SECTION 1
INTRODUCTION

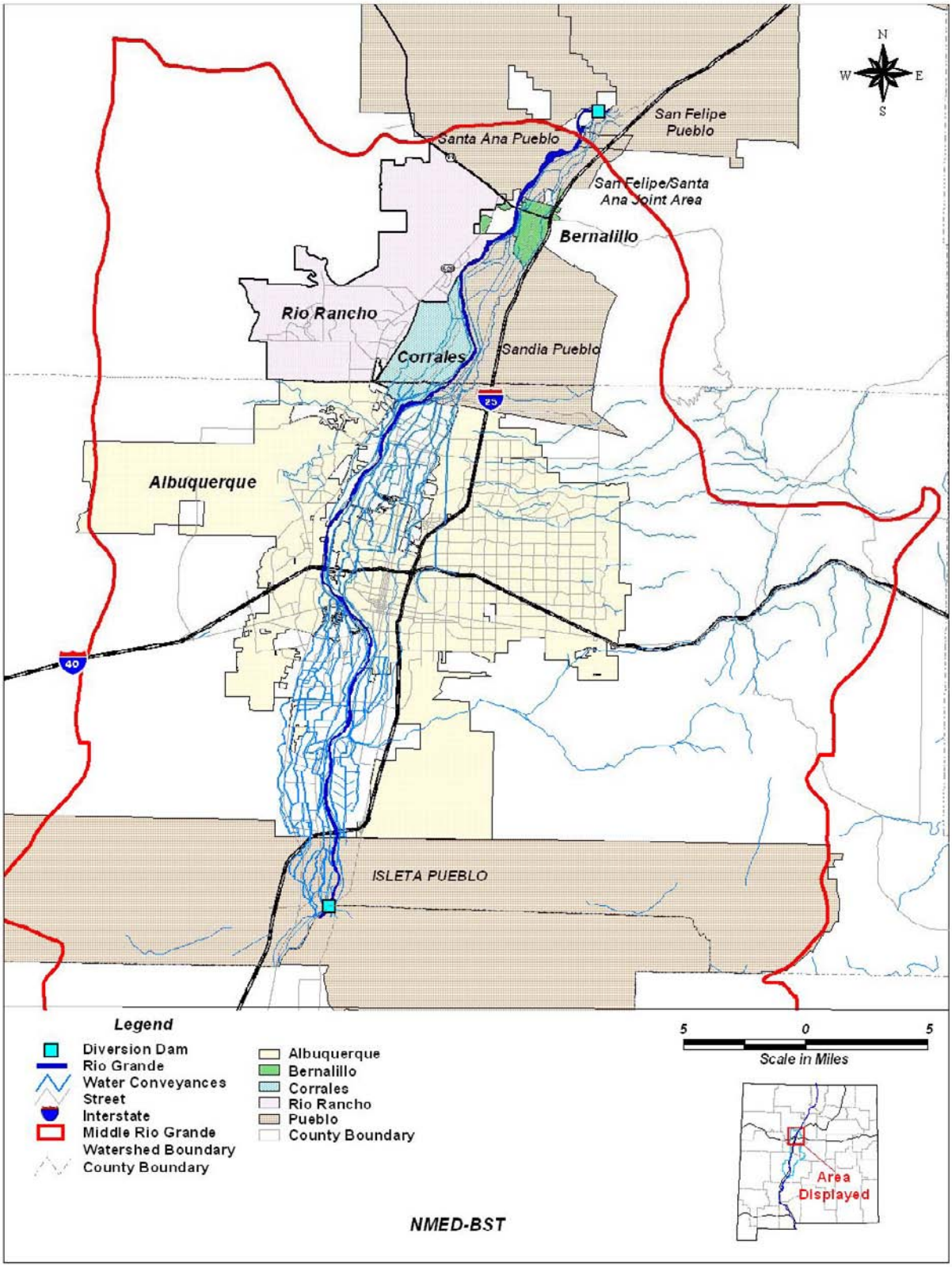
1.1 Purpose and Scope

The Middle Rio Grande (MRG) Microbial Source Tracking Project was driven by a wide array of water quality management programs, but the reason for conducting this project was singular in purpose: to identify specific sources of fecal coliform causing high levels of bacteria in the MRG. Initiated in February 2002, this project was undertaken to advance implementation of the fecal coliform total maximum daily loads (TMDL) approved by the U.S. Environmental Protection Agency (USEPA) Region 6 in May 2002. This project was jointly funded by the New Mexico Environment Department (NMED), Bernalillo County, and Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

This project is one of many that reflect the direction of the NMED water quality management program and NMED's commitment to restore and maintain the designated uses in impaired watersheds. Following completion of the TMDL, NMED determined that the most appropriate next step for addressing the fecal coliform loading problem in the MRG watershed was to acquire additional data to assist in developing a more detailed implementation plan. To achieve this objective, NMED chose to utilize the relatively new scientific method known as Microbial Source Tracking (MST) to provide additional data and certainty necessary to identify specific sources or types of fecal contamination throughout the MRG watershed. Given the vast number of sources of fecal coliform bacteria in the environment, it was believed that differentiating those sources by species type or category would provide invaluable data essential for adequately and economically designing and targeting specific point and nonpoint source management measures. In addition, a more clear understanding of the sources of bacteria, especially as a function of flows and wet weather events, would provide a more accurate evaluation of the true potential for human health effects.

The MRG, for the purposes of this study, is defined as the Rio Grande from the northern boundary of Isleta Pueblo to the southern boundary of Santa Ana Pueblo. The Pueblo of Sandia also has jurisdiction over a portion of the MRG watershed. The project study area is depicted in Figure 1.1. While the contributing watershed upstream of the MRG (HUC 13020201) covers thousands of square miles, in order to focus on the same geographic area covered by the approved TMDLs, it was agreed at the outset of the project that the study would only address the contributing subwatersheds associated with the Albuquerque metropolitan area (HUC 13020203) north of Isleta Pueblo.

Figure 1.1 MRG Project Study Area



1.2 Regulatory Background

In 1978 the New Mexico Legislature revised the New Mexico (NM) Water Quality Act (WQA), which became the basic authority for water quality management in New Mexico. This law expanded the duties and powers of the NM Water Quality Control Commission (WQCC) to more effectively implement requirements of the federal Clean Water Act (CWA). These duties include adoption of water quality standards (WQS) and regulations "…to prevent or abate water pollution in the state or in any specific geographic area or watershed of the state...or for any class of waters." Under the NM WQA, water is defined as "…all water including water situated wholly or partly within or bordering upon the state, whether surface or subsurface, public or private, except private waters that do not combine with other surface or subsurface water." The NM WQCC is the State water pollution control agency for all purposes of the CWA, and may take all necessary actions to secure the benefits of the CWA.

Under the authority of the NM WQA, the NM WQCC adopted the basic framework for water quality management in New Mexico. Major components of this framework include:

- the State water quality management plan;
- the nonpoint source management program;
- the State continuing planning process;
- surface WQSs;
- TMDLs;
- regulations for discharge to surface waters;
- regulations for disposal of refuse in watercourses;
- regulations for spill-cleanup; and
- utility operators regulations.

Since the NM WQCC has no technical staff of its own, responsibilities for water quality management activities are delegated to constituent agencies, generally the NMED or the Oil Conservation Division of the NM Energy, Minerals and Natural Resources Department. Responsibilities for water quality management activities involving surface waters are delegated to the NM Surface Water Quality Bureau (SWQB). The Pueblo of Sandia also has jurisdiction over a portion of the MRG watershed.

1.3 Designated Uses and Water Quality Standards

Water quality standards, consisting of designated beneficial uses, water quality criteria to protect the uses, and antidegradation policies, serve dual purposes of establishing water quality goals for the nation's water bodies and providing the regulatory basis for establishing certain treatment controls and strategies. Both State of New Mexico and Pueblo of Sandia WQSs apply to the MRG. State WQSs, as described in *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (20.6.4 NM Administrative Code [NMAC]), are summarized in Table 1.1, which was derived from the MRG Fecal Coliform TMDL Report (NMED 2002).

The MRG is divided into two segments (20.6.4.105 and 20.6.4.106) and is classified by NM WQSs as having designated uses as a limited warm water fishery and secondary contact recreation and irrigation. Segment 20.6.4.105 is defined as the main stem of the

Rio Grande from the headwaters of Elephant Butte Reservoir upstream to Alameda Bridge (Corrales Bridge), the Jemez River from the Jemez Pueblo boundary upstream to the Rio Guadalupe, and intermittent flow below the perennial reaches of Rio Puerco and the Jemez River which enters the main stem of the Rio Grande. Segment 20.6.4.106 is defined as follows: The main stem of the Rio Grande from Alameda Bridge (Corrales Bridge) upstream to the Angostura Diversion Works.

Water quality criteria list specific constituent levels to be maintained to ensure that designated uses are met. To protect contact recreation use, water quality criteria are based on the concentrations of fecal coliform bacteria in water. Fecal coliform bacteria are a group of moderately heat-tolerant coliform bacteria abundant in the intestines of warm-blooded animals, but are not believed to survive long in the environment. Because they are relatively easy to measure in water, they are used as an indicator of the possible presence of fecal pathogenic microorganisms in water, including other bacteria, viruses, and harmful protozoans. Most fecal coliform bacteria are not pathogenic. *E. coli* is often the most abundant species of the fecal coliform group of bacteria, and a few strains of *E. coli*, notably strain O157:H7, are pathogenic. State WQSs for fecal coliform for Segments 20.6.4.105 and 20.6.4.106 are listed in Table 1.1.

Table 1.1 State of New Mexico Designated Uses and Fecal Coliform Criteria Applicable to the Middle Rio Grande

Designated Uses	Fecal Coliform Criteria
MRG Segment 20.6.4.105	
• Irrigation • Limited warm water fishery • Livestock watering • Wildlife habitat • Secondary contact	The monthly geometric mean of fecal coliform bacteria shall not exceed 1,000 cfu/100 mL; no single sample shall exceed 2,000 cfu/100 mL.
MRG Segment 20.6.4.106	
• Irrigation • Limited warm water fishery • Livestock watering • Wildlife habitat • Secondary contact	The monthly geometric mean of fecal coliform bacteria shall not exceed 200 cfu /100 mL; no single sample shall exceed 400 cfu/100ml.

Pueblo of Sandia WQSs related to fecal coliform bacteria are summarized in Table 1.2. The Pueblo of Isleta has jurisdiction downstream of the studied portion of the MRG. The uses and criteria in the Pueblo of Isleta standards are identical to the standards of the Pueblo of Sandia.

Table 1.2 Pueblo of Sandia Designated Uses and Fecal Coliform Criteria Applicable to the Middle Rio Grande[1]

Designated Uses	Fecal Coliform Criteria
Primary contact ceremonial	a. geometric mean maximum of 100 colonies/100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days.) b. single sample maximum of 200 colonies/100 mL.
Primary contact recreation	a. April 1 to September 30 1) geometric mean maximum of 100 colonies/100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days.) 2) Single sample maximum of 200 colonies/100 mL. b. October 1 to March 31 Fecal coliform standards for secondary contact recreation use apply.
Secondary contact recreation	a. geometric mean maximum of 200 colonies/100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days.) b. single sample maximum of 400 colonies/100 mL.
Warm water fishery	a. geometric mean maximum of 100 colonies/100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days.) b. single sample maximum of 200 colonies/100 mL.
Agricultural water supply	a. geometric mean maximum of 1000 colonies/100 mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days.) b. single sample maximum of 2000 colonies/100 mL.

1.4 Water Quality Assessment and Total Maximum Daily Loads

Section 303(d) of the federal CWA requires states to assess all water bodies to determine if they are supporting all applicable WQSs. The 2000-2002 State of New Mexico §303(d) List included the MRG as water quality limited because fecal coliform levels sometimes exceed water quality criteria.

Section 303(d) also requires states to develop TMDL plans for water bodies determined to be water quality limited. A TMDL describes the maximum amount of a pollutant a water body can assimilate (load capacity) without violating a state's or Tribe's WQSs. A TMDL also allocates load capacity to known point sources and nonpoint

---

1 *These standards apply to all tribal surface waters, that is, all waters within the exterior boundaries of the Pueblo of Sandia Indian Reservation, including water situated wholly or partly within, or bordering upon, the Reservation, whether public or private, except for private waters that do not combine with other surface waters. (Pueblo of Sandia Water Quality Standards, August 10, 1993)*

sources. TMDLs are defined in 40 CFR Part 130 as the sum of the individual wasteload allocations (WLA) for point sources and load allocations (LA) for nonpoint sources, including a margin of safety (MOS) and natural background conditions. In November 2001, the NMED completed a TMDL for fecal coliform in the MRG (NMED 2002). TMDL numeric targets were calculated to provide protection of contact recreation designated use. Load capacities were estimated as a function of these water quality targets and the assimilative capacity of the MRG. Load allocations presented in the MRG fecal coliform TMDL (Table 1.3) are based on the load allowances developed using these targets.

Table 1.3 Approved Fecal Coliform TMDLs for the MRG – NMED 2002

Station	Load Allocation	Waste Load Allocation	Margin of Safety	TMDL
Discharges to Sandia Pueblo Tribal Waters				
Bernalillo WWTF	0	3.030×10^{9} cfu	0	3.030×10^{9} cfu/day
North Diversion Channel	0	6.438×10^{11} cfu	0	6.438×10^{11} cfu/day
Discharges to State of New Mexico Waters				
Rio Rancho #3 WWTF	0	3.219×10^{9} cfu	0	3.219×10^{9} cfu/day
Rio Rancho #2 WWTF	0	2.083×10^{10} cfu	0	2.083×10^{10} cfu/day
City of Albuquerque WWTF	0	2.878×10^{11} cfu	0	2.878×10^{11} cfu/day
San Jose Drain	0	1.068×10^{10} cfu	0	1.068×10^{10} cfu/day
South Diversion Channel	0	1.444×10^{11} cfu	0	1.444×10^{11} cfu/day
Tijeras Arroyo	0	1.199×10^{11} cfu	0	1.199×10^{11} cfu/day
La Cueva Arroyo	6.435×10^{11}cfu/day		0	
Pino Arroyo	6.166×10^{11} cfu/day		0	
Grant Line Arroyo	6.156×10^{11} cfu/day		0	
North Fork Hahn Arroyo	6.146×10^{11} cfu/day		0	
South Fork Hahn Arroyo	5.729×10^{11} cfu/day		0	
Hahn Arroyo	3.453×10^{11} cfu/day		0	
Embudo Arroyo	3.450×10^{11} cfu/day		0	
Academy Acres Drain	3.421×10^{11} cfu/day		0	
Tramway Floodway	3.127×10^{11} cfu/day		0	

The TMDL process integrates point, nonpoint, and natural background sources spatially and temporally in water quality management planning and permitting. It is a geographically based approach to preparing LAs and WLAs for pollutants that impair water quality integrity (NMED 2002). The TMDL establishes the allowable loadings or other water quality parameters for a waterbody. In doing so, it establishes the basis for water quality-based controls and the alternatives analysis. The TMDL process provides a mechanism for integrating the management of both the point and nonpoint pollution sources that contribute to impairment of use in a waterbody. When implemented, these controls should provide the pollution reduction necessary to meet appropriate WQSs which may be developed based on site-specific criteria or uses.

THIS PAGE INTENTIONALLY LEFT BLANK