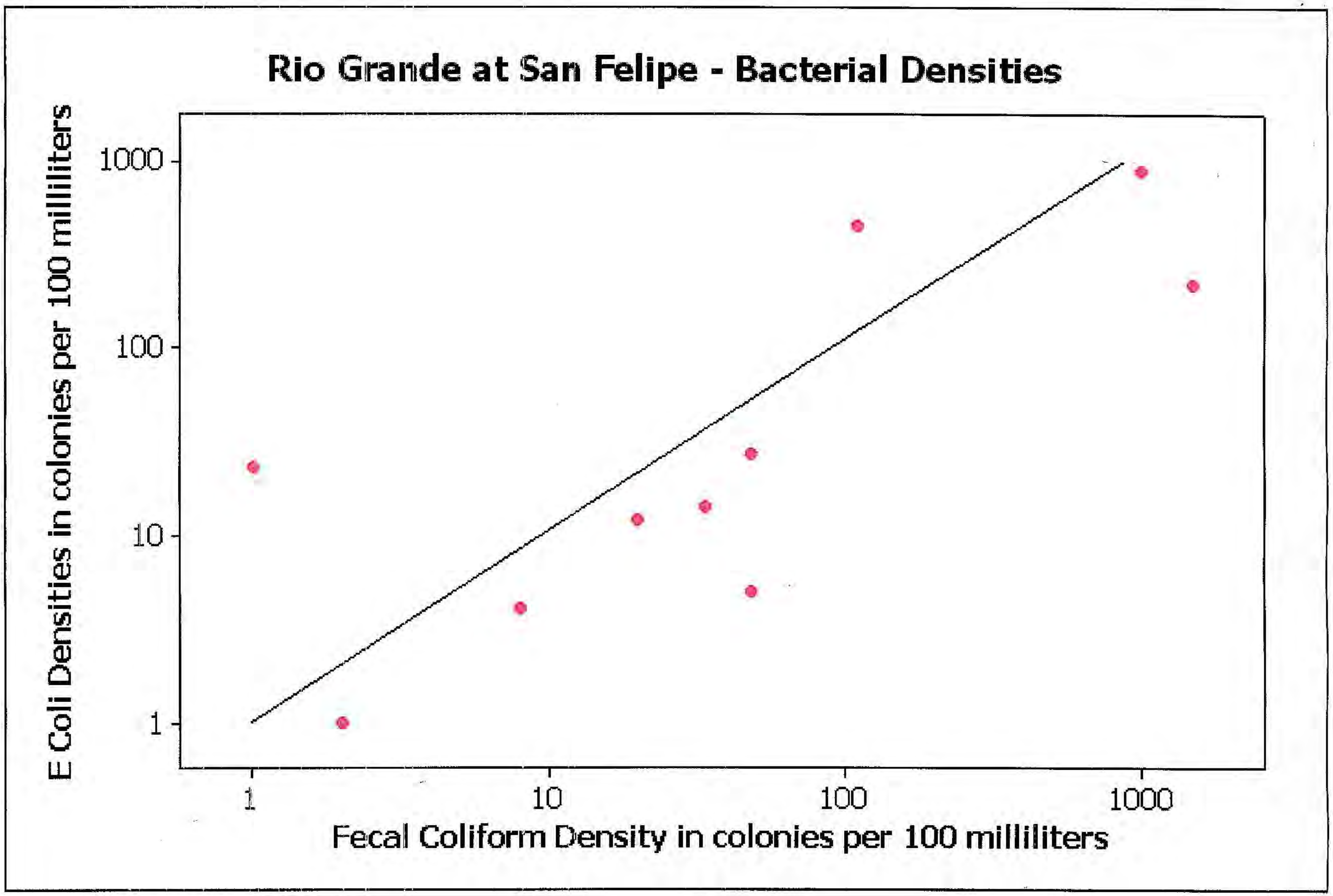
NMDOT, District Three

attachments

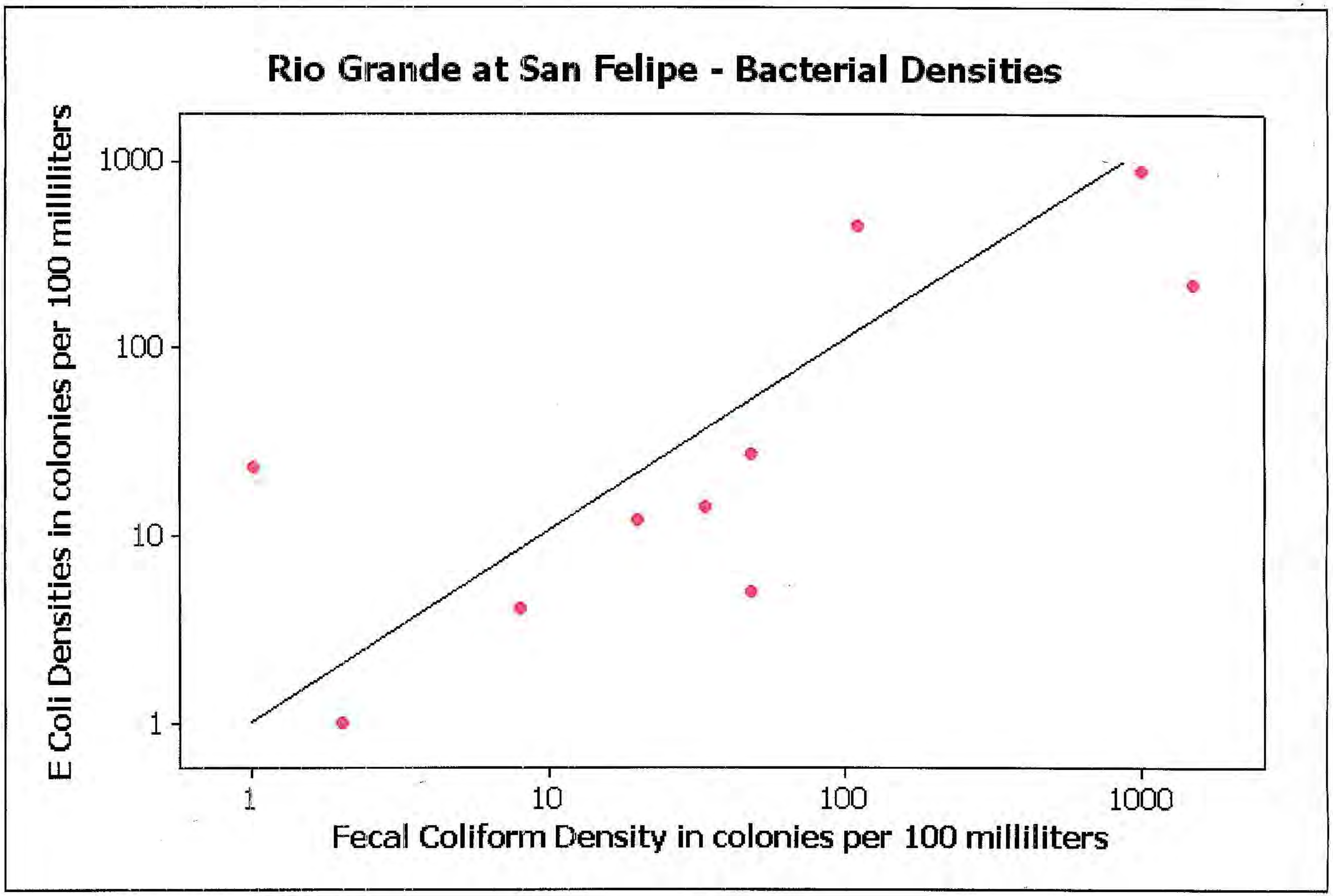
<u>SWQB Response:</u> *As previously noted, SWQB E.coli samples were collected by SWQB staff operating under the NMED/SWQB Standard Operating Procedures for Data Collection and analyzed per IDEXX Laboratories, Inc and Colilert®-18 procedures as described in <u>Standard Methods for the Examination of Water and Wastewater</u>, protocol 8310 B. The USGS E.coli data were collected by USGS staff operating under the <u>National Field Manual for the Collection of Water-Quality Data</u> (Chapter A.7). The data from both agencies is publically available and collected with EPA-approved methods and is therefore eligible to be included in water quality assessments. SWQB noted the differences in the E.coli data during the assessment process, but had no reason to discard either dataset as invalid. Due to the dynamic nature of the Rio Grande, varying E.coli results across a given time period are not atypical.*

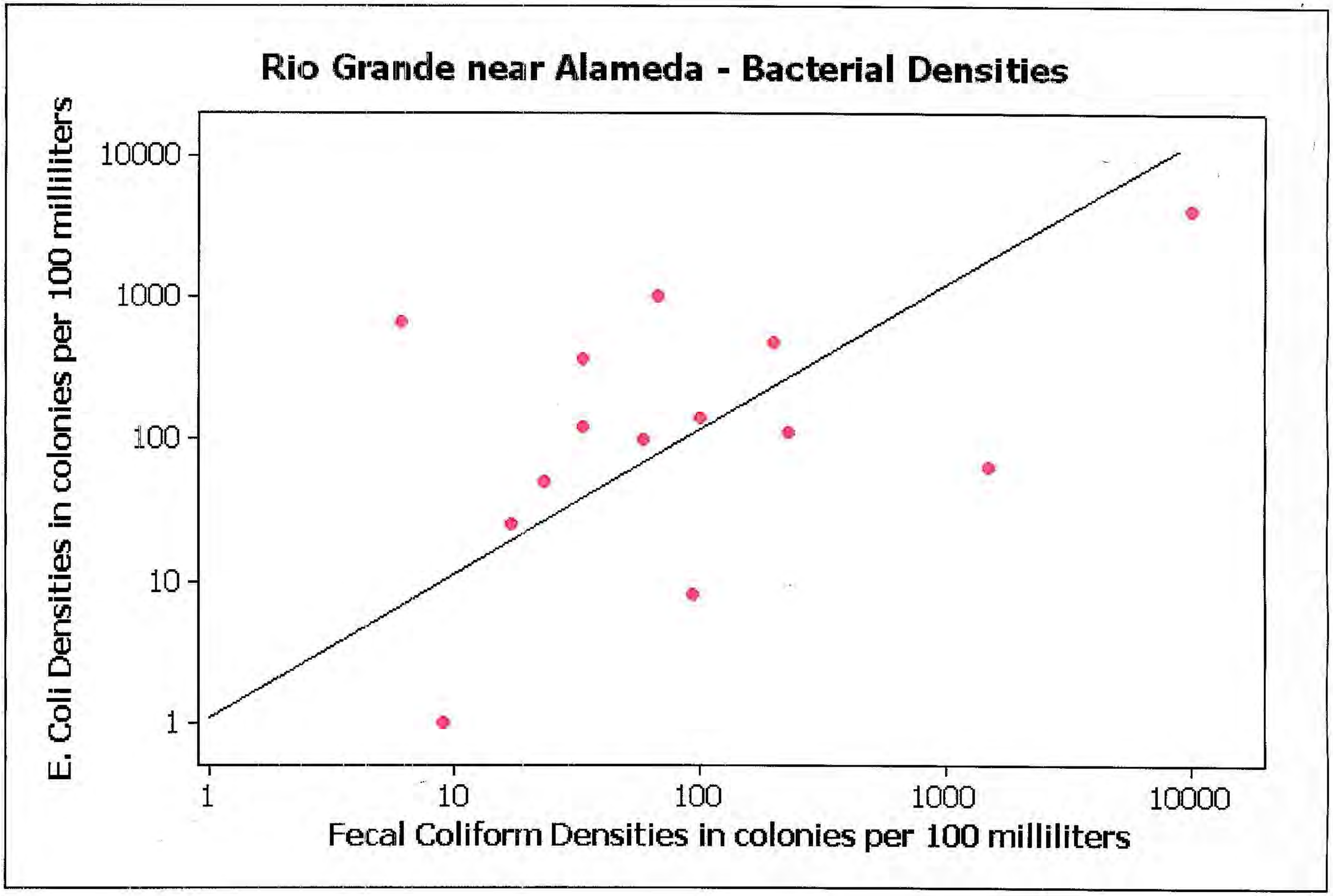
A footnote has been added to Tables D.1 and D.2 to indicate those samples that have exceeded the Tribal single sample E.coli criterion.


Rio Grande at Otowi Bridge - Bacterial Densities- 1998-2008
E. Coli Densites in colonies per 100 milliliters
Fecal Coliform Density in colonies per 100 milliliters
10000
1000
100
10
1
1
10
100
1000
10000

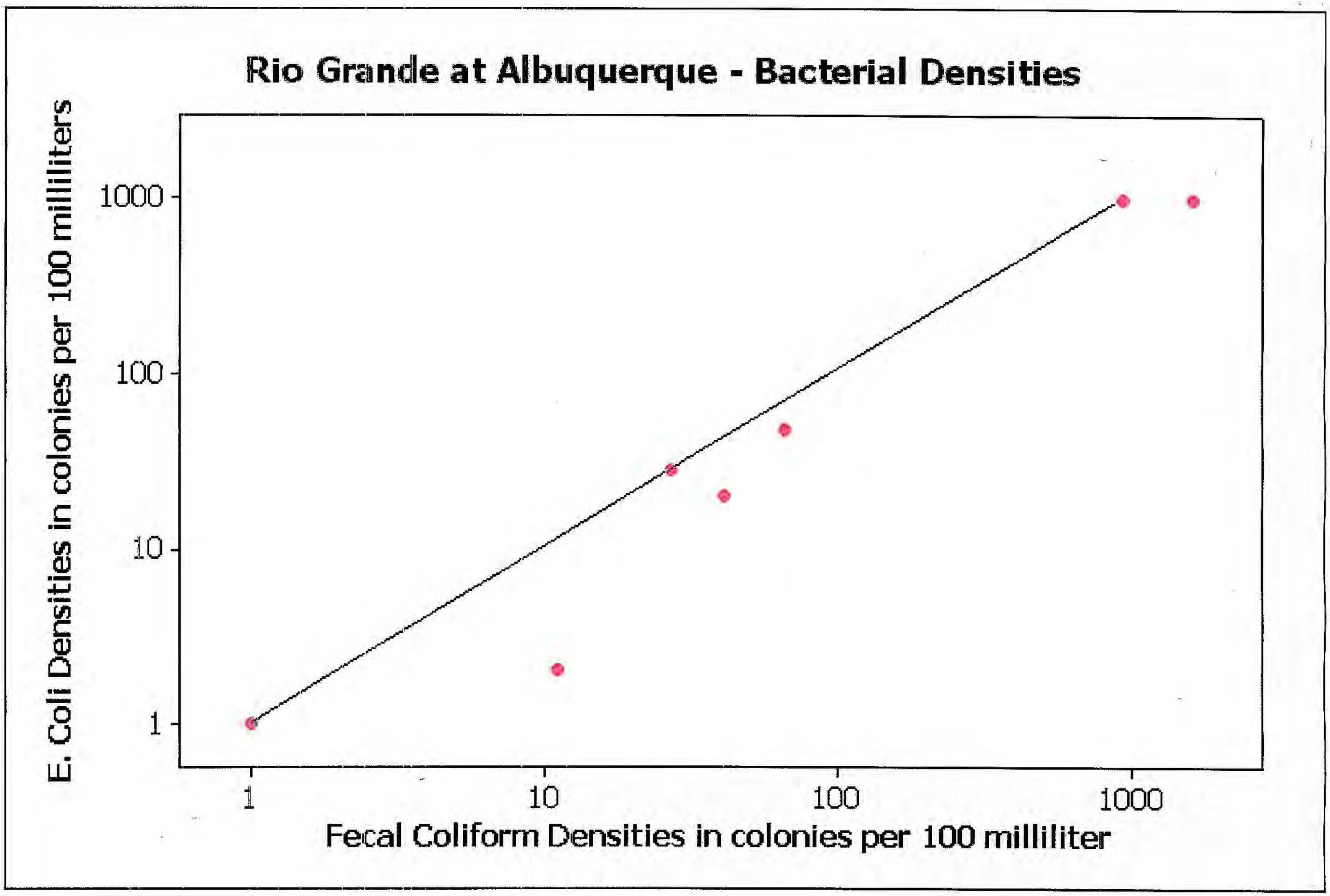


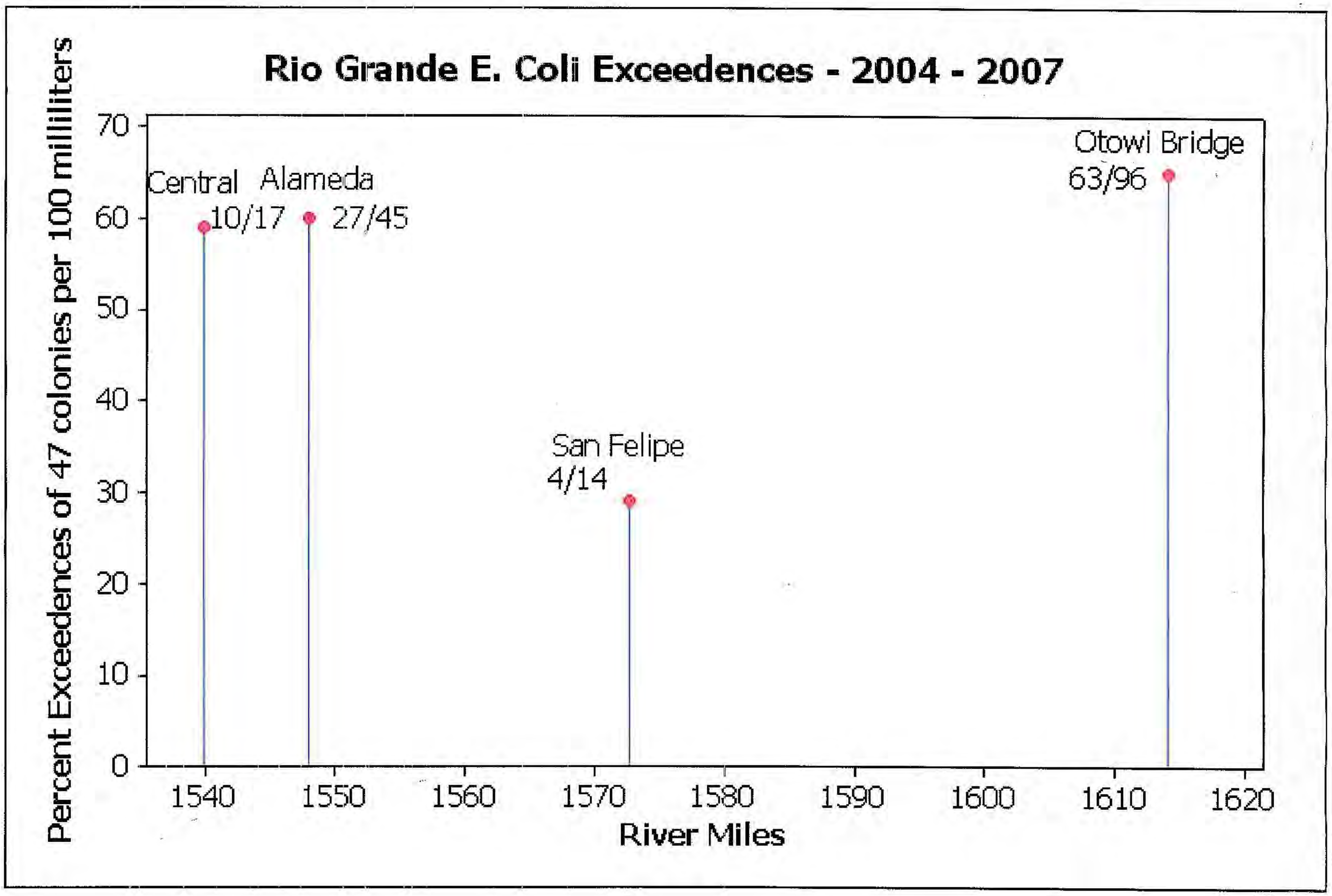
Rio Grande at San Felipe - Bacterial Densities
E Coli Densities in colonies per 100 milliliters
1000
100
10
1
1
10
100
1000
Fecal Coliform Density in colonies per 100 milliliters


Rio Grande at San Felipe - Bacterial Densities
E Coli Densities in colonies per 100 milliliters
1000
100
10
1
1
10
100
1000
Fecal Coliform Density in colonies per 100 milliliters

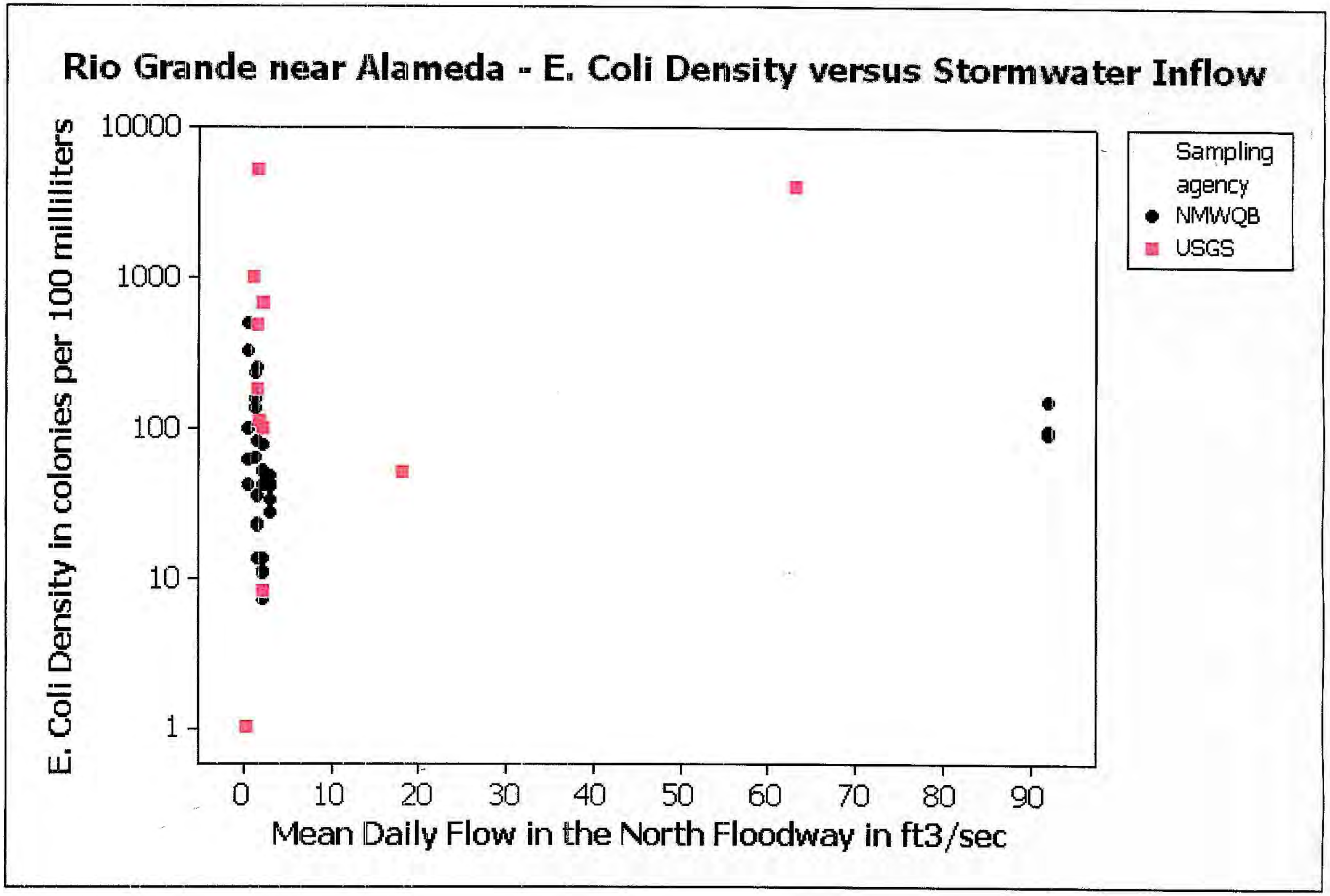


Rio Grande near Alameda - Bacterial Densities
E. Coli Densities in colonies per 100 milliliters
10000
1000
100
10
1
1
10
100
1000
10000
Fecal Coliform Densities in colonies per 100 milliliters

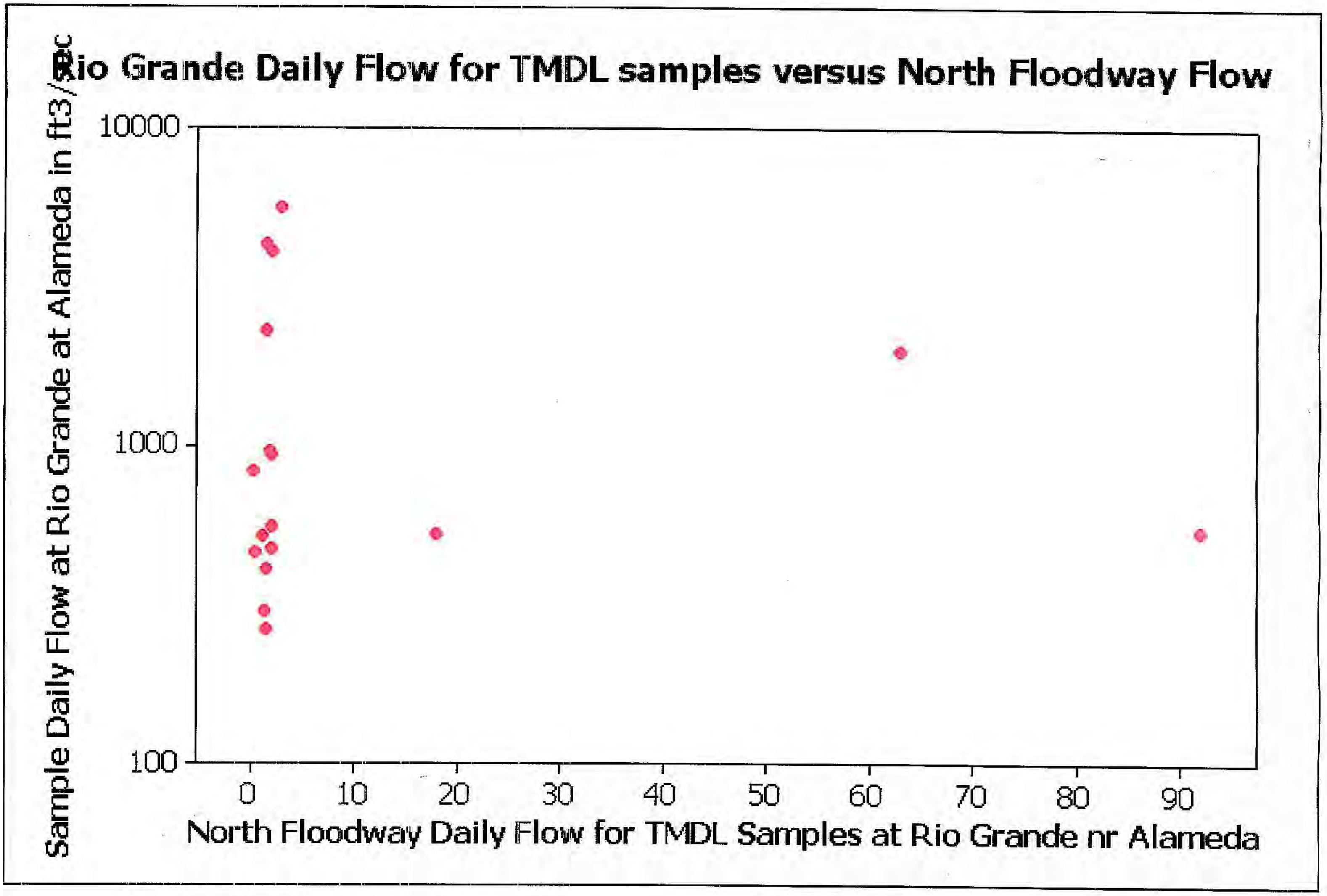

Rio Grande at Albuquerque - Bacterial Densities
E. Coli Densities in colonies per 100 milliliters
1000
100
10
1
1
10
100
1000
Fecal Coliform Densities in colonies per 100 milliliter

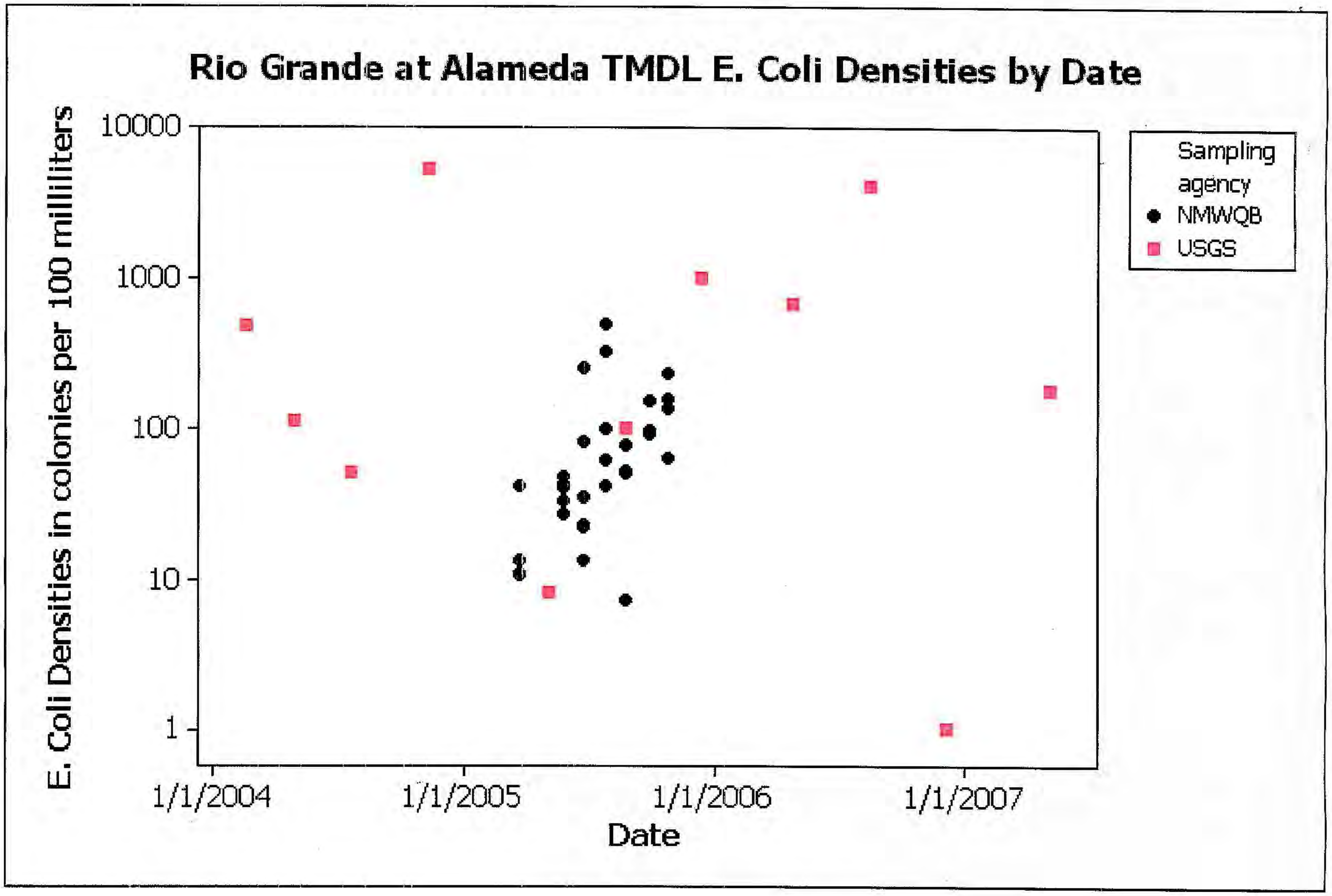


Rio Grande E. Coli Exceedences - 2004 - 2007
Percent Exceedences of 47 colonies per 100 milliliters
River Miles
Central 10/17
Alameda 27/45
San Felipe 4/14
Otowi Bridge 63/96
0
10
20
30
40
50
60
70
1540
1550
1560
1570
1580
1590
1600
1610
1620



Rio Grande near Alameda - E. Coli Density versus Stormwater Inflow
E. Coli Density in colonies per 100 milliliters
10000
1000
100
10
1
0
10
20
30
40
50
60
70
80
90
Mean Daily Flow in the North Floodway in ft3/sec
Sampling agency
NMWQB
USGS


Rio Grande Daily Flow for TMDL samples versus North Floodway Flow
Sample Daily Flow at Rio Grande at Alameda in ft3/sec
10000
1000
100
0
10
20
30
40
50
60
70
80
90
North Floodway Daily Flow for TMDL Samples at Rio Grande nr Alameda


Rio Grande at Alameda TMDL E. Coli Densities by Date
E. Coli Densities in colonies per 100 milliliters
10000
1000
100
10
1
1/1/2004
1/1/2005
1/1/2006
1/1/2007
Date
Sampling agency
NMWQB
USGS

Comment Set H:

PUEBLO OF SANTA ANA
OFFICE OF THE GOVERNOR

October 26, 2009

NOV 0 2 2009

Ms. Heidi Henderson
NMED SWQB
PO Box 5469
Santa Fe, NM 87502

Dear Ms. Henderson:

The Pueblo of Santa Ana (the Pueblo) recently reviewed the New Mexico Environment Department's (NMED) Public Comment Draft Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed and has developed the following technical questions to aid in clarification:

1. What was the technical basis for NMED to conduct monitoring below the Angostura Diversion? Is this monitoring site considered a reference point, and if so, what is the justification for this?
2. Is NMED considering additional monitoring stations <u>above</u> the Angostura Diversion with new wastewater treatment plants online to discharge to the Rio Grande? What is the process for adding sites upstream of the Angostura Diversion for future consideration in NMED's "Water Quality Monitoring of the Middle Rio Grande" report?
3. The current area of concern for *E. coli* in the Middle Rio Grande falls below the 550 bridge at the point of Bernalillo's Wastewater Treatment Plant discharge. It would be helpful to include approximate or recorded flow data within the document for NMED's monitoring sites (i.e. Table D.1) as it may assist with interpreting *E. coli* results.
4. What is the protocol for developing a TMDL in "shared waters" of dual jurisdiction; waters that, on one side of the channel are State lands and on the other side are Tribal or Pueblo lands?
5. The State of NM will undergo the triennial review of its water quality standards at the end of 2009. Considering the proposed designated use changes of secondary contact to primary contact and the inclusion of public water supply (segment 20.6.4.106), how will the TMDL for *E. coli* be revised and how does NMED propose to address this designated use change?
6. How and when will the provisional data collected on dissolved oxygen (DO) and other parameters in the Middle Rio Grande be incorporated into potential future TMDLs? Why was DO not included in the 2009 TMDL schedule as stated in the 2008-2010 State of New Mexico Integrated List?

If you have any questions regarding the Pueblo's comments, please contact Jennifer Wellman, Water Resources Division Manager, at (505)771-6754 or Genevieve McGeisey, Water Quality Scientist, at (505)771-6757. Thank you for your consideration of these issues.

Sincerely,

Bruce Sanchez
Governor

02 DOVE ROAD • SANTA ANA PUEBLO • NM 87004
TEL: 505-867-3301 • FAX: 505-867-3395 •

SWQB Response: *Thank you for your comments. Although the comments were received after the end of the 45-day public comment period, SWQB chose to respond to the comments.*

1. *SWQB conducted water quality sampling at the Rio Grande below Angostura Diversion Works (30RGrand473.7) site during the 2005 water quality survey. This site was chosen because it is at the uppermost site of the Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) Assessment Unit (AU) and is representative of the Rio Grande as it enters this AU. The site is considered a reference or background site for this study as it is located upstream of the municipalities in the Middle Rio Grande watershed.*

2. *For the purposes of the 2005 Middle Rio Grande survey, SWQB defined the Middle Rio Grande as the watershed from the Angostura Diversion to Elephant Butte Reservoir. SWQB has established Assessment Units upstream of the Angostura Diversion; the next two upstream are the Rio Grande (non-Pueblo Angostura Diversion to Cochiti Reservoir) and Rio Grande (Cochiti Reservoir to San Ildefonso bnd) Assessment Units. SWQB has three established stations in the Rio Grande (Cochiti Reservoir to San Ildefonso bnd) AU, but none in the Rio Grande (non-Pueblo Angostura Diversion to Cochiti Reservoir) AU due to the limited length of State waters along this reach of the Rio Grande.*

3. *Flow data has been added to Appendix D.*

4. *SWQB develops multi-jurisdictional TMDLs by using the most conservative water quality standard in the TMDL calculations. In this case, SWQB developed the TMDLs for the Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge) and Rio Grande (non-Pueblo Alameda Street Bride to Angostura Diversion) by using the Pueblo of Isleta and Pueblo of Sandia standards, respectively. The regulations in 40 CFR §131.10(b) require the development of the TMDL using the tribal standards in order to be protective of the downstream standards. The regulations in 40 CFR §122.4(d) require allocations and effluent limits to be developed using the tribal standards in order to be protective of the downstream waters. A statement addressing this issue has been added to Section 2.3.*

5. *The NMED" Proposed Amendments to the Standards for Interstate and Intrastate Surface Waters, 20.6.4 NMAC" proposes a change from secondary contact to primary contact as well as the addition of the public water supply designated use for Segments 20.6.4.105 and 20.6.4.106. NMED proposes to change secondary contact to primary contact so that the designated use is consistent with the assigned criteria; the monthly geometric mean and single sample criteria already reflect primary contact E.coli criteria recommendations, so only the term for the designated use is included in the proposed changes. According to the NMED Proposed Amendments document,*

    > *"…the Department does not propose criteria at this time to apply generally to the public water supply use. The reason is that public water systems are required to provide treatment to comply with the Drinking Water Regulations. As a result, the water provided by public water systems must be safe to drink regardless of the quality of the source water. Nonetheless, it may be prudent to establish ambient water quality criteria as a preventative approach that could reduce treatment*

costs. The Department intends to commence a stakeholder discussion after the triennial review to discuss the issue further."

SWQB will continue to monitor the Rio Grande and apply the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (January 2008) to collected water quality data in order to assess the impairment status of the Rio Grande.

6. *The Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge) and Rio Grande (non-Pueblo Alameda Street Bridge to Angostura Diversion) were listed as impaired for dissolved oxygen on the 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated List. However, per the February 2009 Record of Decision, EPA delisted these two segments of the Rio Grande for dissolved oxygen. However, the dissolved oxygen listings for these two segments of the Rio Grande are included in the Draft 2010-2012 State of New Mexico CWA §303(d)/§305(b) Integrated List. A schedule set for the dissolved oxygen TMDLs for these Assessment Units will not be set until after the impairment has been approved by the WQCC and EPA. Likewise, a TMDL for the ambient toxicity listing for the Rio Grande (non-Pueblo Alameda Street Bride to Angostura Diversion) has not been scheduled.*

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APPENDIX F
JURISDICTIONAL AREA APPROACH

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EPA released a memo entitled "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs" in November 2002 clarifying EPA regulations regarding Waste Load Allocations (WLA) and Municipal Separate Storm Sewer Systems (MS4s) in TMDLs. In November 2008, EPA released the draft <u>TMDLs to Stormwater Handbook</u> to provide guidance to states as to how to include WLAs for MS4s in TMDLs. The handbook provides a number of options for states to consider when developing TMDLs that include MS4 allocations. One of the waterbody-based approaches to TMDL development includes the jurisdictional area approach:

"Jurisdictional area: loading capacity is allocated to permitted stormwater sources (and other land-based sources) on the basis of the portion of the drainage area included within their physical boundary. Without knowing the specific area draining to a stormwater conveyance system, the stormwater source area can be represented by the jurisdictional or operational area of the source (e.g., urbanized area for an MS4). For example, if the loading capacity is 100 lbs/day and the urbanized area of an MS4 represents 30 percent of the area draining to the assessment location, the MS4 WLA is specified as 30 lbs/day." (Section 4.3.2)

The handbook also gives specific direction on incorporating WLAs for MS4s in TMDLs developed using Load Duration Curves:

"TMDLs developed using the load duration approach most often identify the portion of the loading capacity for the stormwater WLA(s) on the basis of jurisdictional area. However, because the duration curve framework establishes a series of individual flow-variable loading capacities, the portion of each loading capacity attributed to individual sources typically will also vary by flow. Figure 19 illustrates a TMDL that was developed using a duration curve framework. In the Figure 19 example, stormwater WLAs for MS4 communities are based on the percent jurisdictional area approach. In this case, 3 percent of the watershed falls within the jurisdiction of MS4 communities. Thus, the MS4 WLA is 3 percent of the available allocation for each flow zone. The remaining 97 percent is designated for nonpoint sources and natural background as the LA for each zone." (Section 4.3.2.2)

The excerpts from the <u>TMDLs to Stormwater Handbook</u> provide the framework from which SWQB developed the WLA for the Phase I and Phase II MS4 permittees for each impaired Assessment Unit. However, the MRG-area presented two additional challenges. Unlike the 2002 Middle Rio Grande fecal coliform TMDL, the MRG E.coli TMDL includes both Phase I and Phase II MS4 permits. Additionally, the two permits each include jurisdictional area in the Rio Grande (Isleta Pueblo boundary to Alameda Bridge) and Rio Grande (non-Pueblo Alameda to Angostura Diversion) Assessment Units. As both AUs are also impaired for *E.coli*, TMDL calculations are therefore included for both AUs. The following explanation provides additional detail on these jurisdictional area calculations to supplement the information provided in Section 4.4.1.

Determination of Contributing Watershed Area

For the purposes of the MS4 WLA determinations, the contributing watershed is considered to be the Rio Grande drainage from Isleta Pueblo boundary to Cochiti Reservoir. This contributing drainage includes the USGS Hydrologic Unit Codes (HUCs) displayed in Figure F.1 and Table F.1. The total contributing area from the 8 HUCs is 2084.15 sq. mi.

As noted in Figure F.1, HUCs 1302020303 and 1302020302 do not contribute drainage to the Rio Grande (Alameda Bridge to Angostura Diversion) AU. Additionally, HUC 1302020301 only partially contributes to the Rio Grande (Alameda Bridge to Angostura Diversion) AU. The fraction that contributes to this AU (i.e. is upstream of the Alameda Bridge) was estimated to be 259 sq mi based on an east-west line drawn at the Alameda Bridge. Therefore, the total watershed area contributing to the Rio Grande (Alameda Bridge to Angostura Diversion) AU is the sum of these areas, totaling 1612.72 sq mi.

Phase I Permit Jurisdictional Area Approach

Four entities are authorized to discharge under the Phase I MS4 permit: City of Albuquerque, Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), New Mexico Department of Transportation District 3, and University of New Mexico. The Phase I permit states:

> *"This permit covers all areas, except agricultural lands, within the corporate boundary of the City of Albuquerque, New Mexico served by, or otherwise contributing to discharges from municipal separate storm sewers owned or operated by the permittees listed above."*

Based on the incorporated city limits of the City of Albuquerque from GIS coverages, the Incorporated Area of the City of Albuquerque was determined to be 188.08 square miles (sq. mi.). However, 7.2 sq. mi. fall into the Rio Grande (Alameda Bridge to Angostura Diversion) AU while 180.88 sq. mi. fall into the Rio Grande (Isleta Pueblo bnd to Alameda Bridge) AU, again this division is based on an east-west line drawn at the Alameda Bridge.

Therefore, for the Rio Grande (Isleta Pueblo bnd to Alameda Bridge) AU, the Phase I MS4 WLA is calculated as follows (see Table F.2):

Total jurisdictional area / Total contributing drainage area =
180.88 sq. mi. / 2084.15 sq. mi. = 8.68%

The Phase I MS4 WLA for the Rio Grande (Alameda Bridge to Angostura Diversion) AU is calculated as follows (see Table F.2):

Total jurisdictional area / Total contributing drainage area =
7.2 sq. mi. / 1612.72 sq. mi. = 0.45%

These calculations are summarized in Section 4.4.1. The Phase I MS4 WLA values used in the TMDL document were rounded from these percent jurisdictional estimates to 9% and 1%, respectively.

Phase II Permit Jurisdictional Area Approach

The nine sMS4 permittees eligible for coverage under the general Phase II MS4 permit are listed in Table 4.7. The Phase II sMS4 permit (NMR040000) reads:

> *"This permit authorizes the discharge of storm water from small municipal separate storm sewer systems (MS4s) provided the MS4 is located fully or partially within an urbanized area as determined by the 2000 Decennial Census."*

The Urbanized Areas (UA) upstream from the Isleta Pueblo boundry within the Rio Grande drainage was determined from GIS coverages to be 108.89 sq. mi.; 29.53 sq. mi. fall into the Rio Grande (Isleta Pueblo bnd to Alameda Bridge) AU and 79.35 sq. mi. fall into the Rio Grande (Alameda Street Bridge to Angostura Diversion) AU. This UA values exclude the Incorporated Area of the City of Albuquerque. For the purposes of the MS4 WLA determinations, the contributing watershed is considered to be the Rio Grande drainage from Isleta Pueblo boundary to Cochiti Reservoir. This contributing drainage includes the USGS Hydrologic Unit Codes (HUCs) displayed in Figure F.1 and Table F.1. The total contributing area from the 8 HUCs is 2084.15 sq. mi.

Therefore, for the Rio Grande (Isleta Pueblo bnd to Alameda Bridge) AU, the Phase II MS4 WLA is calculated as follows (see Table F.3):

Total jurisdictional area / Total contributing drainage area =
29.53 sq. mi. / 2084.15 sq. mi. = 1.42%

The Phase II MS4 WLA for the Rio Grande (Alameda Bridge to Angostura Diversion) AU is calculated as follows (see Table F.3):

Total jurisdictional area / Total contributing drainage area =
79.35 sq. mi. / 1612.72 sq. mi. = 4.92%

These calculations are summarized in Section 4.4.1. The Phase II MS4 WLA values used in the TMDL document were rounded from these percent jurisdictional estimates to 1% and 5%, respectively.

Thus, the total WLA assigned to each AU for both Phase I and Phase II permits is as follows:

Rio Grande (Isleta Pueblo bnd to Alameda Bridge): 9 + 1 = 10%
Rio Grande (Alameda Bridge to Angostura Diversion): 1+ 5 = 6%

Without rounding of these estimated values, the Rio Grande (Isleta Pueblo bnd to Alameda Bridge) WLA is 10.10% and the Rio Grande (Alameda Bridge to Angostura Diversion) WLA is 5.37%. In evaluating the potential impact, SWQB finds that, while the WLA is slightly smaller for the Rio Grande (Isleta Pueblo bnd to Alameda Bridge), this approach results in both a larger overall WLA allocation for MS4 permitees within the Middle Rio Grande and a 10% larger WLA for the Rio Grande (Alameda Bridge to Angostura Diversion) AU providing the permittees a larger WLA with which to work.

The remaining ninety percent was designated for nonpoint sources and natural background as the LA for each zone in the Rio Grande (Isleta Pueblo boundary to Alameda Street Bridge) AU. The remaining ninety four percent was designated for nonpoint sources and natural background as the LA for each zone in the Rio Grande (Alameda Street Bridge to Angostura Diversion). The WLA values for NMS000101 (Albuquerque Phase I MS4 permit) and NMR040000 (Phase II MS4s) are listed in Tables 4.11 and 4.12.

The TMDLs were calculated as described in Tables 4.4 and 4.5. From this calculated TMDL value, the Margin of Safety (MOS) and the NPDES permits were subtracted for each flow duration interval. In order to calculate the Phase I and Phase II MS4 permit WLAs, the percentages, derived using the jurisdictional area approach, were applied to the remaining TMDL quantity for each flow duration interval. For example, the high flow WLA for the Rio Grande (Isleta Pueblo bnd to Alameda Street Bridge) AU was calculated as follows:

TMDL –MOS* – NPDES WLA** = LA
$5.27 \times 10^{12} - 1.40 \times 10^{12} - 1.35 \times 10^{11} = 3.73 \times 10^{12}$ cfu/day

**as discussed in Section 4.7*
***note: sum of WLA for NM0022250 and NM0027873*

The MS4 WLAs were assigned as a percentage of the LA.
Phase I MS4 WLA = 9% and Phase II MS4 WLA = 1%, therefore;

NMS000101 WLA = $0.09 \times 3.73 \times 10^{12}$ cfu/day = 3.36×10^{11} cfu/day
NMR040000 WLA = $0.01 \times 3.73 \times 10^{12}$ cfu/day = 3.73×10^{10} cfu/day
Total MS4 WLA = NMS000101 WLA + NMR040000 WLA = 3.73×10^{11} cfu/day

The remaining available load is allocated to the LA. The final TMDL allocations read as follows:

TMDL – MOS – NPDES WLA – MS4 WLA = LA
$5.27 \times 10^{12} - 1.40 \times 10^{12} - 1.35 \times 10^{11} - 3.73 \times 10^{11} = 3.36 \times 10^{12}$ cfu/day

<u>References:</u>

US EPA, 2002. "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs." Washington, D.C.

US EPA, 2008. <u>TMDLs to Stormwater Permits Handbook</u> (draft). Washington, D.C.

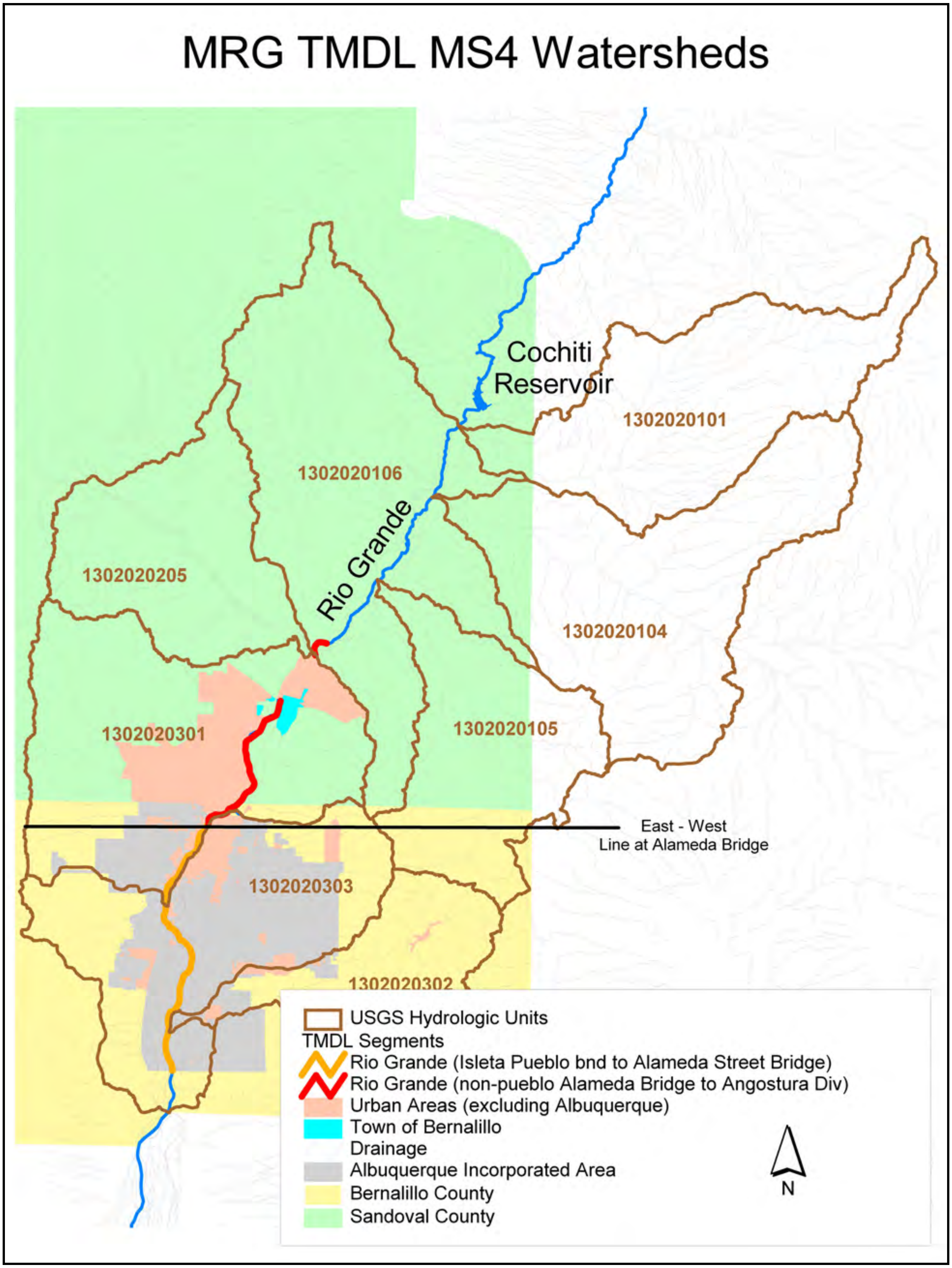

Figure F.1: Albuquerque-area MS4 jurisdiction

Table F.1: USGS Hydrologic Unit Code (HUC) areas

HUC	Total Area (sq mi)	Total Contributing Watershed Areas Rio Grande (Isleta Pueblo bnd to Alameda Bridge)	Rio Grande (Alameda Bridge to Angostura Div)
1302020301- Arroyo de Las Calabacillas-Rio Grande	329.97	329.97	259
1302020303 - City of Albuquerque-Rio Grande	268.72	268.72	n/a
1302020302 - Tijeras Arroyo	131.74	131.74	n/a
1302020106 - Arroyo Tonque-Rio Grande	388.81	388.81	388.81
1302020101 - Santa Fe River	256.06	256.06	256.06
1302020205 - Lower Jemez River	192.60	192.60	192.60
1302020104 - Outlet Galisteo Creek	322.37	322.37	322.37
1302020105 - Arroyo Tonque	193.88	193.88	193.88
Totals	**2084.15**	**2084.15**	**1612.72**

Table F.2: Phase I MS4 WLA allocations

	Rio Grande (Isleta Pueblo bnd to Alameda Bridge)	Rio Grande (Alameda Bridge to Angostura Div)
Incorporated Area of the City of Albuquerque (sq mi)	180.88	7.2
Total contributing watershed area (see Table F.1)	2084.15	1612.72
Percent jurisdictional area	**8.68%**	**0.45%**

Table F.3: Phase II MS4 WLA allocations

	Rio Grande (Isleta Pueblo bnd to Alameda Bridge)	Rio Grande (Alameda Bridge to Angostura Div)
Urbanized Area within Rio Grande drainage excluding Albuquerque (sq mi)	29.53	79.35
Total contributing watershed area (see Table F.1)	2084.15	1612.72
Percent jurisdictional area	**1.42%**	**4.92%**