Final Draft

TOTAL MAXIMUM DAILY LOAD

FOR THE

JEMEZ RIVER WATERSHED

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Prepared by

New Mexico Environment Department, Surface Water Quality Bureau

Monitoring, Assessments, and Standards Section

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For Additional Information please visit:

https://www.env.nm.gov/swqb/index.html

~or~

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Cover Photo: Jemez River above Soda Dam, SWQB 2013

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LIST OF ABBREVIATIONS

4Q3	4-Day, 3-year low-flow frequency
Act	New Mexico Water Quality Act
ADB	Assessment database
AU	Assessment unit
BLM	Bureau of Land Management
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general stormwater permit
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
^{o}C	Degrees Celsius
EQIP	Environmental Quality Incentive Program
^{o}F	Degrees Fahrenheit
GIS	Geographic information system
HQCWAL	High Quality Cold Water Aquatic Life
HUC	Hydrologic unit code
ISC	Interstate Stream Commission
km^2	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
MA	Mega-annum / million years
MASS	Monitoring, Assessment and Standards Section
MGD	Million gallons per day
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 stormwater permit
µS	Microsiemen
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NTU	Nephelometric turbidity units
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
§	Section
SEV	Severity of ill effect
sMS4	Small Municipal Separate Storm Sewer
SWPPP	Stormwater pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAA	Use Attainability Analysis

ug/L	Micrograms per Liter
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USNPS	U.S. National Park Service
WBP	Watershed-based plan
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through June 5, 2013)
WQX	Water quality exchange
WRAS	Watershed restoration action strategies
wt %	Weight percent
WWTP	Wastewater treatment plant

EXECUTIVE SUMMARY

Section 303(d) of the Federal Water Pollution Control Act, a.k.a., Clean Water Act, 33 U.S.C. §1313[1], requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be impaired. A TMDL defines the amount of a pollutant that a waterbody can assimilate without exceeding the state's water quality standard for that waterbody and allocates loads to known point sources and nonpoint sources. It further identifies potential methods, actions, or limitations that could be implemented to achieve water quality standards. "Total Maximum Daily Load" is defined as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint source and background conditions; see 40 C.F.R. §130.2(i)[2]. TMDLs also include a Margin of Safety (MOS), a required component that acknowledges and counteracts uncertainty.

The New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) conducted water quality surveys of the Jemez River watershed of north-central New Mexico in 2013, with additional sampling occurring in 2014 and 2015. Water quality monitoring stations were located within the watersheds to evaluate ambient water quality conditions and the impact of tributary streams. As a result of assessing data generated during these monitoring efforts, the following impairments[3] of water quality standards were found:

- *E. coli* in Clear Creek and the Jemez River; and
- Nutrients in Clear Creek, East Fork Jemez River, Jaramillo Creek, and Rio Guadalupe.

This TMDL addresses the above impairments as summarized in Tables ES-1 – ES-9. The 2013-2015 field studies identified other potential water quality impairments that are not addressed in this document due to additional data needs, assessment protocol revisions or re-application, or impending use attainability analyses. Additional information can be reviewed in the 2016-2018 Clean Water Act §303(d)/ §305(b) Integrated Report and List. If additional impairments are verified or found, subsequent TMDLs will be developed for those impairments. The SWQB has previously prepared TMDLs for portions of these watersheds including: TMDLs for Total Organic Carbon and turbidity on Clear Creek (2003); turbidity, temperature, and arsenic on the East Fork Jemez River (2006 and 2009); temperature and turbidity on Jaramillo Creek (2006); stream bottom deposits, turbidity, chronic aluminum, arsenic, boron, temperature, and nutrients on the mainstem Jemez River (2003, 2004, and 2009); stream bottom deposits and temperature on Rio Cebolla (2003); and chronic aluminum, stream deposits and turbidity for Rio Guadalupe (2004).

The SWQB's Monitoring, Standards, and Assessment Section (MASS) is scheduled to collect water quality data in the Jemez Watershed in 2021 and 2022. TMDLs will be re-examined and potentially revised at those times as this document is considered to be an evolving management plan. In the event that the new data indicate that the targets used in the analyses are not appropriate and/or if new standards are adopted, the TMDLs will be adjusted accordingly. When attainment of applicable water quality standards has been achieved, the impairment will be removed from New Mexico's CWA §303(d) List of Impaired Waters (§303(d) List).

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[1] http://www.epw.senate.gov/water.pdf
[2] http://www.gpo.gov/fdsys/pkg/CFR-2002-title40-vol18/pdf/CFR-2002-title40-vol18-part130.pdf
[3] http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm

SWQB's Watershed Protection Section will continue to work with watershed groups to develop Watershed-Based Plans (WBPs) to implement strategies that attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the WBP will be done with participation of all interested and affected parties. Further information on WBPs is in Section 7.

ES-1 Summary for Clear Creek (Rio de las Vacas to San Gregorio Lake)

New Mexico Standards Segment	20.6.4.108						
Waterbody Identifier	NM-2106.A_54						
Segment Length	5.14 mi						
Parameters of Concern	*E. coli*, plant nutrients						
Uses Affected	Primary contact, HQCWAL						
Geographic Location	Jemez USGS Hydrologic Code 13020202						
Scope/size of Watershed	11 mi^2						
Land Type	Southern Rockies - 21						
Probable Sources*	Diversions, flow alteration, dispersed rangeland grazing						
IR Category	5/5A						
TMDL for:	**WLA_{TOTAL}**	**+**	**LA**	**+**	**MOS**	**=**	**TMDL**
E. coli	**0**	**+**	**$3.00x10^8$**	**+**	**$5.30x10^8$**	**=**	**$3.53x10^9$ cfu/day**
Total Phosphorus	**0**	**+**	**0.10**	**+**	**0.02**	**=**	**0.12 lbs/day**
Total Nitrogen	**0**	**+**	**1.31**	**+**	**0.23**	**=**	**1.54 lbs/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Tables 4.10 and 5.11*

ES-2 Summary for Clear Creek (San Gregorio Lake to headwaters)

New Mexico Standards Segment	20.6.4.108						
Waterbody Identifier	NM-2106.A_55						
Segment Length	3.9 mi						
Parameters of Concern	Plant nutrients						
Uses Affected	HQCWAL						
Geographic Location	Jemez USGS Hydrologic Code 13020202						
Scope/size of Watershed	3 mi^2						
Land Type	Southern Rockies - 21						
Probable Sources*	Dispersed rangeland grazing, hiking trails						
IR Category	5/5B						
TMDL for:	**WLA_{TOTAL}**	**+**	**LA**	**+**	**MOS**	**=**	**TMDL**
Total Phosphorus	**0**	**+**	**0.07**	**+**	**0.01**	**=**	**0.08 lbs/day**
Total Nitrogen	**0**	**+**	**0.85**	**+**	**0.15**	**=**	**1.00 lbs/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 5.11.*

ES-3 Summary for East Fork Jemez (VCNP to headwaters)

New Mexico Standards Segment	20.6.4.108
Waterbody Identifier	NM-2106.A_10
Segment Length	8.66 mi
Parameters of Concern	Plant nutrients
Uses Affected	HQCWAL
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	44 mi^2
Land Type	Southern Rockies - 21
Probable Sources*	Wildlife other than waterfowl, dispersed rangeland grazing, watershed runoff following forest fire
IR Category	5/5B
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
Total Phosphorus	**0 + 0.11 + 0.02 = 0.14 lbs/day**
Total Nitrogen	**0 + 1.44 + 0.25 = 1.69 lbs/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 5.11*

ES-4 Summary for Jaramillo Creek (East Fork Jemez to headwaters)

New Mexico Standards Segment	20.6.4.108
Waterbody Identifier	NM-2106.A_12
Segment Length	10.03 mi
Parameters of Concern	Plant nutrients
Uses Affected	HQCWAL
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	22 mi^2
Land Type	Southern Rockies - 21
Probable Sources*	Wildlife other than waterfowl, dispersed rangeland grazing
IR Category	5/5B
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
Total Phosphorus	**0 + 0.07 + 0.01 = 0.08 lbs/day**
Total Nitrogen	**0 + 0.89 + 0.16 = 1.04 lbs/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 5.11*

ES-5 Summary for Jemez River (Jemez Pueblo bnd to Rio Guadalupe)

New Mexico Standards Segment	20.6.4.107
Waterbody Identifier	NM-2105_71
Segment Length	1.87 mi
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	475 mi^2
Land Type	Southern Rockies – 21; Arizona/New Mexico Plateau – 22
Probable Sources*	Diversions, onsite treatment systems, crop production, municipal point source discharge
IR Category	5/5A
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
E. coli	**$4.78x10^7$ + $3.11x10^{10}$ + $3.46x10^9$ = $3.46x10^{10}$ cfu/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 4.10*

ES-6 Summary for Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)

New Mexico Standards Segment	20.6.4.107
Waterbody Identifier	NM-2105.5_10
Segment Length	9.62 mi
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	469 mi^2
Land Type	Southern Rockies – 21
Probable Sources*	Onsite treatment systems, wildlife other than waterfowl, dispersed campgrounds, municipal point source discharge
IR Category	5/5A
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
E. coli	**$3.58x10^8$ + $3.06x10^{10}$ + $3.44x10^9$ = $3.44x10^{10}$ cfu/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Tables 4.10*

ES-7 Summary for Jemez River (Soda Dam nr Jemez Springs to East Fork)

New Mexico Standards Segment	20.6.4.108
Waterbody Identifier	NM-2106.A_00
Segment Length	3.81
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	181 mi^2
Land Type	Southern Rockies – 21
Probable Sources*	Onsite treatment systems, wildlife other than waterfowl
IR Category	5/5B
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
E. coli	**0 + $1.16x10^{10}$ + $2.06x10^{9}$ = $1.37x10^{10}$ cfu/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 4.10*

ES-8 Summary for Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)

New Mexico Standards Segment	20.6.4.106
Waterbody Identifier	NM-2105_75
Segment Length	1.86 mi
Parameters of Concern	*E. coli*
Uses Affected	Primary contact
Geographic Location	Jemez USGS Hydrologic Code 13020202
Scope/size of Watershed	588 mi^2
Land Type	Arizona/New Mexico Plateau – 22
Probable Sources*	Onsite treatment systems, residences/buildings, crop production, dispersed rangeland grazing
IR Category	5/5A
TMDL for:	**WLA_{TOTAL} + LA + MOS = TMDL**
E. coli	**0 + $3.47x10^{10}$ + $3.86x10^{9}$ = $3.86x10^{10}$ cfu/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 4.10*

ES-9 Summary for Rio Guadalupe (Jemez River to confl with Rio Cebolla)

New Mexico Standards Segment	20.6.4.108						
Waterbody Identifier	NM-2106.A_30						
Segment Length	12.6 mi						
Parameters of Concern	Plant nutrients						
Uses Affected	HQCWAL						
Geographic Location	Jemez USGS Hydrologic Code 13020202						
Scope/size of Watershed	267 mi^2						
Land Type	Southern Rockies – 21						
Probable Sources*	Flow alteration, onsite treatment systems, dispersed rangeland grazing						
IR Category	5/5A						
TMDL for:	**WLA_{TOTAL}**	**+**	**LA**	**+**	**MOS**	**=**	**TMDL**
Total Phosphorus	**0**	**+**	**0.47**	**+**	**0.08**	**=**	**0.56 lbs/day**
Total Nitrogen	**0**	**+**	**5.90**	**+**	**1.04**	**=**	**6.94 lbs/day**

** Additional Probable Sources noted during the 2013 water quality survey are listed in Table 5.11.*

1.0 INTRODUCTION

Under Section (§) 303 of the federal Clean Water Act (CWA), individual states establish water quality standards, which are subject to the approval of the U.S. Environmental Protection Agency (USEPA). Under §303(d)(1) of the CWA (33 U.S.C. §1313(d)[4]), states are required to develop a list of waters within a state that are impaired and establish a 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 standard 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 water quality standard. It also allocates that load capacity to known point sources and nonpoint sources (NPS) at a given flow. TMDLs are defined in the Code of Federal Regulations (40 C.F.R. §130[5]) as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for Nonpoint Source (NPS) and natural background conditions, and include a margin of safety (MOS). This document provides TMDLs for assessment units (AUs) within the Jemez River watershed that have been determined to be impaired based on a comparison of measured concentrations and conditions with water quality criteria.

This document is divided into several sections. Section 2.0 provides background information on the Jemez River watershed and relevant tributary watersheds. Section 3.0 provides information on the water quality surveys performed in the basin in 2013-2015. Section 4.0 presents TMDLs developed for *E. coli*; and Section 5.0 presents TMDLs developed for nutrients. Pursuant to CWA §106(e)(1), Section 6.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 7.0 discusses implementation of TMDLs and the relationship between TMDLs and watershed planning; Section 8.0 discusses assurance; Section 9.0 discusses public participation in the TMDL process; and Section 10.0 provides references for this document. Appendices are referenced throughout and are found at the end of the document.

[4] http://www.epw.senate.gov/water.pdf
[5] http://www.gpo.gov/fdsys/pkg/CFR-2002-title40-vol18/pdf/CFR-2002-title40-vol18.pdf

2.0 BASIN BACKGROUND

2.1 Description and Land Ownership

The Jemez River 8-digit Hydrologic Unit (HUC-8) is a large tributary to the Rio Grande, with its headwaters located in the Jemez Mountains of north-central New Mexico (**Figure 2.1**).

Figure 2.1 General location of the Jemez River watershed in New Mexico

The basin extends into Sandoval, Rio Arriba, and Los Alamos counties, and includes the main stem of the Jemez River, Rio Guadalupe, San Antonio Creek, and several tributaries. Land ownership and management in the Jemez River watershed includes US Forest Service (USFS), US National Park Service (USNPS), Tribal, State, and Private (**Figure 2.2**).

Land use and cover in the watershed is primarily forest (78%) and range land (21%), with much smaller components of agricultural land, urban or built-up, barren land, water and wetlands that make up less than 1% each of the watershed area (**Figure 2.3**).

The Jemez River watershed contains twelve Level IV Ecoregions (**Figure 2.4**), which fall into the Arizona/New Mexico Plateau and Southern Rockies Level III classifications (Griffith G.E. *et al.,* 2006)). The southern component of the watershed is the Arizona/New Mexico Plateau, comprised of the Level IV classifications: Albuquerque Basin, Semiarid Tablelands, San Juan/Chaco Tablelands and Mesas, and the Rio Grande Floodplain. The northern portion of the watershed is the Southern Rockies and is comprised of: Crystalline Mid-Elevation Forests, Crystalline Subalpine Forests, Foothill Shrublands, Grassland Parks, Sedimentary Mid-Elevation Forests, Sedimentary Subalpine Forests, Volcanic Mid-Elevation Forests, and the Volcanic Subalpine Forests. The Jemez River Watershed is generally characterized by high relief topography in the north of the watershed, while the southern portion is characterized by foothills, mesas and tablelands, and wide floodplains.

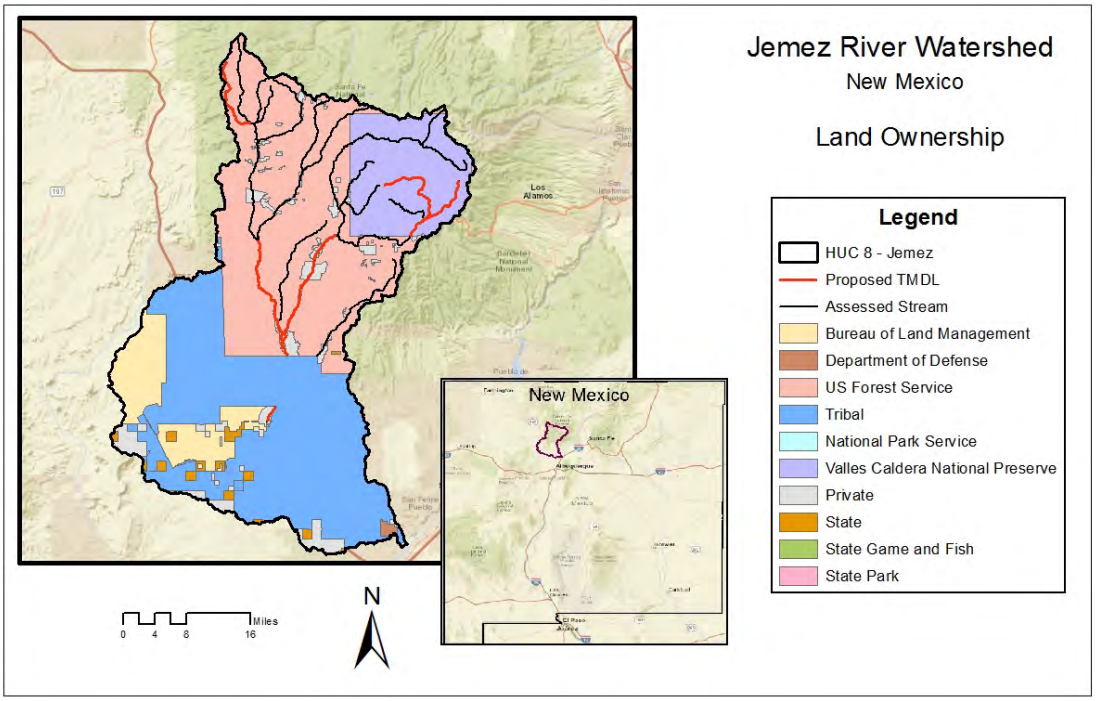

Figure 2.2 Land ownership in the Jemez River watershed

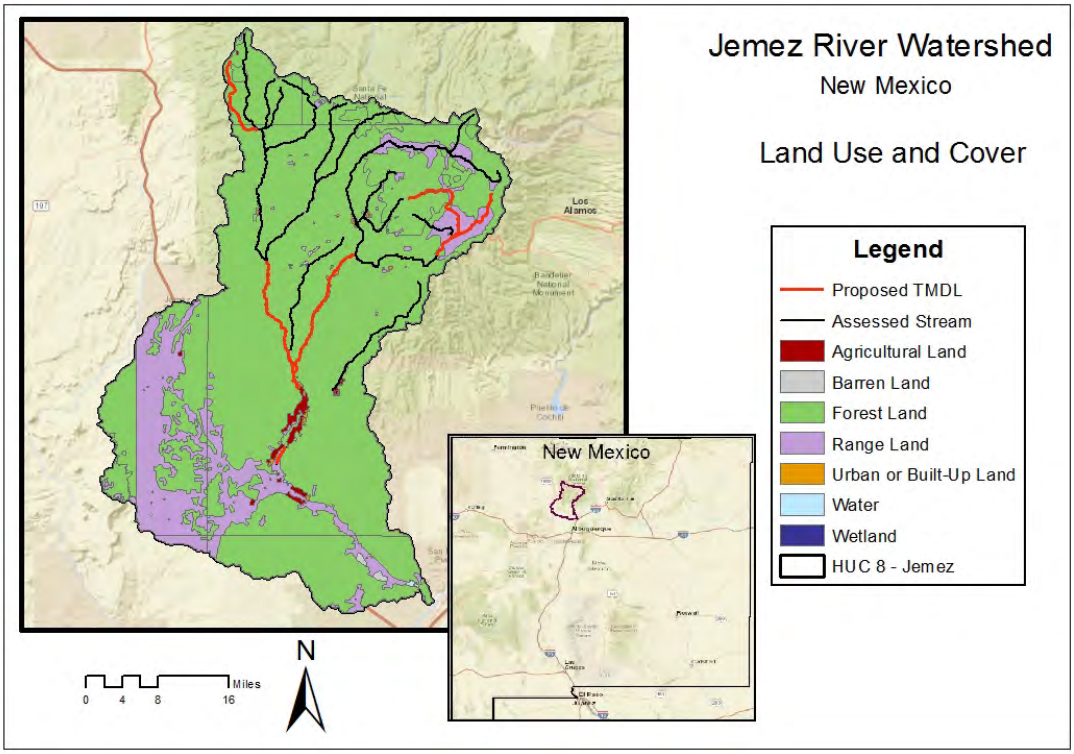

Figure 2.3 Land use and cover in the Jemez River watershed

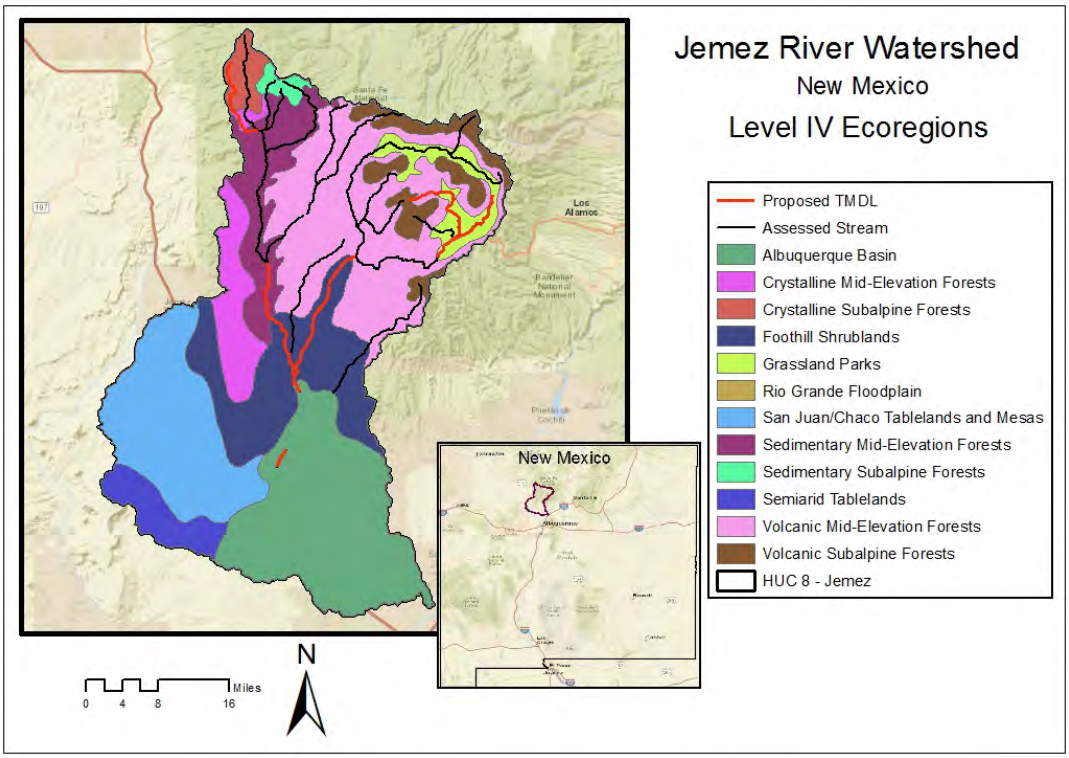

Figure 2.4 Level IV Ecoregions of the Jemez River watershed

2.2 Geology

The Jemez River watershed headwaters are located primarily in the Jemez Mountains in the northeast, which lie at the intersection of the Rio Grande Rift and the Jemez Lineament (**Figure 2.5**), with the Rio Guadalupe and its tributaries originating in the Sierra Nacimiento in the northwest. The Rio Grande Rift is a generally north-south trending spreading center that runs from Mexico to southern Colorado. It is an area of thinning crust and extension, resulting in volcanism and normal faulting. The Jemez Lineament is a series of connected volcanic centers trending southwest/northeast. It begins in central Arizona, continues through Mt. Taylor, the Valles Caldera, the Taos Volcanic Field, and terminates at the Raton Volcanic Field (Aldrich 1986).

Volcanism in the Jemez Mountains began approximately 14 MA with relatively small volcanic eruptions of basaltic magma. Over time, the mantle-derived basalt melted the crustal country rock, resulting in a shift of magma character from mafic to silicic. The resulting Toledo Caldera eruption, approximately 1.6 MA, produced a large volume of rhyolite, ash, and pyroclastic flow, which ultimately formed the lower Bandelier Tuff (Otowi). Approximately 75 mi^2 of ash was released during this event (VOGRIPA 2016). For comparison, the 1980 eruption of Mt. St. Helens in Washington released approximately 0.5 mi^2 of ash. Approximately 1.2MA, the Valles Caldera eruption occurred in essentially the same footprint as the Toledo Caldera and formed the upper Bandelier Tuff (Tshirege).

More recently, magma has erupted through the ring faults resulting from the previous caldera-forming events, creating the small volcanic domes common within the greater Valles Caldera.

The most recent of these, the Banco Bonito lava flow, occurred approximately 40,000 years ago (Bailey *et al*. 1961).

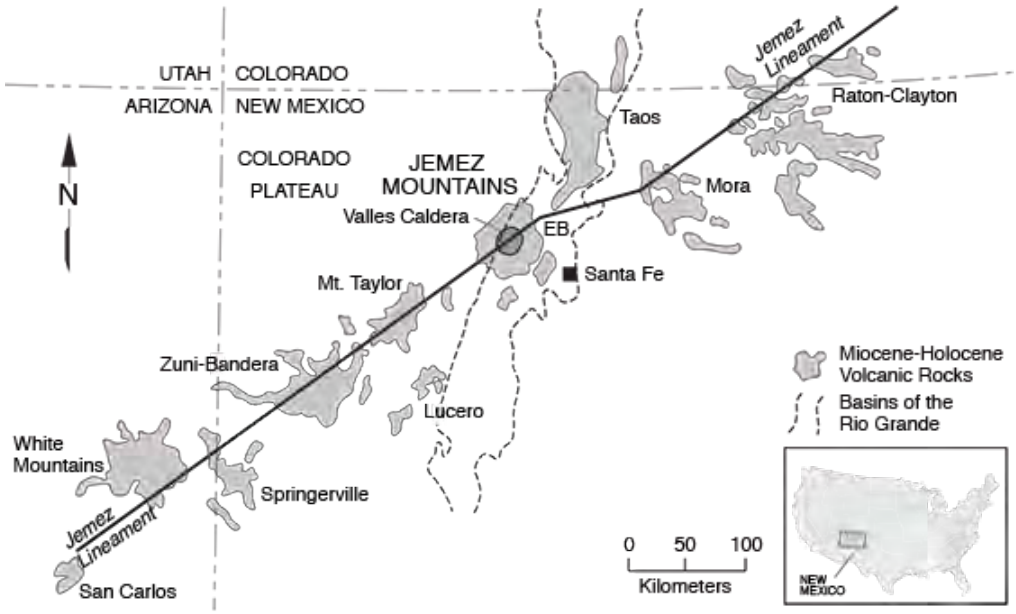

Figure 2.5 Diagram of the Jemez Lineament and the Rio Grande Rift in relationship to the Valles Caldera. From Teacher's Guide to Valles Caldera, modified from Goff *et al*., 1981.

The Jemez River watershed is dominated in the northwest by igneous rocks, primarily dating to the Neogene and Quaternary periods, whereas in the south and easternmost regions, metamorphic, sedimentary rocks, and alluvium are the primary rock types. The Sierra Nacimiento, located to the west of the caldera, is differentiated from the rest of the Jemez Mountains by Precambrian basement, uplifted during the Laramide. Rocks in the Sierra Nacimiento are typically Precambrian metamorphic and plutonic rocks typical of basement (Pollock *et al.* 2004). The generalized geology of the watershed can be found in **Figure 2.6**.

The region's complex geologic history has resulted in surface mining, as well as geothermal energy exploration. Commodities mined historically include silver, gold, copper, gypsum, sulfur, sand, gravel, and crushed stone. Commodities mined currently include gypsum, pumice, sand, and gravel (McLemore 1996).

Soils in the Jemez Watershed are highly complex, variable and not yet completely mapped. Based on available data, soils are typically derived from igneous and sedimentary rocks (Soil Survey Staff 2016)[6].

[6] http://websoilsurvey.nrcs.usda.gov/

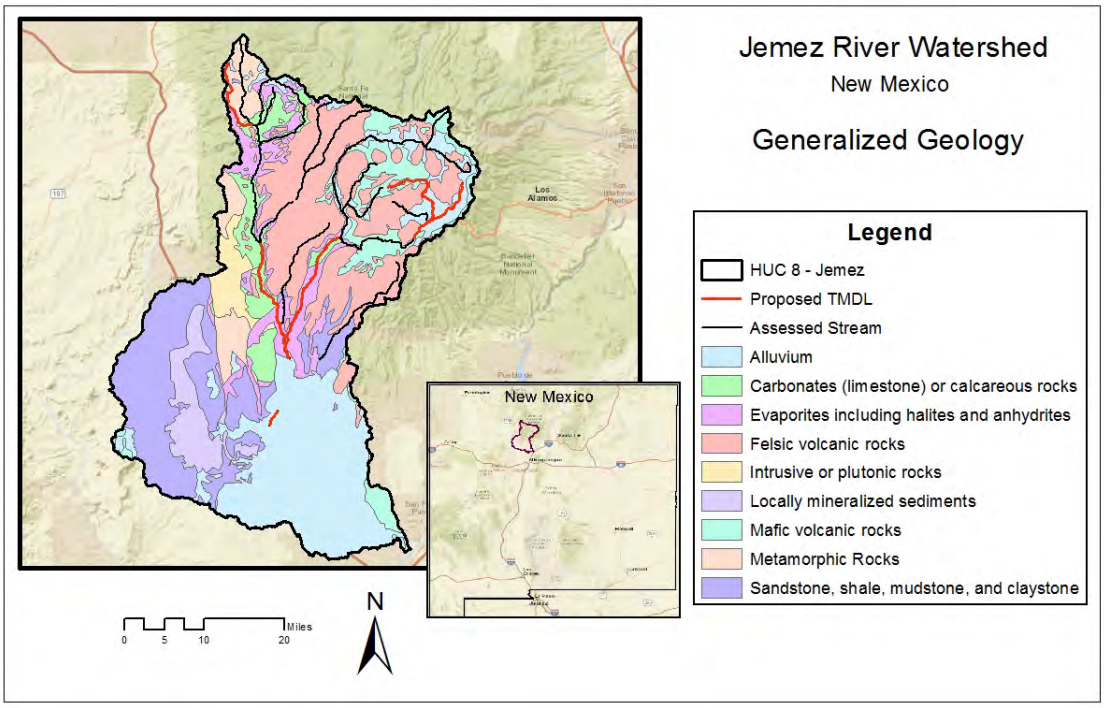

Figure 2.6 Generalized geology of the Jemez River watershed.

TMDLs have been developed for assessment units in which constituent or pollutant concentrations measured during the 2013-2014 water quality survey, as combined with data from outside sources that meet NMED's data quality requirements, indicate impairment. The TMDLs in this document are comprised of *E. coli* and plant nutrient impairments. TMDLs have been developed for AUs on the mainstem of the Jemez River, as well as for tributaries to the mainstem, described in the sections below.

2.3 Rio Guadalupe

The Rio Guadalupe HUC 10 watershed originates on U.S. Forest Service land in the San Pedro Parks Wilderness in north-central New Mexico in the Sierra Nacimiento. As presented in **Figure 2.7**, land ownership in the watershed is primarily USFS, with small portions held by tribal entities, the state, private, and Other Federal Agency, which represents the Valles Caldera National Preserve (VCNP). Please note that management and administration of the VCNP was transferred in 2015 from the Valles Caldera National Trust to the National Park Service.

Land cover in the watershed is primarily forest with small inholdings of agricultural, rangeland, barren, and urban or built-up land (**Figure 2.8**). The Rio Guadalupe watershed contains seven Level IV Ecoregions (**Figure 2.9**): Crystalline Mid-Elevation Forests, Crystalline Subalpine Forests, Foothill Shurblands, Sedimentary Mid-Elevation Forests, Sedimentary Subalpine Forests, Volcanic Mid-Elevation Forests, and Volcanic Subalpine Forests (Griffith G.E. *et al.* 2006). SWQB sampling locations range in elevation from below 5,700 ft. to greater than 9,400 ft. above mean sea level.

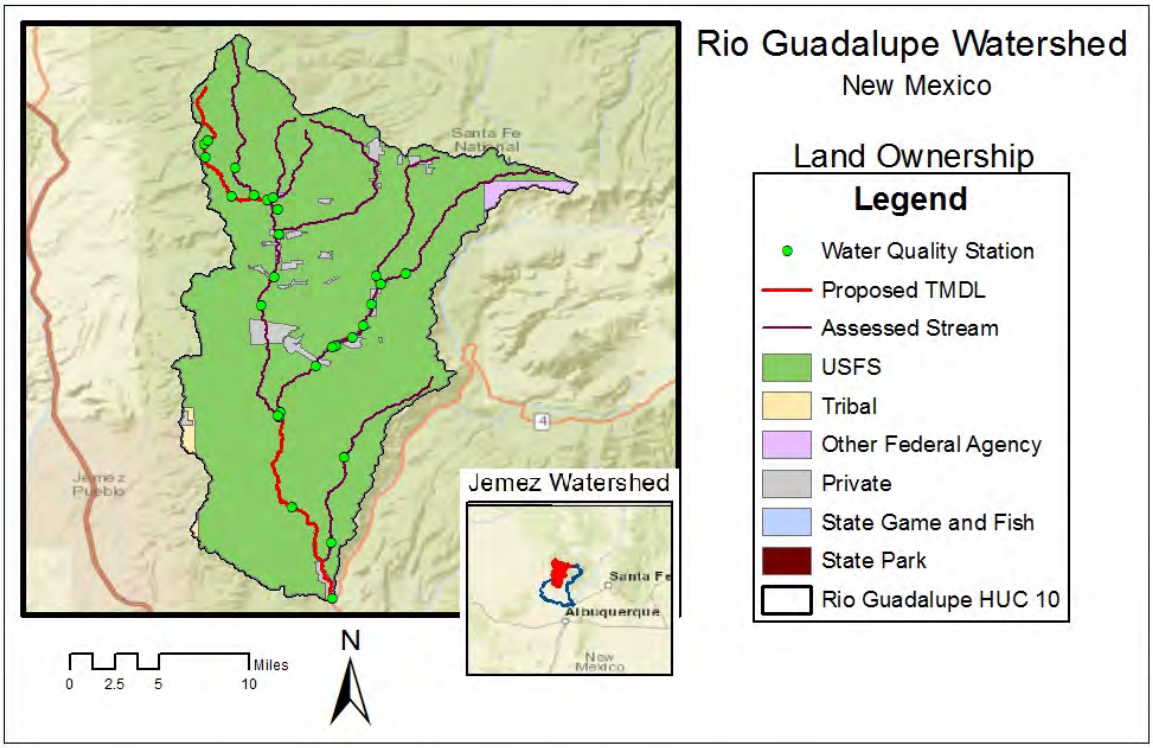

Figure 2.7 Land ownership in the Rio Guadalupe HUC 10

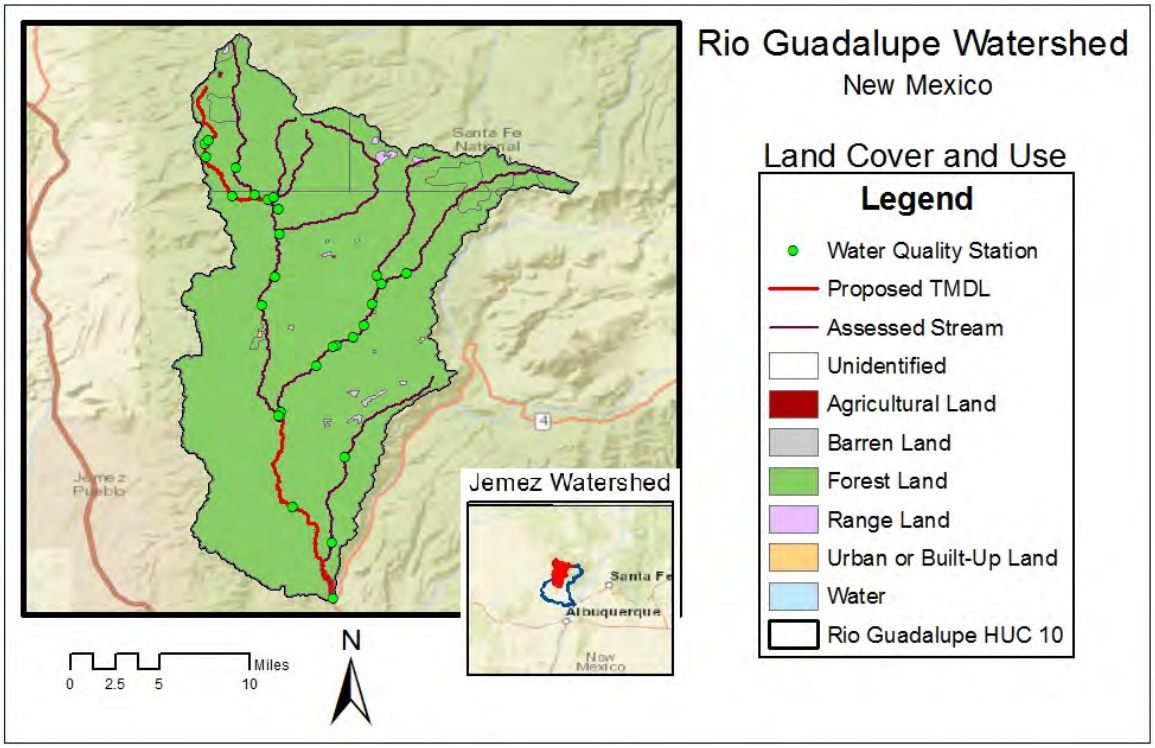

Figure 2.8 Land use and cover in the Rio Guadalupe HUC 10

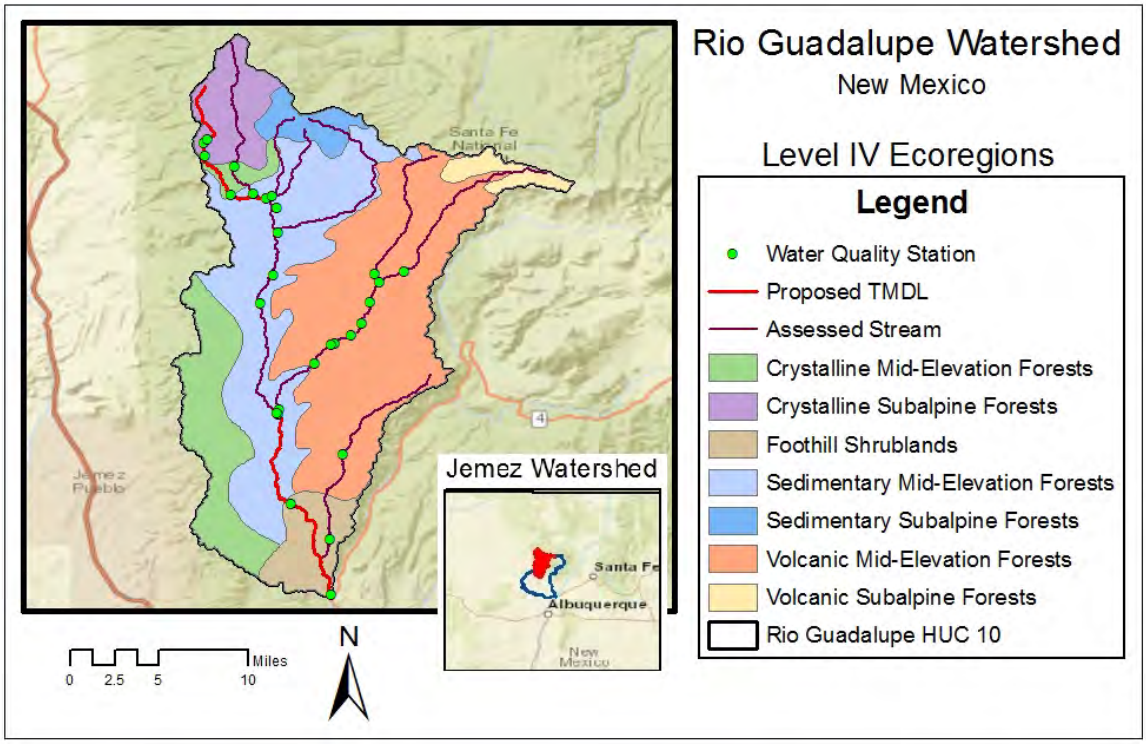

Figure 2.9 Level IV Ecoregions in the Rio Guadalupe HUC 10

The Rio Guadalupe watershed is characterized by high relief topography in the north of the HUC 10. The southern portion of the watershed is characterized by foothills and wider floodplains. Geology in the watershed is diverse, comprised of all three major rock types – metamorphic, igneous, and sedimentary – and ranging in age from the early Proterozoic to the recent deposition of alluvium. Tertiary volcanic rocks dominate the eastern half of the watershed while the western half of the watershed varies widely. A generalized geologic map can be found in **Figure 2.10**.

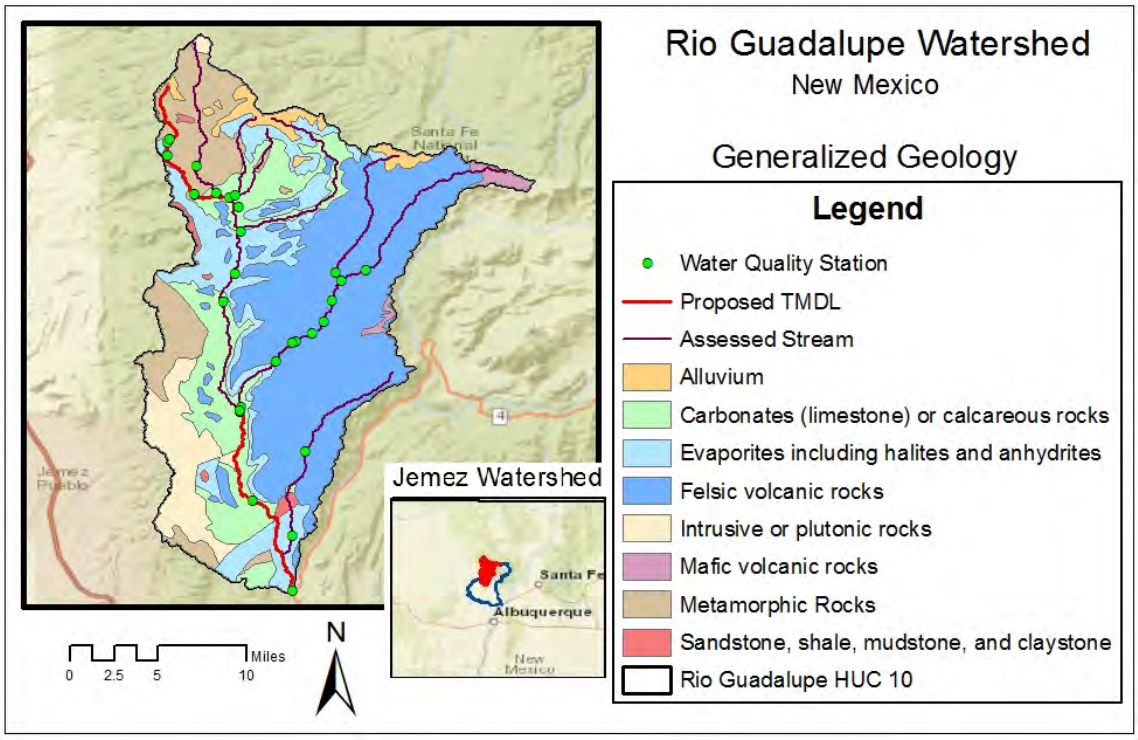

Figure 2.10 Generalized geology of the Rio Guadalupe Watershed

The following TMDLs are presented in this document for the Rio Guadalupe HUC 10 watershed:

- Clear Creek (Rio de las Vacas to San Gregorio Lake): *E. coli*, Plant nutrients;
- Clear Creek (San Gregorio Lake to headwaters): Plant nutrients; and
- Rio Guadalupe (Jemez River to confl with Rio Cebolla): Plant nutrients.

2.4 East Fork Jemez

The headwaters of the East Fork Jemez River watershed originate on the Valles Caldera National Preserve in north-central New Mexico. As presented in **Figure 2.11**, land ownership in the HUC 12 is primarily federal, with large tracts held by the USFS and Other Federal Agency, which represents the Valles Caldera National Preserve. There are inholdings of privately-held land in the south of the watershed.

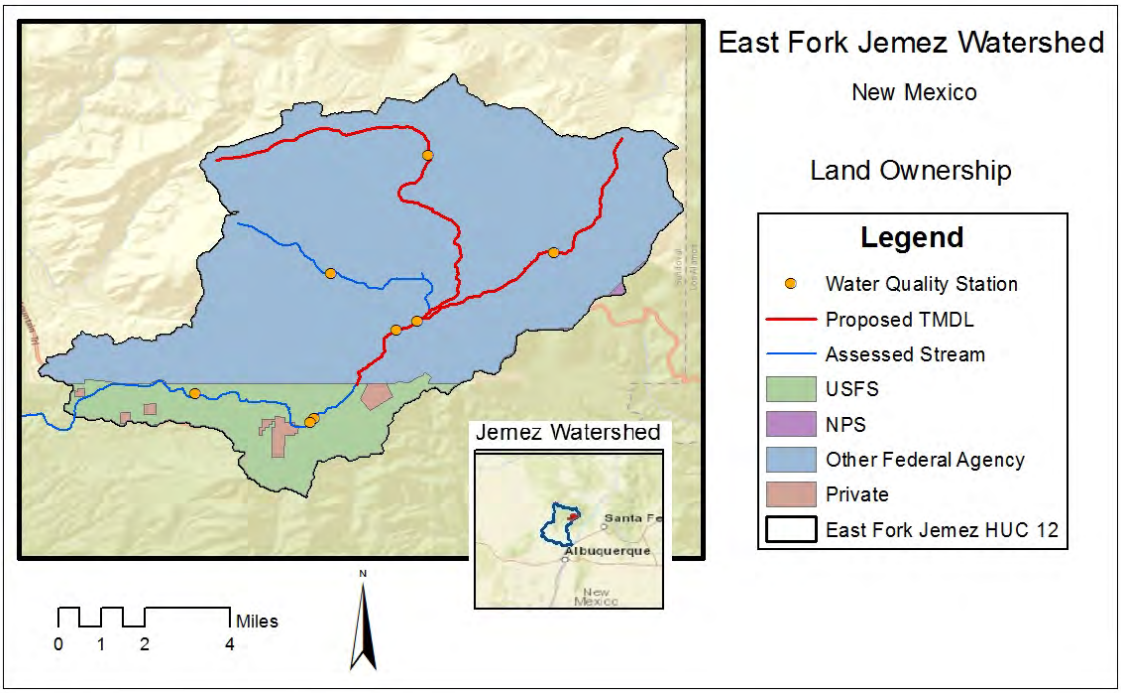

Figure 2.11 Land ownership in the East Fork Jemez Watershed

Land cover in the East Fork Jemez HUC is primarily forest and rangeland, with small components of residential and a quarry (**Figure 2.12**).

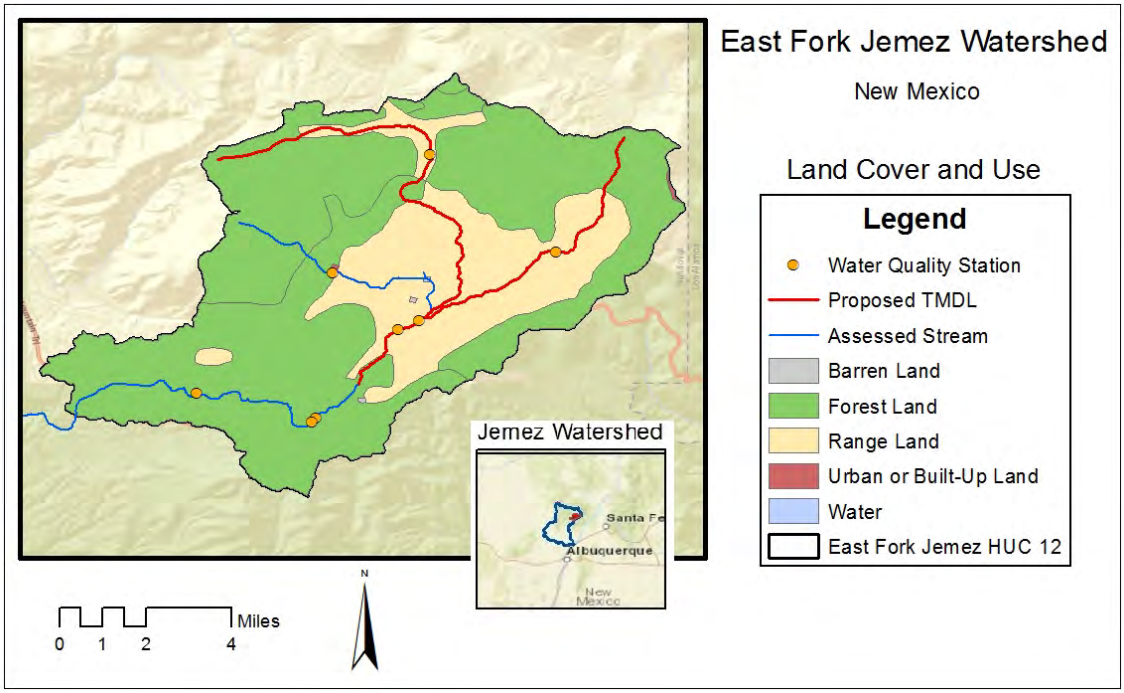

Figure 2.12 Land use and cover in the East Fork Jemez Watershed

The East Fork Jemez HUC 12 contains three Level IV Ecoregions (**Figure 2.13**): Grassland Parks, Volcanic Mid-Elevation Forests, and Volcanic Subalpine Forests (Griffith G.E. *et al.* 2006). SWQB sampling locations range in elevation from below 6,800 ft to greater than 8,600 ft above mean sea level.

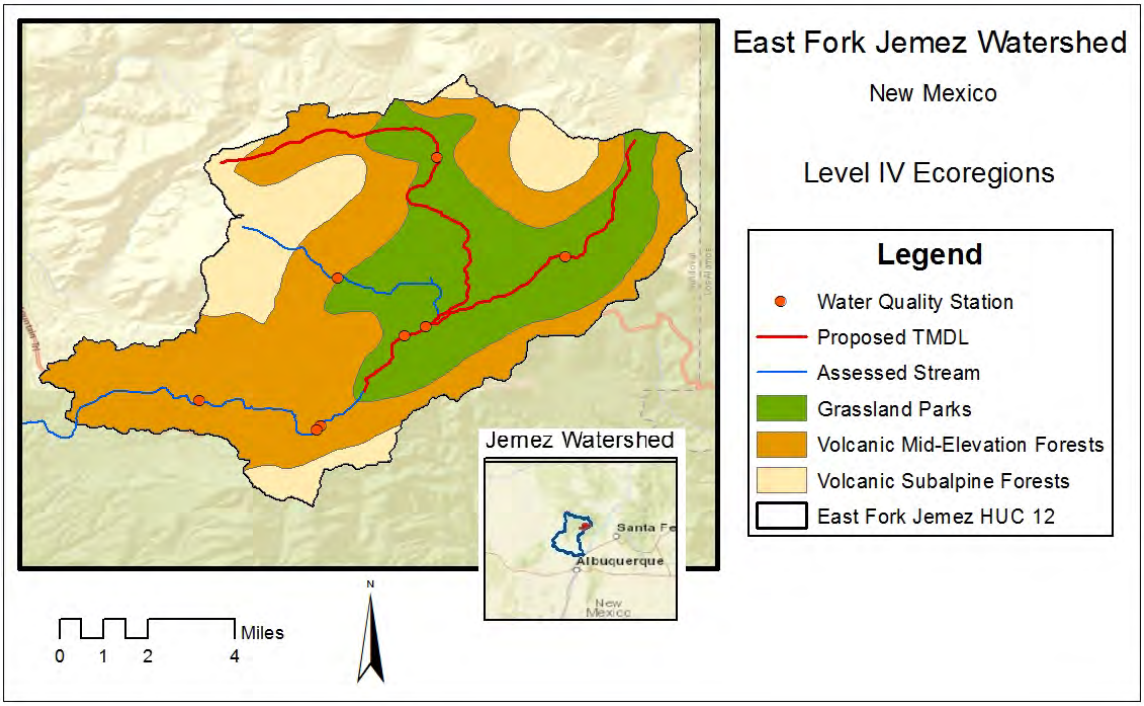

Figure 2.13 Level IV Ecoregions in the East Fork Jemez Watershed

The East Fork Jemez watershed is characterized by broad meadows interspersed with higher relief cinder cones. Elevation in this watershed ranges from approximately 11,000 ft. to approximately 7,700 ft. Geology in the watershed is diverse, comprised of felsic and mafic igneous rocks, as well as alluvium (**Figure 2.14**). The igneous rocks range in age from the Tertiary to the Quaternary and are comprised of volcanic rocks. Alluvium overlies the volcanic units and is dated to the Quaternary.

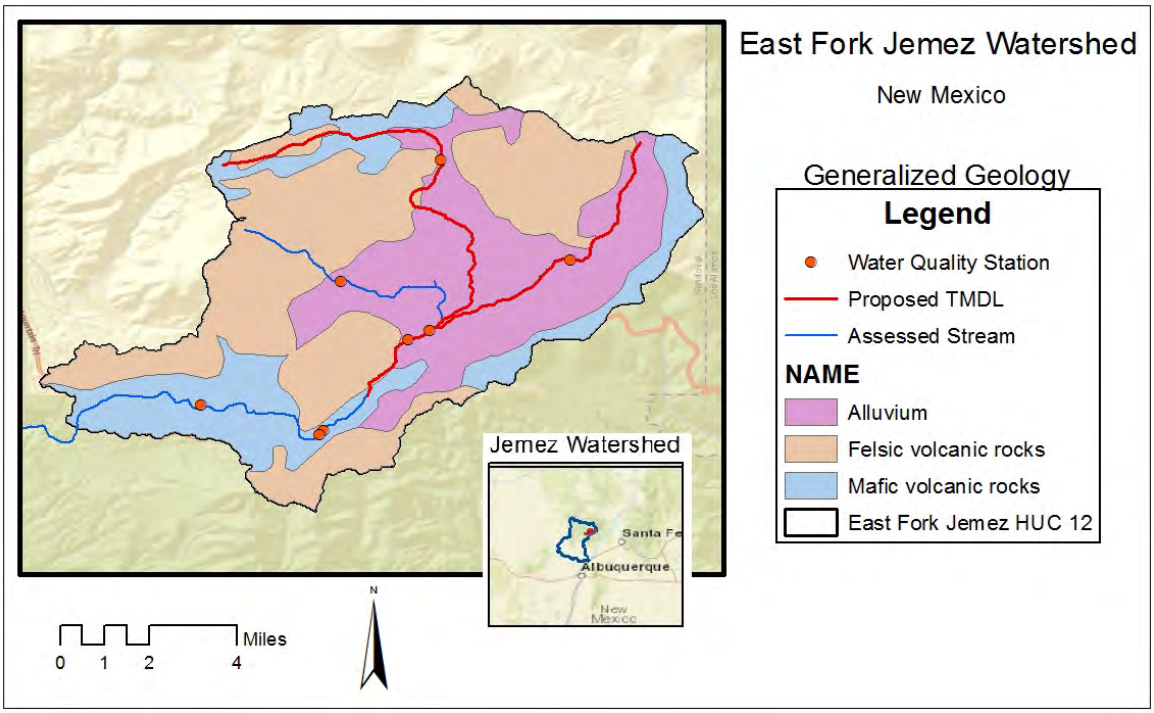

Figure 2.14 Generalized geology of the East Fork Jemez Watershed

The following TMDLs are presented in this document for the East Fork Jemez HUC 12:

- East Fork Jemez (VCNP to headwaters): Plant nutrients
- Jaramillo Creek (East Fork Jemez to headwaters): Plant nutrients

2.5 Water Quality Standards and Designated Uses

Water quality standards (WQS) for all assessment units in this document are set forth in sections 20.6.4.106, 20.6.4.107, and 20.6.4.108 of the *Standards for Interstate and Intrastate Surface Waters*, 20.6.4 New Mexico Administrative Code ("NMAC"), as amended through June 5, 2013 (NMAC 2013)[7]. These standards have been approved by USEPA for CWA purposes. The following are the relevant NMAC sections:

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, excluding waters on Santa Ana pueblo, and intermittent water in the Jemez river below the Jemez pueblo boundary, excluding waters on Santa Ana and Zia pueblos, that enters the main stem of the Rio Grande. Portions of the Rio Grande in this segment are under the joint jurisdiction of the state and Sandia pueblo.

[7] http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.pdf

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

B. Criteria: At mean monthly flows above 100 cfs, the monthly average concentration for: TDS 1,500 mg/L or less, sulfate 500 mg/L or less and chloride 250 mg/L or less.

20.6.4.107 RIO GRANDE BASIN – The Jemez river from the Jemez pueblo boundary upstream to Soda dam near the town of Jemez Springs and perennial reaches of Vallecito creek.

A. Designated Uses: coldwater aquatic life, primary contact, irrigation, livestock watering and wildlife habitat; and public water supply on Vallecito creek.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: temperature 25ºC (77ºF).

20.6.4.108 RIO GRANDE BASIN – Perennial reaches of the Jemez river and all its tributaries above Soda dam near the town of Jemez Springs, except San Gregorio lake and Sulphur creek, above its confluence with Redondo creek, and perennial reaches of the Guadalupe river and all its tributaries.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 400 µS/cm or less (800 µS/cm or less on Sulphur creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less; and pH within the range of 2.0 to 8.8 on Sulphur creek.

The mainstem of the Jemez River travels through the Jemez, San Ysidro, and Santa Ana pueblos upstream of its confluence with the Rio Grande. The Pueblo of Jemez and the Pueblo of San Ysidro do not have USEPA-approved water quality standards at this time. The Pueblo of Santa Ana, farthest downstream from the AUs discussed in this document, promulgated water quality standards in 2015.

2.6 Antidegradation and TMDLs

New Mexico's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC)[8] establish surface water quality standards that consist of designated uses of surface waters of the State, the water quality criteria necessary to protect the uses, and an antidegradation policy. New Mexico's antidegradation policy, which is based on the requirements of 40 CFR Part 131.12[9], describes how waters are to be protected from degradation (Subsection A of 20.6.4.8 NMAC). The *Antidegradation Policy Implementation Procedures* establish the process for implementing the antidegradation policy (NMED/SWQB 2011). At a minimum, the policy mandates that "the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state." In addition, the State's antidegradation policy requirements as detailed in the *Antidegradation Policy Implementation Procedures* (NMED/SWQB 2011) must

[8] http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.pdf
[9] http://www.gpo.gov/fdsys/pkg/CFR-2002-title40-vol18/pdf/CFR-2002-title40-vol18.pdf

be met, whether or not a segment is impaired. TMDLs are consistent with the policy because implementation of a TMDL restores water quality so that existing uses are protected and water quality criteria are achieved. The *Antidegradation Policy Implementation Procedure* can be found in Appendix A of the *Statewide Water Quality Management Plan and Continuing Planning Process* document[10].

[10] http://www.nmenv.state.nm.us/swqb/Planning/WQMP-CPP/

3.0 INTENSIVE WATER QUALITY SURVEYS

SWQB intensively surveyed the Jemez River in 2013 and 2014[11]. Brief summaries of the surveys and hydrologic conditions during the sample periods are provided in the following subsections. The survey was initially planned to be completed in 2013, but wildfires in the watershed resulted in a delay of a portion of planned sampling. More information on wildfires in the Jemez watershed that may impact water quality can be found in Section 3.3 and **Appendix D**.

3.1 Survey Design

Surface water quality samples were collected monthly between March and December for the 2013 SWQB field survey and June through October in 2014. Surface water quality monitoring stations were selected to characterize water quality of stream reaches throughout the basin. Stations used in the survey are listed in **Table 3.1** and shown on **Figure 3.1**. Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. Surface water grab samples from these stations were analyzed for a variety of chemical and physical parameters. Data from grab samples are housed in the SWQB Surface Water Quality Information Database (SQUID) and uploaded to USEPA's Water Quality Exchange (WQX) database.

All sampling and assessment techniques used during the surveys are detailed in the *Quality Assurance Project Plan* (QAPP)[12] (NMED/SWQB 2016) and Assessment Protocol[13] (NMED/SWQB 2015). As a result of the monitoring efforts, several surface water impairments were found or confirmed. Accordingly, these impairments were either added to or remained on New Mexico's CWA §303(d)/305(b) Integrated List and Report, the most recent of which was approved for the 2016-2018 cycle[14].

[11] https://www.env.nm.gov/swqb/MAS/sampling/SamplingSummary-Jemez2015.pdf
[12] https://www.env.nm.gov/swqb/QAPP/
[13] https://www.env.nm.gov/swqb/protocols/
[14] https://www.env.nm.gov/swqb/303d-305b/

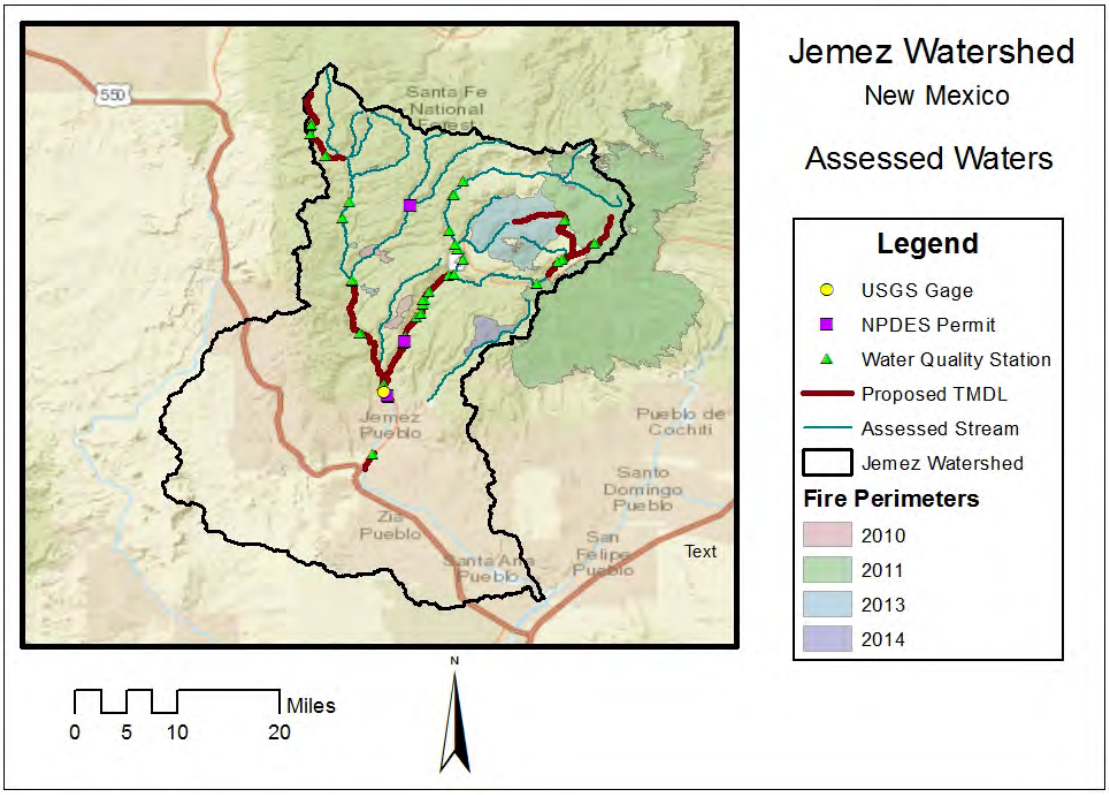

Figure 3.1 Assessed waters in the Jemez Watershed

Table 3.1 SWQB 2013-2014 Jemez water quality sampling stations in TMDL AUs

Station ID	Station Name
31ClearC002.3	Clear Creek at NM 126
31ClearC008.1	Clear Creek below San Gregorio Lake
31ClearC009.2	Clear Creek abv San Gregorio Lake
31EFkJem015.2	East Fork Jemez River below Las Conchas day use area
31Jarami008.0	Jaramillo above Cerro Pinon at Rd B
31JemezR046.6	Jemez River near Canon, below Municipal School
31JemezR049.2	Jemez River above Rio Guadalupe
31JemezR064.2	Jemez River at Jemez State Monument
31JemezR064.9	Jemez River above Soda Dam
31JemezR066.4	Jemez River at Entrada Road
31JemezR070.3	Jemez River at USGS gage below Battleship Rock

31JemezR037.0	Jemez River above San Ysidro at NM Hwy 4
31RGuada000.1	Rio Guadalupe above Jemez River
31RGuada010.0	Rio Guadalupe at Deer Creek Landing

3.2 Hydrologic Conditions

There is one active United States Geological Survey (USGS) gaging station in the watersheds in this document – USGS 08324000 – Jemez River near Jemez, NM. Gage location is represented in **Figure 3.1**. Daily stream flow at USGS 08324000 is presented graphically in **Figure 3.2** for the 2013-14 calendar years.

USGS 08324000 – Jemez River near Jemez, NM is located on the Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AU. The gage has a period of record from 1936 to the present. Flows during the 2013 and 2014 survey years were typically below the mean annual discharge since the beginning of gage operation, with the exception of a few spikes during monsoon season. The largest divergence for both 2013 and 2014 is a significantly lower contribution of snowmelt to discharge than the average. Both years saw below average snowpack, resulting in lower spring runoff.

As stated in the SWQB Assessment Protocol (NMED/SWQB 2015), data collected during all flow conditions, including low flow (i.e., flows below the 4Q3), were used to determine designated use attainment status during the assessment process. The 4Q3 is the annual lowest four (4) consecutive day flow that occurs with a frequency of at least once every three (3) years. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

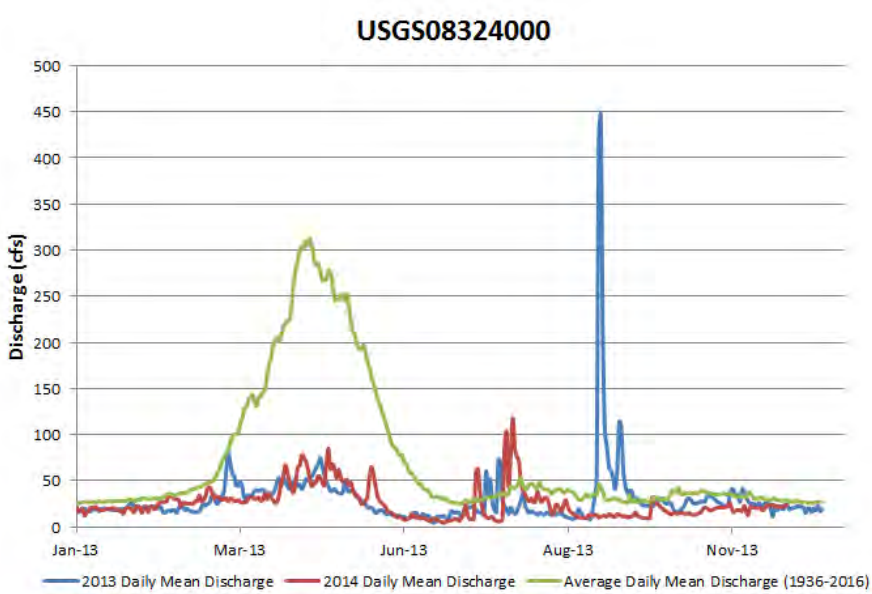

Figure 3.2 USGS 08324000 Jemez River near Jemez, NM

3.3 Wildfires

Several wildfires have impacted the Jemez River watershed since 2010 (**Figure 3.1**). The 2011 Las Conchas fire and the 2013 Thompson Ridge fire perimeters suggest the greatest impact on watersheds discussed in this TMDL. Both occurred in the northeast portion of the watershed, and impacted the headwaters of the Jaramillo Creek and East Fork Jemez headwaters in this document, among others not addressed in these TMDLs.

The 2011 Las Conchas fire burned over 156,000 acres (246 mi^2) in the Jemez River watershed and the neighboring Rio Chama, Upper Rio Grande, and Rio Grande-Santa Fe watersheds. The 2013 Thompson Ridge fire burned approximately 24,000 acres within the Jemez River watershed. Additional information on these two fires is located in **Appendix D**. SWQB staff created the Wildfire Impacts on Surface Water Quality website to inform stakeholders and management agencies about the water quality impacts from fires, accessible at: https://www.env.nm.gov/swqb/Wildfire/.

4.0 BACTERIA - E. COLI

Assessment of data from the 2013-2014 SWQB water quality survey in the Jemez River watershed identified exceedences of the New Mexico water quality criteria for *E. coli* bacteria in the Clear Creek (Rio de las Vacas to San Gregorio Lake), Jemez River (Jemez Pueblo bnd to Rio Guadalupe), Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs), Jemez River (Soda Dam nr Jemez Springs to East Fork), and Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd) AUs. Bacteria data collected and used for assessment of the AUs can be found in **Appendix C**.

As a result, these assessment units are listed on the 2016-2018 CWA §303(d)/ §305(b) Integrated Report and List with *E. coli* as an impairment (NMED/SWQB 2016)[15]. If and when water quality criteria have been met, the reach will be moved to the appropriate category on the CWA §303(d) List.

4.1 Target Loading Capacity

Bacteria standards are expressed as colony forming units (cfu) per unit volume, typically cfu per 100 milliliter (cfu/100mL). Target values for bacteria in the Jemez River (Zia Pueblo bnd to Jemez Pueblo), Jemez River (Jemez Pueblo bnd to Rio Guadalupe), and Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AUs are based on the reduction in bacteria necessary to achieve the numeric criterion associated with the primary contact designated use in 20.6.4.900 NMAC of 126 cfu/100 mL *E. coli* monthly geometric mean and 410 cfu/100 mL *E. coli* single sample. Target values for bacteria for Clear Creek (Rio de las Vacas to San Gregorio Lake) and Jemez River (Soda Dam nr Jemez Springs to East Fork) AUs are based on attainment of the monthly geometric mean of 126 cfu/100 mL and a segment specific *E. coli* single sample criterion of 235 cfu/100 mL.

The criterion for the primary contact designated use was used in assessment as it is the most stringent criteria for the designated uses identified for the AUs. The presence of *E. coli* bacteria is an indicator of the possible presence of other pathogens that may limit beneficial uses and present human health concerns. Samples were assessed by comparing the *E. coli* results to the single sample criterion. Exceedences are presented in **Table 4.1**; data are located in **Appendix C**.

[15] https://www.env.nm.gov/swqb/303d-305b/

Table 4.1 Exceedences of *E. coli*

Assessment Unit	Criteria (single sample)	Number of Exceedences	Number of Samples
Clear Creek (Rio de las Vacas to San Gregorio Lake)	235 cfu/100mL	2	6
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	410 cfu/100mL	2	8
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	410 cfu/100mL	3	14
Jemez River (Soda Dam nr Jemez Springs to East Fork)	235 cfu/100mL	4	17
Jemez River (Zia Pueblo bnd to Jemez Pueblo)	410 cfu/100mL	2	7

4.2 Flow

TMDLs are calculated at a specific flow and bacteria concentrations can vary as a function of flow. SWQB determined streamflow either by using the active USGS gage network or by taking direct flow measurements utilizing standard procedures (NMED/SWQB 2013)[16]. Water quality standard exceedences for all impaired reaches occurred during low and moderate flows. Therefore, for these reaches, the critical flow value used to calculate the TMDLs was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the annual lowest 4 consecutive day flow that occurs with a frequency of at least once every 3 years. According to the New Mexico Water Quality Standards, 20.6.4.11.B.2 NMAC[17], the low flow critical condition is defined as 4Q3 for numeric criteria set in 20.6.4.97 through 20.6.4.900 NMAC, as well as Subsection F of 20.6.4.13 NMAC. Bacteria criteria are found in these sections of the regulations and are therefore bound by this critical condition. Critical low flow was determined on an annual basis utilizing all available daily flow values rather than on a seasonal basis for these TMDLs because exceedences occurred across flow conditions and flow in the gage record was typically non-zero.

SWQB determined streamflow and critical flows using available data from active USGS gages in the study area (**Table 4.2**) as input for DFLOW 3.1a software, developed by the USGS (USEPA 2006)[18] where gage data was available and appropriate. DFLOW allows the user to specify seasonal components that may impact low flow. For example, AUs at higher elevations may have little to no flow during the winter months as a result of freezing conditions, which could result in a 4Q3 of zero. Using a 4Q3 of zero is not a valid input into the equation and would result in a null threshold value. Also, if a stream isn't flowing, its support of designated uses cannot be accurately assessed.

[16] https://www.env.nm.gov/swqb/SOP/
[17] http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.pdf
[18] http://water.epa.gov/scitech/datait/models/dflow/

Table 4.2 USGS gage in study area

Gage	Name	Start Year	End Year	4Q3 (cfs[(b)])	4Q3 (MGD[(c)])
08324000	Jemez River nr Jemez, NM	1936	2016	11.2	7.24

[(b)]cfs = cubic feet per second
[(c)]MGD = Million Gallons per Day

The calculated 4Q3s using DFLOW software and assumptions noted above are:

- Jemez River (Jemez Pueblo bnd to Rio Guadalupe) = 7.24 MGD

The other 3 Jemez River AUs do not contain an active gage, but are located on an actively gaged stream. USGS Gage 08324000 is located in the Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AU; gage information is located in the above **Table 4.2**. A method for estimating the 4Q3 for an ungaged site located on a gaged stream was outlined in Thomas *et al.*, 1997. As part of this method, the ratio of the drainage area at the gaged site and the drainage area at the ungaged location should be between 0.5 and 1.5 (**Table 4.3**). Applying the Thomas method outside of the range above would be inappropriate. Please see *Methods for estimating magnitude and frequency of floods in the southwestern United States*, USGS Water-Supply Paper 2433 (Thomas *et al*. 1997)[19] for details. Two of the three ungaged Jemez River AUs qualify based on the drainage area ratios, and therefore the critical flow for them was based on the gaged data of USGS 08324000.

Table 4.3 Drainage areas and ratios of selected gage on Jemez River to ungaged Jemez River AUs

Name	Drainage Area (mi^2)	Ratio of Gaged to Ungaged
USGS Gage 08324000 - Jemez River nr Jemez, NM	472.1	N/A
Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)	588.3	0.8
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	468.5	1.0
Jemez River (Soda Dam nr Jemez Springs to East Fork)	181.1	2.6

[19] http://pubs.usgs.gov/wsp/2433/report.pdf

In the Thomas method, the following formula is used to estimate flow:

Equation 4.1

$$Q_{T(u)} = Q_{T(g)} \left(\frac{A_u}{A_g}\right)^{0.566}$$

Where,

$Q_{T(u)}$ = weighted flow frequency estimate at the ungaged site (cfs)
$Q_{T(g)}$ = 4Q3 low-flow frequency estimate at the gaged site (cfs)
A_u = drainage area above the ungaged site (mi^2)
A_g = drainage area above the gaged site (mi^2).

The AU located farthest upstream of the gage did not meet the ratio metric to utilize the Thomas equation. In the case of ungaged streams, or where the gage is not representative of a location, an analysis method developed by Waltemeyer (2002) can be used to estimate flow. The critical flow for Jemez River (Soda Dam nr Jemez Springs to East Fork) and Clear Creek (Rio de las Vacas to San Gregorio Lake) was determined using this method.

In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 ft. in elevation). Because the average elevations of both of the watersheds are above 7,500 ft., the decision was made to use the mountainous regions regression equation.

The following mountainous regions regression equation (**Equation 4.2**) is based on data from 40 gaging stations located above 7,500 ft. in elevation with non-zero discharge (Waltemeyer 2002):

Equation 4.2

$$4Q3 = 7.3287 \times 10^{-5} DA^{0.70} {P_w}^{3.58} S^{1.35}$$

Where:

4Q3	= Four-day, three-year low-flow frequency (cfs)
DA	= Drainage area (mi^2)
P_w	= Average basin mean winter precipitation (inches)
S	= Average basin slope (%)

For details and development of this equation, please see *Analysis of the Magnitude and Frequency of the 4-Day Annual Low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams in New Mexico*, USGS Water-Resources Investigations Report 01-4271 (Waltemeyer 2002)[20].

4Q3 values calculated using Waltemeyer's methods are presented in **Table 4.4**. Parameters used in the calculation were determined using Weasel, a Geographic Information System (GIS)

[20] http://nm.water.usgs.gov/publications/abstracts/wrir01-4271.html

application. The 4Q3 result from **Equation 4.2** is in cfs. Conversion to million gallons per day (MGD) was calculated using the unit conversion provided in **Appendix A**.

Table 4.4 Calculation of 4Q3

Assessment Unit	Average Elevation (ft.)	Drainage Area (mi^2)	Mean Winter Precipitation (in)	Average Basin Slope (percent)	4Q3 (cfs)	4Q3 (MGD)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	9249.24	10.54	19.18	0.15	1.15	0.74
Jemez River (Soda Dam nr Jemez Springs to East Fork)	8840.87	181.09	13.61	0.23	4.45	2.87

4.3 Calculations

The *E. coli* geometric monthly mean criterion (126 cfu/100 mL) was used to calculate the allowable stream loads for the impaired assessment units because it is the most conservative applicable criterion. TMDLs, or target loading capacities, for bacteria are calculated with the following equation (**Equation 4.3**), based on flow values, WQS, and a conversion factor to convert to "cfu/day" (**Equation 4.4**):

Equation 4.3

$$Target\ Loading\ Capacity = Critical\ Flow \times Criterion \times Conversion\ Factor$$

Equation 4.4

$$C\ as \frac{cfu}{100mL} * 1000 \frac{mL}{L} * \frac{L}{0.264\ gallons} * Q\ in\ 1{,}000{,}000 \frac{gallons}{day} = cfu/day$$

Where:

C = water quality criterion for bacteria
Q = the critical stream flow in MGD

The more conservative monthly geometric mean criterion is utilized in TMDL calculations to provide an implicit Margin of Safety (MOS). Furthermore, if the higher value single sample criterion was used and achieved as a target, the geometric mean criterion may still not be achieved. The calculated target loads are located in **Table 4.5**. The measured load was calculated using the arithmetic mean of the data.

Table 4.5 TMDL/target *E. coli* loads

Assessment Unit	Critical Flow (MGD)	*E. coli* geometric mean criteria (cfu/100mL)	Conversion Factor[(b)]	TMDL[(a)] (cfu/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.74	126	3.79×10^{7}	3.53×10^{9}
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	7.21	126	3.79×10^{7}	3.44×10^{10}
Jemez River (Soda Dam nr Jemez Springs to East Fork)	2.87	126	3.79×10^{7}	1.37×10^{10}
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	7.24	126	3.79×10^{7}	3.46×10^{10}
Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)	8.08	126	3.79×10^{7}	3.86×10^{10}

[(a)]TMDL values are equivalent to the target load
[(b)] Details can be found in Appendix A. The conversion factor converts flow and concentration into loading units, in this case cfu/day.

The measured loads for *E. coli* were calculated similarly to the target loads. The arithmetic mean of the data used to determine the impairment was substituted for the criterion in **Equation 4.3**. The same conversion factor was used. Results are presented in **Table 4.6**.

The samples collected and the resulting impairment determinations are based on exceedences of the State's single sample criterion, and the TMDL is written to address the monthly geometric mean standard. 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 CWA §303 nor 40 CFR Part 130.7 requires states to include discussions of percent reductions in TMDL documents. Although it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the "percent reduction" value can be calculated in multiple ways and as a result can often be misinterpreted, therefore a percent reduction is not presented for *E. coli*.

Table 4.6 Average Measured *E. coli* load

Assessment Unit	Median Flow (MGD)	*E. coli* Arithmetic Mean (cfu/100mL)	Conversion Factor[(a)]	Measured Load (cfu/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	1.1	297.5	3.79×10^{7}	1.24×10^{10}
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	18	278.1	3.79×10^{7}	1.90×10^{11}
Jemez River (Soda Dam nr Jemez Springs to East Fork)	12.1	504.5	3.79×10^{7}	2.31×10^{11}
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	37.3	210.0	3.79×10^{7}	2.97×10^{11}
Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)	29.5	558.0	3.79×10^{7}	6.24×10^{11}

[(a)] Details can be found in Appendix A. The conversion factor converts flow and concentration into loading units, in this case cfu/day.

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

There are two existing point sources with individual NPDES permits in these AUs (**Table 4.7**). The Village of Jemez Springs holds a permit (NM0028011) for a municipal wastewater treatment plant (WWTP) with one outfall that is authorized to discharge directly to the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU. The Jemez Valley Public Schools holds a permit for a small wastewater treatment plant with one outfall that is authorized to discharge directly to the Jemez River (Jemez Pueblo bnd to Rio Guadalupe). **Table 4.8** details the WLA.

No permittees have been identified in the watersheds by the USEPA as Phase II small Municipal Separate Storm Sewer Systems (sMS4), so a wasteload allocation for an sMS4 has not been developed.

Table 4.7 Existing NPDES permit effluent limits for *E. coli*

Assessment Unit	Facility	Design Capacity Flow (MGD)	*E. coli* Effluent Limits – monthly geometric average (cfu/100mL)	*E. coli* Effluent Limit – Daily Maximum (cfu/100mL)
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	Village of Jemez Springs WWTP NPDES No. NM0028011, expiration: 28 February, 2021	0.075	126	410
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	Jemez Valley Public Schools NPDES No. NM0028479, expiration: 31 October, 2018	0.01	126	410

Table 4.8 Assigned *E. coli* WLA

Assessment Unit	Facility	Design Capacity Flow (MGD)	*E. coli* criterion of receiving water[(a)] (cfu/100mL)	Conversion Factor	WLA (cfu/day)
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	Village of Jemez Springs WWTP NPDES No. NM0028011, expiration: 28 February, 2021	0.075	126	3.79×10^7	3.58×10^8
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	Jemez Valley Public Schools NPDES No. NM0028479, expiration: 31 October, 2018	0.01	126	3.79×10^7	4.78×10^7

(a) The monthly geometric mean *E. coli* criterion for both AUs is 126 cfu/100mL.

Excess bacteria concentrations may be a component of some stormwater discharges covered by general NPDES permits, so the load for these dischargers will be addressed in this document as a component of the Load Allocation.

Stormwater 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 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. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (BMPs), and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that waste load allocations and/or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Stormwater discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not practicable to calculate individual WLAs for facilities covered by the MSGP at this time using the available tools. The discharges from these permits are typically transitory, and enforcement is complex as permittees are temporary. Loads that are in compliance with the MSGP are therefore currently included as part of the LA. While these sources are not given individual allocations, they are addressed through other means, including BMPs, stormwater pollution prevention conditions, and other requirements.

4.4.2 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity TMDL using the equation below.

Equation 4.4

$$WLA + LA + MOS = TMDL$$

Or

$$LA = TMDL - MOS - WLA$$

For the *E. coli* TMDLs presented in this document, the WLA is 0 with the exception of the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) and Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AUs. In this TMDL document, a WLA of 0 is due to the lack of NPDES permitted

dischargers in the relevant AUs. The MOS is estimated to be 15% of the target load calculated in **Table 4.5** for ungaged AUs; an MOS of 10% has been assigned to gaged AUs. Results of the TMDL calculations are presented in **Table 4.9**. Additional details on the MOS are presented in Section 4.7.

The extensive data collection and analyses necessary to determine background *E. coli* loads for the watersheds in this section were beyond the resources available for this study. It is therefore assumed that a portion of the LA is made up of natural background loads.

Table 4.9 TMDL for *E. coli*

Assessment Unit	WLA (cfu/day)	LA (cfu/day)	MOS (15%)[(b)] (cfu/day)	TMDL[(a)] (cfu/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0	3.00×10^{9}	5.30×10^{8}	3.53×10^{9}
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	3.58×10^{8}	3.06×10^{10}	3.44×10^{9}	3.44×10^{10}
Jemez River (Soda Dam nr Jemez Springs to East Fork)	0	1.16×10^{10}	2.06×10^{9}	1.37×10^{10}
Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	4.78×10^{7}	3.11×10^{10}	3.46×10^{9}	3.46×10^{10}
Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)	0	3.47×10^{10}	3.86×10^{9}	3.86×10^{10}

[(a)]TMDL values are equivalent to the target load capacity; these values are displayed in Table 4.5.
[(b)] Margin of Safety for Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd) AU, Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU, and Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AU are 10%. See Section 4.7 for details.

4.5 Identification and Description of Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment, an example of which may be found in **Appendix B**. The approach for identifying probable sources of impairment was modified by SWQB in 2010 to include additional input from a variety of stakeholders including landowners, watershed group, and local, state, tribal, and federal agencies. Probable source sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list was reviewed and modified as necessary with watershed group/stakeholder input during the TMDL public meeting and comment period.

Although this procedure includes subjective and qualitative elements, SWQB has concluded that it provides the best available information for the identification of probable sources of impairment in a watershed given current resources available for this effort. The list of probable sources is not intended to single out any single land owner or particular land management activity and generally includes several sources per impairment. **Table 4.10** displays pollutant sources that may contribute to each AU as determined by field reconnaissance and evaluation. Probable sources of *E. coli* impairments will be evaluated, refined, and changed as necessary through the WBP.

Table 4.10 Probable Source Summary for *E. coli*

Pollutant Sources	Magnitude	AU	Probable Sources
Point:[(a)]			
	3.58×10^{8}	Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	Village of Jemez Springs WWTP - NM0028011
	4.78×10^{7}	Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	Jemez Valley Public Schools - NM0028479
Nonpoint:[(b)]			
	1.24×10^{10}	Clear Creek (Rio de las Vacas to San Gregorio Lake)	dams/diversions, flow alteration; dispersed rangeland grazing
	1.90×10^{11}	Jemez River (Soda Dam nr Jemez Springs to East Fork)	Paved roads, on-site treatment systems, wildlife other than waterfowl
	1.89×10^{11}	Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	Onsite treatment systems, paved roads, impervious surfaces/pavement, dispersed campgrounds, wildlife other than waterfowl
	2.97×10^{11}[(c)]	Jemez River (Jemez Pueblo bnd to Rio Guadalupe)	Dams/diversions, onsite treatment systems, crop production, paved roads, irrigated crop production
	6.24×10^{11}	Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)	Onsite treatment systems, residences/buildings, paved roads, crop production, irrigated crop production, rangeland grazing, dams/diversions

(a) The magnitudes of point source probable sources are based on the NPDES permit and WLA assigned in the TMDL. Permittees may be discharging above this amount if there are violations of permit effluent limits.
(b) The nonpoint source probable source magnitude is calculated by subtracting the point source load from the measured load.
(c) The magnitude of load allocation appears to be the same as the total measured load as a result of the relatively small WLA assigned to NM0028479. It is a function of the number formatting.

4.6 Linkage of Water Quality and Pollutant Sources

The Village of Jemez Springs WWTP is a potential source of bacteria in the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU, and the Jemez Valley Public Schools treatment

system is a potential source of bacteria in the Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AU. Data collected at the outfalls of the facilities is presented in **Appendix C**. Among nonpoint source probable sources of bacteria in the Jemez River and Rio Guadalupe watersheds are livestock grazing in close proximity to riparian areas, in addition to wastes from pets, waterfowl, and other wildlife. Howell *et al*. (1996) found that bacteria concentrations in underlying sediment increase when cattle have direct access to streams. Natural sources of bacteria are also present in the form of other wildlife such as elk, deer, and any other warm-blooded mammals.

In addition to direct input from grazing operations and wildlife, *E. coli* concentrations may be subject to elevated levels as a result of re-suspension of bacteria-laden sediment during storm events. While the highest concentrations of *E. coli* may occur during storm events rather than when flow is at 4Q3 levels, these events are rare, and the dilution of stormwater by the base flows, combined with the transitory nature of the events, the 4Q3 is considered a more conservative estimate of the long-term stream condition. Habitat modifications, including loss of riparian habitat, road maintenance and runoff, and land development and redevelopment, as well as other recreational pollution sources, appear to also be important contributors of bacteria in the relevant watersheds. While sufficient data currently exist to support development of *E. coli* TMDLs, further study is necessary to better determine sources and their relative contributions.

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data and the point source and NPS load estimates. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and inputs and explicit recognition of potential errors in flow calculations. Therefore, the MOS is the sum of the following assumptions:

- *Conservative Assumptions:*
  - *E. coli* bacteria are able to survive in the freshwater environment (Wcisło and Chróst 2000); and
  - Basing the target load capacity on the geometric mean criterion rather than the higher-concentration single sample criterion.
- *Explicit recognition of potential errors:*
  - Uncertainty exists in sampling nonpoint sources of pollution. A conservative MOS for this element is therefore **5%**.
  - The critical flow value for the ungaged streams was estimated based on a regression equation from Waltemeyer (2002). There is inherent error in all flow calculations, including those based on gage data. A conservative MOS for this element for AUs which used the regression equation is therefore **10%**.
  - There is inherent error in all flow measurements; a conservative MOS for this element in gaged streams is **5%**.

4.8 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. Data used in the calculation of these TMDLs were collected during the spring, summer, and fall in order to ensure coverage of any potential seasonal variation in the system. Bacteria exceedences occurred during flows throughout the sampling season, although more exceedences were recorded during sampling events between June and August. Higher flows may generate more nonpoint source runoff containing bacteria. It is also possible that higher concentrations are observed under a low flow

condition when there is insufficient dilution. Because there were exceedences throughout the sampling timeframe, seasonality was not considered a factor in development of *E. coli* TMDLs in this document.

4.9 Future Growth

Growth estimates by water planning region and county are available from the New Mexico Bureau of Business and Economic Research's Report on Historical and Future Population Dynamics in New Mexico Water Planning Regions (NMBBER 2008). These estimates project growth to the year 2060. **Table 4.11** displays the 2010 population based on US Census data, projected 2060 population, and the associated percent change for Sandoval County, most relevant to the *E. coli* TMDLs in this document.

According to SWQB data and a limited number of permitted NPDES permittees with a reasonable potential to discharge *E. coli*, bacterial loading is primarily due to diffuse nonpoint sources. The estimate of future growth in Sandoval County is not anticipated to lead to a significant increase in bacteria that cannot be controlled with BMPs in the watersheds discussed in this TMDL. Sandoval County contains the Rio Rancho metro area, the third largest city in New Mexico, and most of the projected population growth is expected to be attributed to growth there. The high percentage of tribal and federally-held lands in the Jemez watershed suggests that population growth would be limited in the watershed. However, it is imperative that BMPs continue to be utilized to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

Table 4.11 Projected population

County	2010 Population	Projected 2060 Population	Percent Change
Sandoval	131,561	292,367	122%

4.10 Reasonable Assurance

In the cases of TMDLs developed for waters that contain both point and nonpoint sources of pollution, a state must provide reasonable assurance that nonpoint source load controls, in combination with reasonable WLAs, will result in achievement of expected load reductions.

As stated in Sections 7.0 and 8.0, NMED and SWQB make every effort to provide these assurances. In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state, and private entities, NMED has established Memoranda of Understanding (MOU) with various federal agencies, in particular the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM). A MOU has also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

5.0 PLANT NUTRIENTS

Nutrient assessment conclusions for the Jemez River watershed were included in the 2016-2018 Clean Water Act Integrated §303(d)/§305(b) List of Assessed Waters (NMED/SWQB 2016a). Assessment of water quality data indicated nutrient impairment through exceedences of both causal and response variables. Total Phosphorus and Total Nitrogen TMDLs were developed to work in parallel to affect water quality improvement.

Nitrogen and phosphorus are essential for proper functioning of aquatic ecosystems. However, nuisance levels of algae and other aquatic vegetation can develop rapidly in response to nutrient enrichment when other factors (e.g., light, temperature, and substrate) are not limiting.

5.1 Target Loading Capacity

There are two potential causes of nutrient enrichment in a given stream upon which this document will focus: excessive total nitrogen (TN) and/or total phosphorus (TP). Nutrient criteria, whether numeric or narrative, control the excessive growth of attached algae and higher aquatic plants. Controlling algae and plant growth preserves aesthetic and ecologic characteristics along the waterway. Numeric thresholds are necessary to establish targets for TMDLs, to develop water quality-based permit limits and source control plans, and to support designated uses within the watershed.

While conceptually there may be a number of possible combinations of TN and TP concentrations that are protective of water quality, the application of simple chemical limitation concepts to a complex biologic system to determine these combinations, where the goal is to control the excessive growth of attached algae and higher aquatic plants, is challenging. One of the primary reasons for this is that different species of algae and higher aquatic plants have different nutritional needs. Some species may exhibit nitrogen limitation while others will exhibit phosphorous limitation or co-limitation by both nutrients. Because of the diversity of nutritional needs amongst organisms, numeric thresholds for both TN and TP are required to preserve the aesthetic and ecologic characteristics along a waterway. Focusing on one nutrient or trading a decrease in one for an increase in the other may simply favor a particular species without achieving water quality standards (USEPA 2015).

For these TMDLs, the target values are based on the numeric translators for the narrative criterion for TN and TP as set forth in Subsection E of 20.6.4.13 NMAC:

> ***Plant Nutrients:*** *Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in the dominance of nuisance species in surface waters of the state.*

This narrative criterion can be challenging to assess because the relationships between nutrient levels and impairment of designated uses are not defined, and distinguishing nutrients from "other than natural causes" is difficult. Therefore, SWQB, with the assistance from USEPA and the USGS, developed a *Nutrient Assessment Protocol* (NMED/SWQB 2015) to assist in meeting these challenges. It incorporates both cause (TN and TP) and response variables (dissolved oxygen (DO), periphyton, chlorophyll *a*, and percent cyanobacteria) and uses a weight-of-

evidence approach to determine impairment. Threshold values for each of the cause and response variables are used to translate the narrative nutrient criteria into quantifiable endpoints. Water quality assessments for nutrients are based on quantitative measurements of these causal and response indicators. If these measurements exceed the numeric nutrient threshold values, indicate excessive primary production (e.g., large DO and pH fluctuation and/or high chlorophyll *a* concentration), and/or demonstrate an unhealthy biological community (e.g., high cyanobacteria counts), the waterbody is considered to be impaired.

Phosphorous is found in water primarily as orthophosphate. In contrast nitrogen may be found as several dissolved species, all of which must be considered in nutrient loading. Total nitrogen is defined as the sum of Nitrate+Nitrite (N+N), and Total Kjeldahl Nitrogen (TKN). At the present time, there is no USEPA-approved method to test for total nitrogen, however a combination of USEPA methods 351.2 (TKN) and 353.2 (N+N) is appropriate for estimating total nitrogen (APHA 1989). The applicable threshold values for cause (phosphorus and nitrogen) and response (DO, pH, and chlorophyll *a*) variables in the relevant AUs are shown in **Table 5.1**. These threshold values were used for water quality assessments (NMED/SWQB 2015) and as a starting point for TMDL development.

Table 5.1 Applicable nutrient-related thresholds for Relevant AUs

Ecoregion	21- Southern Rockies
WQS segment	20.6.4.108 NMAC
Aquatic Life Use	High Quality Coldwater
Total Phosphorus	0.02 mg/L
Total Nitrogen	0.25 mg/L
Dissolved Oxygen	6.0 mg/L
Chlorophyll *a*	5.5 $\mu g/cm^2$
pH	6.6-8.0

Exceedence ratios of applicable thresholds for each AU can be found in **Tables 5.2** and **5.3.** Impairment of the dissolved oxygen and pH response variables is determined using long-term datasets, so the table simply states whether the response variable indicated nutrient impairment or not.

Table 5.2 Exceedence Ratios – Causal Variables

AU	Total Phosphorus	Total Nitrogen[(a)]
Clear Creek (Rio de las Vacas to San Gregorio Lake)	4/7	0/0
Clear Creek (San Gregorio Lake to headwaters)	3/8	1/1
East Fork Jemez (VCNP to headwaters)	6/7	3/3
Jaramillo Creek (East Fork Jemez to headwaters)	3/4	2/2
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	11/13	3/3

Notes: (a) Total Nitrogen samples were not used in formal assessment due to the low number of samples which produced useable data.

Table 5.3 Exceedence Ratios – Response Variables

AU	Dissolved Oxygen	pH	Chlorophyll-a
Clear Creek (Rio de las Vacas to San Gregorio Lake)	Impaired	Not impaired	0/1
Clear Creek (San Gregorio Lake to headwaters)	Impaired	Impaired	0/0
East Fork Jemez (VCNP to headwaters)	Impaired	Not Assessed	0/0
Jaramillo Creek (East Fork Jemez to headwaters)	Impaired	Not Assessed	0/0
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	Impaired	Not Impaired	1/2

Notes: Dissolved oxygen and pH assessments are performed using long-term datasets rather than instantaneous grab samples.

5.2 TMDL Development

TMDLs are calculated for a specific flow, and nutrient concentrations can vary as a function of flow. Determining the critical flow in a stream is typically done using the 4Q3 of an AU. The 4Q3 is the four consecutive day low flow that occurs with a frequency of once in three years.

5.3 Target Loading Capacity

The target values for the nitrogen and phosphorus TMDLs are based on the thresholds identified in the SWQB Assessment Protocols of 0.25 and 0.02 mg/L, respectively (NMED/SWQB 2015). Exceedence ratios are listed in **Tables 5.2 and 5.3**. The data are available in **Appendix C**. There were TP exceedences in each of the AUs discussed in this section. Exceedences of TN are widely unknown due to an analytical problem that resulted in reported detection limits higher than the

threshold in the majority of collected samples. As a result of the small assessable sample pool, it is not clear whether TN values indicate impairment in the AUs. In addition to the TN and TP measurements, the response variable dissolved oxygen exceeded the criterion in the long-term datasets for all of the AUs.

5.4 Flow

TMDLs are calculated at a specific flow and nutrient concentrations can vary as a function of flow. SWQB determined streamflow either by using the active USGS gage network or by taking direct flow measurements utilizing standard procedures (NMED/SWQB 2013)[21]. WQS exceedences for the impaired reaches occurred during low and moderate flows. Historically, the SWQB has used the 4-day, 3-year low-flow frequency (4Q3) to calculate nutrient TMDLs. The 4Q3 is the annual lowest 4 consecutive day flow that occurs with a frequency of at least once every 3 years. Exceedences occurred across a wide range of flow measurements and throughout the sampling period.

As all of the AUs in this section are located on ungaged streams; the critical flow was determined using an analysis method developed by Waltemeyer (2002) to estimate the 4Q3 of streams in New Mexico. In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of New Mexico (i.e., statewide and mountainous regions above 7,500 ft. in elevation). Because the average elevation of each of the watersheds is above 7,500 ft., the decision was made to use the mountainous regions regression equation.

The following mountainous regions regression equation (**Equation 5.1**) is based on data from 40 gaging stations located above 7,500 ft. in elevation with non-zero discharge (Waltemeyer 2002):

Equation 5.1

$$4Q3 = 7.3287 \times 10^{-5} DA^{0.70} {P_w}^{3.58} S^{1.35}$$

Where:

4Q3	= Four-day, three-year low-flow frequency (cfs)
DA	= Drainage area (mi^2)
P_w	= Average basin mean winter precipitation (inches)
S	= Average basin slope (%)

For details and development of this equation, please see *Analysis of the Magnitude and Frequency of the 4-Day Annual Low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams in New Mexico*, USGS Water-Resources Investigations Report 01-4271 (Waltemeyer 2002)[22].

4Q3 values calculated using Waltemeyer's methods are presented in **Table 5.4**. Parameters used in the calculation were determined using Weasel, a Geographic Information System (GIS)

[21] http://www.nmenv.state.nm.us/swqb/SOP/
[22] http://nm.water.usgs.gov/publications/abstracts/wrir01-4271.html

application. The 4Q3 result from Equation 5.1 is in cfs. Conversion to million gallons per day (MGD) was calculated using the unit conversion provided in **Appendix A**.

Table 5.4 Calculation of 4Q3

Assessment Unit	Average Elevation (ft)	Drainage Area (mi^2)	Mean Winter Precipitation (in)	Average Basin Slope (percent)	4Q3 (cfs)	4Q3 (MGD)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	9249	10.54	19.18	0.15	1.15	0.74
Clear Creek (San Gregorio Lake to headwaters)	9972	3.21	23.32	0.12	0.74	0.48
East Fork Jemez (VCNP to headwaters)	9041	43.93	13.85	0.18	1.25	0.81
Jaramillo Creek (East Fork Jemez to headwaters)	9115	22.13	14.16	0.17	0.77	0.50
Rio Guadalupe (Jemez River to confluence with Rio Cebolla)	8413	267.49	13.27	0.23	5.15	3.33

5.5 Calculations

The TP threshold of 0.02 mg/L was used to calculate the allowable stream loads of TP for the impaired assessment units. The TN threshold of 0.25 mg/L was used to calculate those for TN. TMDLs, or target loading capacities, for TP and TN are calculated with the following equation (**Equation 5.2**), based on flow values, WQS, and a conversion factor to convert to pounds per day (lbs/day) (**Equation 5.3**):

Equation 5.2

$$Target\ Loading\ Capacity = Critical\ Flow \times Criterion \times Conversion\ Factor$$

Equation 5.3

$$C\ as \frac{cfu}{100mL} * 1000 \frac{mL}{L} * \frac{L}{0.264\ gallons} * Q\ in\ 1{,}000{,}000 \frac{gallons}{day} = cfu/day$$

Where:

C = water quality criterion for total phosphorus or total nitrogen
Q = the critical stream flow in million gallons per day (MGD)

The calculated target loads for TP and TN are located in **Tables 5.5** and **5.6**. The measured loads were calculated using the arithmetic mean of the data for a conservative measured load estimate. The arithmetic mean of a dataset is always greater than the geometric mean (Muirhead 1903).

Table 5.5 Target/TMDL Total Phosphorus Loads

AU	Critical Flow (MGD)	Criterion (mg/L)	Unit Conversion Factor[(a)]	TMDL (lbs/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.74	0.02	8.34	0.12
Clear Creek (San Gregorio Lake to headwaters)	0.48	0.02	8.34	0.08
East Fork Jemez (VCNP to headwaters)	0.81	0.02	8.34	0.14
Jaramillo Creek (East Fork Jemez to headwaters)	0.50	0.02	8.34	0.08
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	3.33	0.02	8.34	0.56

(a) Details can be found in Appendix A. The conversion factor converts volume and concentration into loading units; in this case, lbs/day.

Table 5.6 Target/TMDL Total Nitrogen Loads

AU	Critical Flow (MGD)	Criterion (mg/L)	Unit Conversion Factor[(a)]	TMDL (lbs/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.74	0.25	8.34	1.54
Clear Creek (San Gregorio Lake to headwaters)	0.48	0.25	8.34	1.00
East Fork Jemez (VCNP to headwaters)	0.81	0.25	8.34	1.69
Jaramillo Creek (East Fork Jemez to headwaters)	0.50	0.25	8.34	1.04
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	3.33	0.25	8.34	6.94

(a) Details can be found in Appendix A. The conversion factor converts volume and concentration into loading units; in this case, lbs/day.

The measured loads for TP were calculated in the same manner as the target loads, substituting the arithmetic mean of the measured concentrations for the water quality criterion (**Table 5.7**), and the load reduction estimate is shown in **Table 5.8**. The measured load for total nitrogen was not calculated due to lack of assessable analytical data on which to base the calculation. Measured loads and load reduction estimates are not required components of TMDLs; neither

CWA §303 nor 40 CFR Part 130.7 requires states to include discussions of percent reductions in TMDL documents.

Table 5.7 Measured Total Phosphorus Loads

AU	Critical Flow (MGD)	Arithmetic Mean (mg/L)	Unit Conversion Factor[(a)]	Measured Load (lbs/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.74	0.024	8.34	0.15
Clear Creek (San Gregorio Lake to headwaters)	0.48	0.023	8.34	0.09
East Fork Jemez (VCNP to headwaters)	0.81	0.084	8.34	0.57
Jaramillo Creek (East Fork Jemez to headwaters)	0.50	0.12	8.34	0.50
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	3.33	0.039	8.34	1.08

(a) Details can be found in Appendix A. The conversion factor converts volume and concentration into loading units; in this case, lbs/day.

Table 5.8 Percent Reduction – Total Phosphorus

Assessment Unit	Target Load (lbs/ day)	Measured Load (lbs /day)	Percent Reduction (%)[(a)]
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.12	0.15	16.67
Clear Creek (San Gregorio Lake to headwaters)	0.08	0.09	13.04
East Fork Jemez (VCNP to headwaters)	0.14	0.57	76.19
Jaramillo Creek (East Fork Jemez to headwaters)	0.08	0.50	83.33
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	0.56	1.08	48.72

(a) Percent reduction is the amount that the existing measured load must be reduced to achieve the TMDL and is calculated as follows: (Measured Load – TMDL) / Measured Load x 100

5.6 Waste Load Allocations and Load Allocations

5.6.1 Waste Load Allocation

There are no NPDES permits or MS4 storm water permits in the AUs covered by these TMDLs. However, excess nutrient loading may be a component of some storm water discharges covered under general NPDES permits. 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 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. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids,

erosion, and sediment control Best Management Practices (BMPs), and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that waste load allocations and/or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Storm water discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by the General Permits at this time using the available tools. The discharges from these permits are typically transitory and enforcement is complex as permittees are temporary. Loads that are in compliance with the General Permits are therefore currently included as part of the LA. While these sources are not given individual allocations, they are addressed through other means, including BMPs, storm water pollution prevention conditions, and other requirements. Therefore the waste load components of these nutrient TMDLs is zero.

5.6.2 Load Allocation

Since the WLAs for the TMDLs in this section are 0, the load allocation is simply the TMDL value, less the MOS. The TMDL allocations are located in **Table 5.9** and **5.10**. Details on the MOS are located in Section 5.9

Table 5.9 TMDL Allocations – Total Phosphorus

Assessment Unit	Target Concentration (mg/L)	TMDL[(a)] (lbs/day)	Load Allocation (lbs/day)	Waste Load Allocation (lbs/day)	Margin of Safety (15%) (lbs/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.02	0.12	0.10	0	0.02
Clear Creek (San Gregorio Lake to headwaters)	0.02	0.08	0.07	0	0.01
East Fork Jemez (VCNP to headwaters)	0.02	0.14	0.11	0	0.02
Jaramillo Creek (East Fork Jemez to headwaters)	0.02	0.08	0.07	0	0.01
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	0.02	0.56	0.47	0	0.08

[(a)]TMDL values are equivalent to the target load capacity; these values are displayed in Table 5.5.

Table 5.10 TMDL Allocations – Total Nitrogen

Assessment Unit	Target Concentration (mg/L)	TMDL[(a)] (lbs/day)	Load Allocation (lbs/day)	Waste Load Allocation (lbs/day)	Margin of Safety (15%) (lbs/day)
Clear Creek (Rio de las Vacas to San Gregorio Lake)	0.25	1.54	1.31	0	0.23
Clear Creek (San Gregorio Lake to headwaters)	0.25	1.00	0.85	0	0.15
East Fork Jemez (VCNP to headwaters)	0.25	1.69	1.44	0	0.25
Jaramillo Creek (East Fork Jemez to headwaters)	0.25	1.04	0.89	0	0.16
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	0.25	6.94	5.90	0	1.04

[(a)]TMDL values are equivalent to the target load capacity; these values are displayed in Table 5.5.

5.7 Identification and Description of Pollutant Sources

SWQB fieldwork typically includes an assessment of the probable sources of impairment. The approach includes solicitation of input from a variety of stakeholders, including landowners, watershed groups, and local, state, tribal, and federal agencies. Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. In this case, a probable source survey of the lake was performed by field staff during the water quality survey. A draft probable source list is in **Table 5.11** and can be reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period.

Table 5.11 Probable Sources for Total Phosphorus and Total Nitrogen

Assessment Unit	Probable Sources
Clear Creek (Rio de las Vacas to San Gregorio Lake)	Dams/diversions, flow alteration, road runoff, dispersed rangeland grazing
Clear Creek (San Gregorio Lake to headwaters)	Dispersed rangeland grazing, hiking trails
East Fork Jemez (VCNP to headwaters)	Wildlife other than waterfowl, fish stocking, dispersed rangeland grazing, watershed runoff following forest fire
Jaramillo Creek (East Fork Jemez to headwaters)	Wildlife other than waterfowl, dispersed rangeland grazing
Rio Guadalupe (Jemez River to confl with Rio Cebolla)	Dams/diversions, flow alteration, gravel or dirt roads, onsite treatment systems, residences/buildings, dispersed rangeland grazing, fish stocking

Notes: Probable sources were identified during the 2013 field survey.

5.8 Linkage between Water Quality and Pollutant Sources

Phosphorus and nitrogen generally drive the productivity of algae and macrophytes in aquatic ecosystems, therefore they are regarded as the primary limiting nutrients in freshwater. The main reservoirs of natural phosphorus are rocks and natural phosphate deposits. Weathering, leaching, and erosion are all processes that breakdown rock and mineral deposits allowing phosphorus to be transported to aquatic systems via water or wind. The breakdown of mineral phosphorus produces inorganic phosphate ions ($H_2PO_4^-$, HPO_4^{2-}, and PO_4^{3-}) that can be absorbed by plants from soil or water (USEPA 1999). Phosphorus primarily moves through the food web as organic phosphorus (after it has been incorporated into plant or algal tissue) where it may be released as phosphate in urine or other waste by heterotrophic consumers, including humans and livestock, and reabsorbed by plants or algae to restart the cycle (Nebel and Wright 2000).

The largest reservoir of nitrogen is the atmosphere. About 80% of the atmosphere by volume consists of nitrogen gas (N_2). Although nitrogen is plentiful in the environment, it is not readily available for biological uptake. Nitrogen gas must be converted to other forms, such as ammonia (NH_3 and NH_4^+), nitrate (NO_3^-), or nitrite (NO_2^-) before plants and animals can use it. Conversion of gaseous nitrogen into usable mineral forms occurs through three biologically mediated processes of the nitrogen cycle: nitrogen fixation, nitrification, and ammonification (USEPA 1999). Mineral forms of nitrogen can be taken up by plants and algae and incorporated into plant or algal tissue. Nitrogen follows the same pattern of food web incorporation as phosphorus and is released in waste primarily as ammonium compounds. The ammonium compounds are usually converted to nitrates by nitrifying bacteria, making it available again for uptake, continuing the cycle (Nebel and Wright 2000).

Rain, overland runoff, groundwater, drainage networks, and industrial and residential waste effluents transport nutrients to receiving waterbodies. Once nutrients have been transported into a waterbody, there are several mechanisms by which they can enter the cycle. They can be taken up by algae, macrophytes, and microorganisms either in the water column or the benthos; they can sorb to organic or inorganic particles in the water column and/or sediment; they can

accumulate or be recycled in the sediment; or they can be transformed and released as a gas from the waterbody.

As noted above, phosphorus and nitrogen are essential for proper functioning of ecosystems. However, excess nutrients can cause conditions unfavorable for the proper functioning of aquatic ecosystems. Nuisance levels of algae and other aquatic vegetation such as macrophytes can develop rapidly in response to nutrient enrichment when other factors (e.g., light, temperature, substrate) are not limiting. Unfortunately, the magnitude of nutrient concentration that constitutes an "excess" is difficult to determine and varies by ecoregion.

The effective impact of plant nutrients in a stream can vary as a function of water volume. As volume decreases through diversions and/or drought-related stressors, the waterbody cannot effectively dilute its constituents, which causes the concentration of plant nutrients to increase. Nutrients generally reach a waterbody from land uses that are in close proximity to it because the hydrological pathways are shorter and have fewer obstacles than more distant land uses. During the growing season (i.e., in agricultural return flow) and in stormwater runoff, distant land uses can become hydrologically connected to a waterbody, transporting nutrients from the hillslopes to the stream during these periods. Dry conditions in northern New Mexico and lower than average snowpack in the Jemez Mountains during the survey years have resulted in a generally lower than average daily mean discharge. This decrease in discharge is likely to have contributed to increased concentrations of nutrients in streams.

In addition to agriculture, there are several other human-related activities that influence nutrient concentrations in waterbodies. Residential areas contribute nutrients from septic tanks, landscape maintenance, pet wastes, and backyard livestock (e.g., cattle, horses). Development contributes nutrients by disturbing the land and consequently increasing soil erosion, increasing the impervious area within the watershed, and by directly applying nutrients to the landscape. The Jemez watershed also contains high-use recreation areas which may contribute increased nutrient loads through increased erosion, improper waste disposal, fish stocking, campfires and/or wildfires, and dumping trash near the riparian corridors.

Undeveloped or natural landscapes may also deliver nutrients to a waterbody through decaying plant material, soil erosion, and wild animal waste. One notable example is the large elk population in the VCNP portions of the Jemez watershed. Another geographically occurring nutrient source is atmospheric deposition, which adds nutrients directly to the waterbody through dryfall and rainfall. Atmospheric phosphorus and nitrogen can be found in both organic and inorganic particles, such as pollen and dust. The contributions from natural sources are generally considered to represent background levels, although anthropogenic sources are common and have the capacity to travel long distances, resulting in widespread impacts.

Water pollution caused by on-site septic systems is a widespread problem in New Mexico (McQuillan 2004). Septic system effluents have contaminated more water supply wells and more acre-feet of ground water than all other sources in the state combined. Groundwater contaminated by septic system effluent can discharge into streams gaining from groundwater inflow. Nutrients such as phosphorus and nitrogen released into gaining streams from aquifers

contaminated by septic systems can contribute to eutrophic conditions in downstream waterbodies.

5.9 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the nonpoint source load estimates, and the modeling analysis. The MOS can be expressed either implicitly or explicitly. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

For these TMDLs, the MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors. Therefore, this MOS is the sum of the following two elements:

- Conservative Assumptions
  - Treating phosphorus and nitrogen as pollutants that do not readily degrade in the environment (i.e., persistent).
- Explicit Recognition of Potential Errors
  - Uncertainty exists in sampling nonpoint sources of pollution. A conservative MOS for this element is 5%.
  - The critical flow value for the ungaged streams was estimated based on a regression equation from Waltemeyer (2002). There is inherent error in all flow calculations, including those based on gage data. A conservative MOS for this element for AUs which used the regression equation is therefore **10%**.

5.10 Consideration of Seasonal Variability

Section 303(d)(1) of the CWA requires TMDLs to be "established at a level necessary to implement the applicable WQS with seasonal variation." Data used in the calculation of this TMDL were collected during the spring and summer to ensure coverage of seasonal variation within the growing season when nutrient concentrations are expected to be at their highest. Exceedences of both nitrogen and phosphorus were observed during the growing season.

5.11 Future Growth

Growth estimates by water planning region and county are available from the New Mexico Bureau of Business and Economic Research's *Report on Historical and Future Population Dynamics in New Mexico Water Planning Regions* (NMBBER 2008). These estimates project growth to the year 2060. **Table 5.12** displays the 2010 population based on US Census data, projected 2060 population, and the associated percent change for Sandoval County, most relevant to the nutrient TMDLs in this document.

According to SWQB data and the lack of permitted NPDES permittees with a reasonable potential to discharge nutrients, TN and TP loading is primarily due to diffuse nonpoint sources. The estimate of future growth in Sandoval County is not anticipated to lead to a significant increase in nutrients that cannot be controlled with BMPs in the watersheds discussed in this TMDL. It should be noted that Sandoval County contains the Rio Rancho metro area, the third largest city in New Mexico. Much of the projected population growth would be attributable to growth there. The high percentage of tribal and federally-held lands in the Jemez watershed

suggests that population growth would be limited there. However, it is imperative that BMPs continue to be utilized to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

Table 5.12 Projected population

County	2010 Population	Projected 2060 Population	Percent Change
Sandoval	131,561	292,367	122%

5.12 Reasonable Assurance

In the cases of TMDLs developed for waters that contain both point and nonpoint sources of pollution, a state must provide reasonable assurance that nonpoint source load controls, in combination with reasonable WLAs, will result in achievement of expected load reductions. In the case of TMDLs containing only nonpoint sources of pollutant loading, similar to those contained in this document, this type of reasonable assurance is not required.

However, as stated below in Sections 7.0 and 8.0, NMED and SWQB make every effort to provide these assurances. In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state, and private entities, NMED has established Memoranda of Understanding (MOU) with various federal agencies, in particular the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM). A MOU has also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

6.0 MONITORING PLAN

Pursuant to CWA §106(e)(1), 33 U.S.C. §1251[23], 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, NMSA §§74-6-1 to 17[24], the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State.

The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls, and to conduct water quality assessments.

The SWQB was actively involved in national conversations with USEPA and the Association of Clean Water Administrators (ACWA) regarding the Long Term Vision (Vision) for the CWA § 303(d) program. The goals of the Vision are prioritization of watershed or waters for restoration and protection; assessment of priority waters; protection of unimpaired waters; alternative approaches to restoration and protection; engagement with the stakeholders; and integration with other CWA programs. As a result of the new Vision and goals, the monitoring and TMDL programs in New Mexico are being revised to allow a greater focus on state water quality priorities, encourage TMDL alternatives, and emphasize the value of protecting waterbodies that are not impaired. This document, referred to as a "Prioritization Framework," summarizes the prioritization of monitoring and TMDL activities in New Mexico. The list of monitoring and TMDL priorities through 2020 was determined using the process outlined in the Framework[25].

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored for two consecutive years with an established return frequency of approximately every eight years after the first year of monitoring. The next scheduled monitoring years for the Jemez Watershed are 2021-2022. The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6 (NMED/SWQB, 2016b). In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program.

Prior to assessment, the SWQB requests data from outside entities. If that dataset meets all SWQB quality requirements, it will be used for assessment. Sonde data were received from VCNP staff for the East Fork Jemez (VCNP to headwaters) AU. Those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring and examination. Both long-term and intensive field studies can contribute to the State's Integrated §303(d)/§305(b) listing process for waters requiring TMDLs.

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[23] http://www.epw.senate.gov/water.pdf
[24] http://public.nmcompcomm.us/nmpublic/gateway.dll/?f=templates&fn=default.htm
[25] https://www.env.nm.gov/swqb/TMDL/FinalDraftPrioritizationFrameworkStrategyNewMexicoJuly2015.pdf

7.0 IMPLEMENTATION OF TMDLS

7.1 Point Sources – NPDES Permitting

There are two existing point sources with individual NPDES permits with potential impacts to the Jemez River (Jemez Pueblo bnd to Rio Guadalupe) and Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AUs:

The Village of Jemez Springs holds a permit (NM0028011) for a municipal wastewater treatment plant (WWTP) with one outfall that discharges directly to the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU. The *E. coli* WLA that has been assigned to this point source is 3.58×10^8 cfu/day, which is based upon the monthly geometric average criterion of 126 cfu/100mL. The current NPDES permit effluent limits are based on the water quality criteria for the AU. It is expected that upon NPDES permit renewal, the effluent permit limits for *E. coli* will continue to include a monthly geometric mean criterion of 126 cfu/100 mL and a single sample criterion of 410 cfu/100 mL.

The Jemez Valley Public Schools holds a permit (NM0028479) for a privately-owned sanitary wastewater treatment facility with one outfall that discharges directly to the Jemez River (Jemez Pueblo bnd to Rio Guadalupe) AU. The *E. coli* WLA that has been assigned to this point source is 4.78×10^7 cfu/day, which is based upon the monthly geometric average criterion of 126 cfu/100mL. The current NPDES permit effluent limits are based on the water quality criteria for the AU. It is expected that upon NPDES permit renewal, the effluent permit limits for *E. coli* will continue to include a monthly geometric mean criterion of 126 cfu/100 mL and a single sample criterion of 410 cfu/100 mL.

7.2 Nonpoint Sources – WBP and BMP Coordination

Public awareness and involvement will be crucial to the successful implementation of these plans and improved water quality. A WBP is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It includes opportunities for private landowners and public agencies in reducing and preventing nonpoint source impacts to water quality. This long-range strategy will become instrumental in coordinating efforts to achieve water quality standards in the watershed. The WBP is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WBP leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

Several of the stream reaches discussed in this document have TMDLs already in place, and watershed planning and restoration is ongoing in several AUs. A Watershed Restoration Action Strategy (WRAS) for the Jemez River Watershed was completed in 2005, and a draft WRAS was completed for the Outlet San Antonio was completed in 2011. If necessary, updated planning documents should be drafted to meet the requirements and includes identified impairments and the new TMDLs.

SWQB staff will provide technical assistance such as selection and application of BMPs needed to meet WBP goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholders in this process are likely to include the National Park Service and the Nature Conservancy, in addition to private landowners, USFS, and other interested parties.

7.3 Clean Water Act §319(h) Funding

The Watershed Protection Section of the SWQB can potentially provide CWA §319(h) funding from USEPA to assist in implementation of BMPs to address water quality problems on reaches listed as Category 4 or 5 waters on the CWA §303(d) List. These monies are available to all private, for-profit, and non-profit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal or state agencies. Proposals are submitted by applicants through a Request for Proposal (RFP) process. Selected projects require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is potentially available, generally annually, for both watershed-based planning and on-the-ground projects to improve surface water quality and associated habitat. Further information on funding via CWA § 319(h) can be found at the SWQB website: http://www.nmenv.state.nm.us/swqb/.

7.4 Other Funding Opportunities and Restoration Efforts

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. They can also provide matching funds for appropriate CWA Section 319(h) projects using state revolving fund monies. The USDA Environmental Quality Incentive Program (EQIP) program can provide assistance to private land owners in the basin. The USFS, a major land owner in the watersheds discussed in this document, aligns their mission to protect the lands that they manage with the TMDL process and are another source of assistance. The BLM has several programs in place to provide assistance to improve unpaved roads and grazing allotments.

The New Mexico Legislature appropriated $2.3 million in state funds for the River Stewardship Program during the 2014 Legislative Session and $1 million during the 2015 Special Session. The River Stewardship Program has the overall goal of addressing the root causes of poor water quality and stream habitat. Objectives of the River Stewardship Program include: "restoring or maintaining hydrology of streams and rivers to better handle overbank flows and thus reduce flooding downstream; enhancing economic benefits of healthy river systems such as improved opportunities to hunt, fish, float or view wildlife; and providing state matching funds required for federal CWA grants." A competitive RFP was conducted for 2014 funding and twelve projects located throughout the state were selected. SWQB issued a RFP for the 2015 funding in early 2016 and expects to fund several projects throughout the state. Responsibility for the program is assigned to NMED, and SWQB staff administers the projects.

8.0 APPLICABLE REGULATIONS AND STAKEHOLDER ASSURANCES

New Mexico's Water Quality Act (Act) authorizes the Water Quality Control Commission (WQCC) to "promulgate and publish regulations to prevent or abate water pollution in the state" (NMSA 1978, § 74-6-4 (E)) and to require permits (NMSA 1978, § 74-6-5(A)). The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Act also provides that:

> "[t]he Water Quality Act 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."

NMSA 1978, §74-6-12 (A). In addition, the New Mexico Surface Water Quality Standards, Subsection C of 20.6.4.4 NMAC also provides:

> C. 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.

20.6.4.4 (C) NMAC. New Mexico policies are in general accord with the federal CWA § 101 (g), 33 U.S.C. §1251 (g), goals:

> 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 chapter. It is the further policy of Congress that nothing in this chapter 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.

33 U.S.C. §1251 (g). New Mexico's CWA Section 319 program has been developed in a coordinated manner with the State's 303(d) process. All Section 319 watersheds that are targeted in the annual RFP process coincides with the State's preparation of the biennial impaired waters listing as approved by the USEPA. The State has given a high priority for funding, assessment, and restoration activities to these impaired/listed watersheds.

As a constituent agency, NMED has the authority pursuant to NMSA 1978, Section 74-6-10, 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 NPS. The NMED NPS water quality management program has historically strived for and will continue to promote voluntary compliance to NPS water pollution concerns by utilizing a voluntary, cooperative approach. The State provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through Section 319 of the CWA (33 U.S.C. § 1329). Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state, and private entities, NMED has established MOU with various federal agencies, in particular the USFS and the BLM. A MOU has also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with NPS issues.

The time required to attain standards for all reaches is estimated to be approximately ten to twenty years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. Stakeholders in this process will include the SWQB, and other parties identified in the WBP. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

9.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL. The draft Jemez River Watershed TMDL was first made available for a 30-day comment period beginning June 27, 2016, ending on July 27, 2016. The draft document notice of availability was extensively advertised via email distribution lists, webpage postings, and press releases to area newspapers. A public meeting was held on July 14, 2016 at the Jemez Springs Community Library, 30 Jemez Springs Plaza in Jemez Springs from 6:30-8:30pm; two stakeholders attended. No comments were received during the public comment period.

Once the TMDL is approved by the WQCC, the next opportunity for public participation will be activities as described in Section 7, including participation in watershed planning and protection projects.

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APPENDIX A

CONVERSION FACTOR DERIVATIONS

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FLOW

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:

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

Conversion Factor Derivation for milligrams:

$$CF = 10^6 \times \frac{3.785\ L}{gal} \times \frac{1\ lb}{454{,}000\ mg} = 8.34\left(\frac{L-lb}{gal-mg}\right)$$

Flow is converted from cfs to MGD by the following equation:

$$\left(\frac{ft^3}{s}\right) * \left(\frac{86{,}400\ s}{1\ day}\right) * \left(\frac{7.48\ gal}{ft^3}\right) * \left(\frac{1\ Million\ gal}{1{,}000{,}000\ gal}\right) = MGD$$

APPENDIX B

SOURCE DOCUMENTATION SHEET AND SOURCES

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"Sources" are defined as activities that may contribute pollutants or stressors to a water body (USEPA, 1997). The list of "Probable Sources of Impairment" in the Integrated 303(d)/305(b) List, Total Maximum Daily Load documents (TMDLs), and WBPs is intended to include any and all activities that could be contributing to the identified cause of impairment. Data on Probable Sources is routinely gathered by Monitoring and Assessment Section staff and Watershed Protection Section staff during water quality surveys and watershed restoration projects and is housed in the Assessment Database (ADB) (ADB version 2). ADB was developed by USEPA to help states manage information on surface water impairment and to generate §303(d)/ §305(b) reports and statistics. More specific information on Probable Sources of Impairment is provided in individual watershed planning documents (e.g., TMDLs, WBPs, etc.) as they are prepared to address individual impairments by assessment unit.

USEPA, through guidance documents strongly encourages states to include a list of Probable Sources for each listed impairment. According to the 1998 305(b) report guidance, "…, states must always provide aggregate source category totals…" in the biennial submittal that fulfills CWA section 305(b)(1)(C) through (E) (USEPA, 1997). The list of "Probable Sources" is not intended to single out any particular land owner or single land management activity and has therefore been labeled "Probable" and generally includes several sources for each known impairment.

The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB. Any new impairment listing will be assigned a Probable Source of "Source Unknown." Probable Source Sheets will continue to be filled out during watershed surveys and watershed restoration activities by SWQB staff. Information gathered from the Probable Source Sheets will be used to generate a draft Probable Source list in consequent TMDL planning documents. These draft Probable Source lists will be finalized with watershed group/stakeholder input during the pre-survey public meeting, TMDL public meeting, WBP development, and various public comment periods. The final Probable Source list in the approved TMDL will be used to update the subsequent Integrated List.

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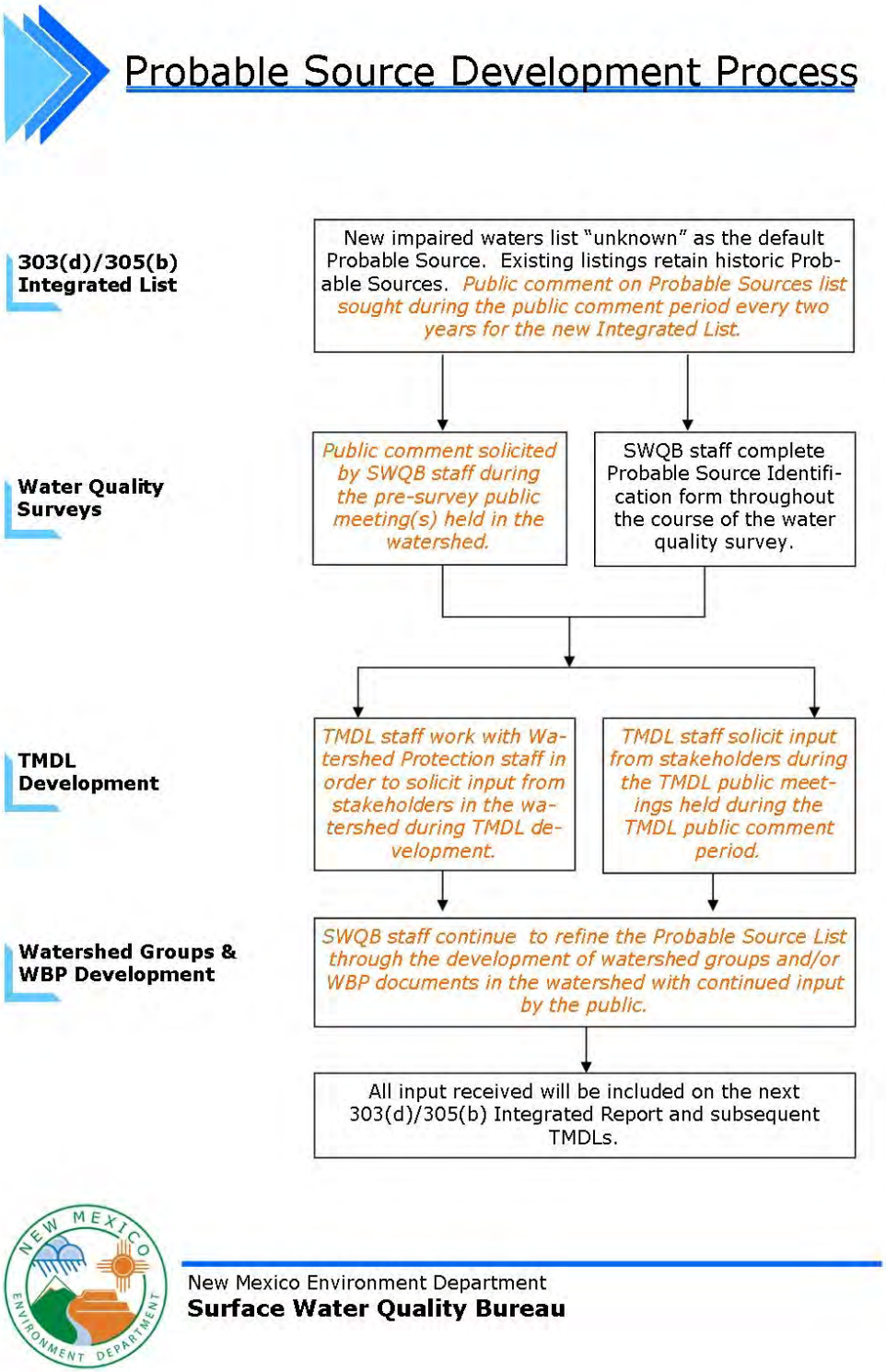

Figure B1. Probable Source Development Process and Public Participation Flowchart

Help Us Identify Probable Sources of Impairment

Name:
Phone Number (optional):
Email or Mailing Address (optional):
Date:
Waterbody or site description (example - Fish Creek near HWY 34 crossing):

From the list below, please check activities known to exist that you are concerned may be contributing to surface water quality impairment. Please score items you check based on distance to or occurrence on or near the waterbody of concern.

(1 = Low occurrence or not near waterbody)
(3 = Moderate occurrence or within ½ mile of waterbody)
(5 = High occurrence or right next to water body)

✓	ACTIVITY	Score			✓	ACTIVITY	Score		
☐	Feedlots	1	3	5	☐	Pavement and Other Impervious Surfaces	1	3	5
☐	Livestock Grazing	1	3	5	☐	Roads/Bridges/Culverts	1	3	5
☐	Agriculture	1	3	5	☐	Habitat Modification(s)	1	3	5
☐	Flow Alterations (water withdrawal)	1	3	5	☐	Mining/Resource Extraction	1	3	5
☐	Stream/River Modification(s)	1	3	5	☐	Logging/Forestry Operations	1	3	5
☐	Storm Water Runoff	1	3	5	☐	Housing or Land Development	1	3	5
☐	Drought Related	1	3	5	☐	Habitat Modification	1	3	5
☐	Landfill(s)	1	3	5	☐	Waterfowl	1	3	5
☐	Industry/Wastewater Treatment Plant	1	3	5	☐	Wildlife other than Waterfowl	1	3	5
☐	Inappropriate Waste Disposal	1	3	5	☐	Recreational Use	1	3	5
☐	Improperly maintained Septic Systems	1	3	5	☐	Natural Sources	1	3	5
☐	Waste from Pets	1	3	5	☐	Other: *(please describe)*	1	3	5

Comments/additional information:

Revised 02Aug12

Figure B2. Probable Source Identification Sheet for the Public

28 Jun 2011
Ver. 5

Probable Source(s) & Site Condition Class Field Form

Station ID:	Station Name/Description:
AU ID:	AU Description:
Field Crew:	Comments:
Date:	Watershed protection staff reviewer: Date of WPS review:

Score the proximity, intensity and/or certainty of occurrence of the following activities in the AU upstream of the site. Consult with the appropriate staff at NMED and other agencies to score "*" cells if needed.

Activity Checklist

Hydromodifications					Silviculture				
Channelization	0	1	3	5	* Logging Ops – Active Harvesting	0	1	3	5
Dams/Diversions	0	1	3	5	* Logging Ops – Legacy	0	1	3	5
Draining/Filling Wetlands	0	1	3	5	* Fire Suppression (Thinning/Chemicals)	0	1	3	5
Dredging	0	1	3	5	Other:	0	1	3	5
Irrigation Return Drains	0	1	3	5	**Rangeland**				
Riprap/Wall/Dike/Jetty Jack -- circle	0	1	3	5	Livestock Grazing or Feeding Operation	0	1	3	5
Flow Alteration (from Water Diversions/Dam Ops – circle)	0	1	3	5	Rangeland Grazing (dispersed)	0	1	3	5
Highway/Road/Bridge Runoff	0	1	3	5	Other:	0	1	3	5
Other:	0	1	3	5	**Roads**				
Habitat Modification					Bridges/Culverts/RR Crossings	0	1	3	5
Active Exotics Removal	0	1	3	5	Low Water Crossing	0	1	3	5
Stream Channel Incision	0	1	3	5	Paved Roads	0	1	3	5
Mass Wasting	0	1	3	5	Gravel or Dirt Roads	0	1	3	5
Active Restoration	0	1	3	5	**Agriculture**				
Other:	0	1	3	5	Crop Production (Cropland or Dry Land)	0	1	3	5
Industrial/ Municipal					Irrigated Crop Production (Irrigation Equip)	0	1	3	5
Storm Water Runoff due to Construction	0	1	3	5	* Permitted CAFOs	0	1	3	5
Landfill	0	1	3	5	* Permitted Aquaculture	0	1	3	5
On-Site Treatment Systems (Septic, etc.)	0	1	3	5	Other:	0	1	3	5
Pavement/Impervious Surfaces	0	1	3	5	**Miscellaneous**				
Inappropriate Waste Disposal	0	1	3	5	Angling Pressure	0	1	3	5
Residences/Buildings	0	1	3	5	Dumping/Garbage/Trash/Litter	0	1	3	5
Site Clearance (Land Development)	0	1	3	5	Exotic Species (describe in comments)	0	1	3	5
Urban Runoff/Storm Sewers	0	1	3	5	Hiking Trails	0	1	3	5
Power Plants	0	1	3	5	Campgrounds (Dispersed/Defined – circle)	0	1	3	5
* Industrial Storm Water Discharge (permitted)	0	1	3	5	Surface Films/Odors	0	1	3	5
* Industrial Point Source Discharge	0	1	3	5	Pesticide Application (Algaecide/Insecticide)	0	1	3	5
* Municipal Point Source Discharge	0	1	3	5	Waste From Pets (high concentration)	0	1	3	5
* RCRA/Superfund Site	0	1	3	5	* Fish Stocking	0	1	3	5
Other:	0	1	3	5	Other:	0	1	3	5
Resource Extraction					**Natural Disturbance or Occurrence**				
* Abandoned Mines (Inactive)/Tailings	0	1	3	5	Waterfowl	0	1	3	5
* Acid Mine Drainage	0	1	3	5	Drought-related Impacts	0	1	3	5
* Active Mines (Placer/Potash/Other – circle)	0	1	3	5	Watershed Runoff Following Forest Fire	0	1	3	5
* Oil/Gas Activities (Permitted/Legacy – circle)	0	1	3	5	Recent Bankfull or Overbank Flows	0	1	3	5
* Active Mine Reclamation	0	1	3	5	Wildlife other than Waterfowl	0	1	3	5
Other:	0	1	3	5	Other Natural Sources (describe in	0	1	3	5

Figure B2. Probable Source Identification Sheet for Internal Use

APPENDIX C

CHEMICAL DATA – 2013, 2014

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E. coli – Clear Creek (Rio de las Vacas to San Gregorio Lake		
Date	**Concentration (cfu/100 mL)**	**Sampling Station**
4/15/13	1	31ClearC002.3
5/23/13	9.8	31ClearC002.3
6/19/13	1299.7	31ClearC002.3
7/17/13	19.9	31ClearC002.3
8/21/13	410.6	31ClearC002.3
8/28/13	44.1	31ClearC002.3
***E. coli* – Jemez River (Jemez Pueblo bnd to Rio Guadalupe)**		
Date	**Concentration (cfu/100 mL)**	**Sampling Station**
3/25/13	3	31JemezR046.6
4/23/13	19.3	31JemezR046.6
5/14/13	48.7	31JemezR046.6
6/18/13	7.3	31JemezR046.6
7/18/13	517.2	31JemezR046.6
9/12/13	866.4	31JemezR046.6
9/18/13	214.3	31JemezR046.6
11/20/13	4.1	31JemezR046.6

E. coli – Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)		
Date	**Concentration (cfu/100 mL)**	**Sampling Station**
3/25/13	1	31JemezR049.2
3/25/13	1	31JemezR064.2
4/23/13	19.9	31JemezR049.2
4/23/13	3.1	31JemezR064.2
5/14/13	4.1	31JemezR049.2
5/14/13	6.3	31JemezR064.2
6/18/13	1	31JemezR049.2
6/18/13	61.3	31JemezR064.2
7/18/13	410.6	31JemezR049.2
7/18/13	238.2	31JemezR064.2
9/5/13	110.4	31JemezR049.2
9/12/13	2419.6	31JemezR064.2
9/18/13	613.1	31JemezR049.2
11/20/13	3.1	31JemezR049.2
E. coli – Jemez River (Soda Dam nr Jemez Springs to East Fork)		
Date	**Concentration (cfu/100 mL)**	**Sampling Station**
3/25/13	1	31JemezR064.9
3/25/13	1	31JemezR070.3
4/23/13	1	31JemezR064.9
4/23/13	2	31JemezR070.3
5/14/13	5.2	31JemezR064.9
5/14/13	7.4	31JemezR070.3
6/18/13	33.6	31JemezR064.9
6/18/13	135.4	31JemezR070.3
7/18/13	290.9	31JemezR064.9
7/18/13	224.7	31JemezR070.3
7/18/13	166.4	31JemezR066.4
9/12/13	2419.6	31JemezR064.9
9/12/13	2419.6	31JemezR070.3
11/20/13	209.8	31JemezR064.9
11/20/13	86.2	31JemezR070.3
11/20/13	152.9	31JemezR066.4
E. coli – Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)		

Date	Concentration (cfu/100 mL)	Sampling Station
3/25/13	4.1	31JemezR037.0
4/23/13	9.9	31JemezR037.0
5/14/13	111.2	31JemezR037.0
6/18/13	1553.1	31JemezR037.0
7/18/13	270	31JemezR037.0
9/12/13	1732.9	31JemezR037.0
9/18/13	224.7	31JemezR037.0
Total Phosphorus – Clear Creek (Rio de las Vacas to San Gregorio Lake		
Date	**Concentration (mg/L)**	**Sampling Station**
4/15/2013	0.039	31ClearC002.3
5/23/13	0.014	31ClearC002.3
5/23/13	0.018	31ClearC008.1
6/19/13	0.027	31ClearC002.3
7/17/13	0.01 (bdl)	31ClearC002.3
8/21/13	362	31ClearC002.3
8/28/13	0.033	31ClearC002.3
Total Phosphorus – Clear Creek (San Gregorio Lake to headwaters)		
Date	**Concentration (mg/L)**	**Sampling Station**
5/23/13	0.01 (bdl)	31ClearC009.2
6/19/13	0.036	31ClearC009.2
7/31/13	0.01 (bdl)	31ClearC009.2
8/21/13	0.01	31ClearC009.2
8/27/13	0.059	31ClearC009.2
10/8/13	0.01 (bdl)	31ClearC009.2
8/8/14	0.034	31ClearC009.2
9/22/14	0.017	31ClearC009.2
Total Phosphorus - East Fork Jemez (VCNP to headwaters)		

Date	Concentration (mg/L)	Sampling Station
3/26/13	0.104	31EFkJem015.2
5/15/13	0.053	31EFkJem015.2
7/11/13	0.1 (bdl)	31EFkJem015.2
7/17/13	0.086	31EFkJem015.2
9/18/13	0.131	31EFkJem015.2
10/10/13	0.071	31EFkJem015.2
11/20/13	0.046	31EFkJem015.2
Total Phosphorus – Jaramillo Creek (East Fork Jemez to headwaters)		
Date	**Concentration (mg/L)**	**Sampling Station**
4/24/13	0.171	31Jarami008.0
5/21/13	0.119	31Jarami008.0
7/3/13	0.1 (bdl)	31Jarami008.0
10/10/13	0.085	31Jarami008.0
Total Phosphorus – Rio Guadalupe (Jemez River to confl with Rio Cebolla)		
Date	**Concentration (mg/L)**	**Sampling Station**
3/25/13	0.021	31RGuada000.1
4/15/13	0.044	31RGuada010.0
4/23/13	0.067	31RGuada000.1
5/14/13	0.021	31RGuada000.1
5/15/13	0.02	31RGuada010.0
6/18/13	0.01 (bdl)	31RGuada000.1
6/19/13	0.026	31RGuada010.0
7/17/13	0.034	31RGuada010.0
7/18/13	0.044	31RGuada000.1
8/29/13	0.04	31RGuada000.1
8/29/13	0.045	31RGuada010.0
9/4/13	0.076	31RGuada000.1
9/5/13	0.065	31RGuada010.0
Total Nitrogen – Clear Creek (San Gregorio Lake to headwaters)		
Date	**Concentration (mg/L)**	**Sampling Station**
8/8/14	0.41	31ClearC009.2
Total Nitrogen – East Fork Jemez (VCNP to headwaters)		

Date	Concentration (mg/L)	Sampling Station
3/26/13	0.95	31EFkJem015.2
9/18/13	1.28	31EFkJem015.2
10/10/13	0.9	31EFkJem015.2
Total Nitrogen – Jaramillo Creek (East Fork Jemez to headwaters)		
Date	**Concentration (mg/L)**	**Sampling Station**
4/24/13	0.75	31Jarami008.0
10/10/13	0.87	31Jarami008.0
Total Nitrogen – Rio Guadalupe (Jemez River to confl with Rio Cebolla)		
Date	**Concentration (mg/L)**	**Sampling Station**
3/25/13	0.56	31RGuada000.1
4/23/13	1.93	31RGuada000.1
6/18/13	1.25	31RGuada000.1

Bdl – Indicates that datum is below detection limit

***E. coli* – Jemez Valley Public Schools outfall**		
Date	**Concentration (cfu/100mL)**	**Sampler**
1/13	9.7	JVPS
2/13	5.2	JVPS
3/13	98.7	JVPS
4/13	75.2	JVPS
5/13	35	JVPS
6/13	65.1	JVPS
6/10/13	15.3	SWQB
8/13	63.1	JVPS
10/4/13	1	SWQB
11/13	5.2	JVPS
12/13	84.2	JVPS
12/19/13	1553	SWQB

***E. coli* – Jemez Springs Wastewater Treatment Plant outfall**		
Date	**Concentration (cfu/100mL)**	**Sampler**
1/13	1	JSWWTP
2/13	1	JSWWTP
3/13	2	JSWWTP
4/13	2	JSWWTP
5/13	4.1	JSWWTP
5/14/13	2419	SWQB
6/13	4.1	JSWWTP
7/13	2	JSWWTP
7/18/13	26.9	SWQB
8/13	1	JSWWTP
10/13	1	JSWWTP
10/4/13	307.6	SWQB
11/13	1	JSWTTP
12/13	2	JSWTTP
12/19/13	755.6	SWQB

APPENDIX D

WILDFIRE INFORMATION

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Thompson Ridge Post-Fire Response

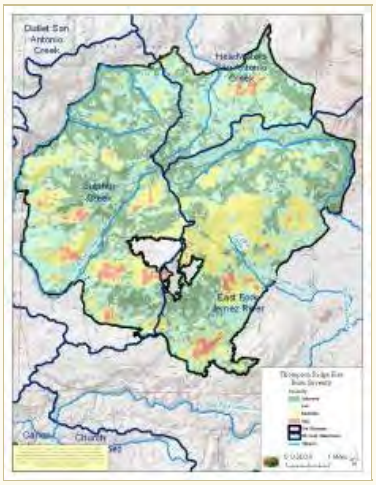
This incident is no longer being updated.

INCIDENT UPDATED 7/31/2013

Incident Overview

THOMPSON RIDGE BAER UPDATE
Wednesday July 31, 2013

Jemez Springs, NM -The Thompson Ridge Fire burned 23,965 acres near and within the Valles Caldera National Preserve recreation and resource areas. The fire was human-caused on May 31 when a downed electrical line, ignited ground cover and spread into the adjacent forest of mixed conifer and ponderosa. To date, approximately $271,000 has been allocated to reduce the threat and severity of post-fire floods that are projected to occur for several years, especially during monsoon seasons.



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BAER Treatments Completed

Cutting and removing burned trees near roads and buildings was a priority as they present an immediate threat to human life and structures. A sawyer crew from Bandelier National Monument felled six trees along Forest Road 105, which accesses a residential area. The crew also downed ten trees which threatened historic cabins in the Valles Caldera. These trees were then anchored into place to serve as barriers to help redirect flood waters and debris away from the cabins. Branches and logs not used as barriers were removed from the site since loose debris, carried by flood waters could cause significant damage.

Sand bag deployment by the Santa Fe County Black Canyon hand crew and a Las Vegas Type II hand crew adds another level of protection to the historic structures. Crews stacked a 6 foot wide by 3 foot high wall behind the Bond Cabin. The sand bag wall slows the residual flow that leaks through the trees, log barriers and organic top layer and redirects it away from the cabin. While some water will reach the building it is not expected to be a significant enough quantity to cause irreparable damage. Crews are deploying sand bags around the remaining historic structures this week.

Debris removal from creeks, streams, roads and arroyos is ongoing. The waterways will be monitored to ensure free flow of water during the monsoons which will likely deposit more debris into the channels. Debris trapped in channels eventually breaks loose, resulting in even greater damage from flooding.

Future On-the-Ground Action

Salmon River Helicopters of Riggins, Idaho is tentatively scheduled to begin aerial rehabilitation operations. The helicopters will load from a yet to be determined site (weather permitting) and drop seed over specified areas above homes in the Sulphur Creek area. The seed is an annual barley plant that will germinate quickly in the warm, wet conditions. It establishes and grows rapidly, but does not germinate or resprout. Native vegetation with eventually take over.

Construction and improvement of water control features on roads and trails will supplement sand bagging and barriers already in place. Installation of drainage dips, low water crossings and deployment of Jersey barriers are part of the BAER operations. Identification and protection of cultural resource sites will continue.

The Forest Service has responsibility for wildland fire suppression and rehabilitation on the Valles Caldera National Preserve; all contract solicitation and award is being managed by the Forest Service. BAER interagency cooperators, stakeholders, and tribal government representatives are coordinating their post-fire response efforts.

Basic Information

Current as of	8/22/2013 9:56:00 AM
Incident Type	Burned Area Emergency Response

UNIT INFORMATION

Santa Fe National Forest
U.S. Forest Service
11 Forest Lane
Santa Fe, NM 87508

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Thompson Ridge BAER Assessment Update - 7/9/2013
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- BAER Emergency Response Treatments Catalog
- New Mexico Family Preparedness Guide
- USDA Nrcs Emergency Watershed Protection Program
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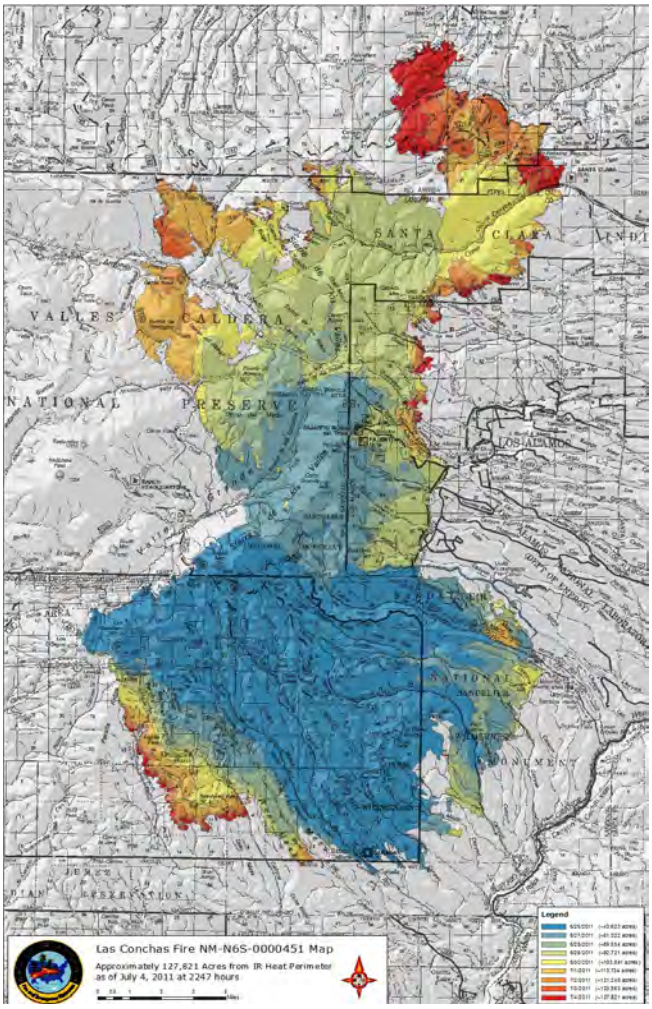
- National Weather Service - Albuquerque Area Alerts
- Thompson Ridge Fire Information
- USFS Burned Area Emergency Response (BAER) Program
- New Mexico Road Conditions & Closures
- New Mexico: After a Wildfire - Post-Fire Resources
- BAER Team: Responding to Post-Fire Threats
- FEMA Fact Sheet: Flood After Fire
- Flooding Safety Tips
- Tres Lagunas Post-Fire Response Inciweb Site

INCIDENT COOPERATORS

- FEMA
- Fish and Wildlife Service
- National Oceanic and Atmospheric Administration
- USDA Forest Service
- Los Alamos County
- National Weather Service
- New Mexico Department of

Las Conchas Fire
Jemez Mountains, NM

The Las Conchas (LC) Fire began around 1pm on June 26, 2011 when a gust of wind blew a 75 foot tall aspen into a power line. From that ridgetop began the largest wildfire in New Mexico history. During the first 14 hours, the fire raced eastward, consuming more than 43,000 acres of forest and destroying dozens of homes. The speed of the fire's spread was astonishing—averaging an acre of forest burned every 1.17 seconds for 14 straight hours. The fire continued to grow over the next five weeks, and was eventually contained by USFS firefighters on August 1st at 156,593 acres (245 square miles).



Las Conchas Fire ignition point. Photo by Bob Parmenter.

Weather and Fuel Conditions

At the time the LC Fire started, the atmosphere was unstable and dry through 22,000 feet above ground level. This also allowed strong winds to mix to the surface from aloft. The temperature was 90°F, relative humidity was 6% and 20-foot winds were gusting to 40 mph from the west. Fuels across the fire area were very dry, with live fuel moistures ranging from 110 in the ponderosa pine to 145 in the oak brush. Dead fuel moistures ranged from 2 to 3 percent in fine fuels and 7 to 10 percent in heavy fuels.

Fire Behavior

The fire demonstrated extreme fire behavior and long range spotting where winds and terrain aligned to funnel winds and cause the fire to become plume dominated. Extremely dry fuel moistures led to nearly complete consumption and very little smoldering fire. Active crown fire occurred mainly in mixed conifer fuel types with passive crown fire occurring in ponderosa pine and pinyon-juniper fuel types.

Stage III fire restrictions had been put in place prior to the fire start, closing forest roads and backcountry use in the area. This action most likely saved lives. With as quickly as the fire moved, evacuation of the area would have been impossible if there had been disbursed recreation going on in the Forest and Park.

Previous Fires

Several large wildfires have occurred across the landscape where the LC Fire burned. Reduced fire behavior occurred in the most recent fire

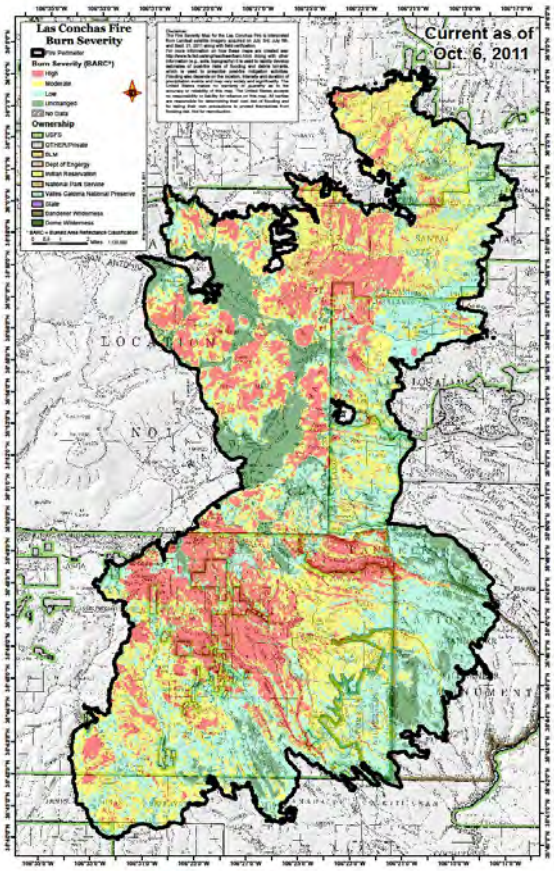
For more information on the Las Conchas Fire, visit Inciweb at www.inciweb.org/incident/2385/ or the Santa Fe National Forest homepage at www.fs.fed.us/r3/sfe/index.html

Las Conchas Fire ignition as seen from space.

perimeters, whereas areas with older fires resulted in little to no reduction in fire behavior. On the northeastern edge of the fire perimeter the fire burned into both the Cerro Grande (2000) and Oso (1998) fire areas which was useful in slowing the LC Fire spread. The northern edge of the fire burned into the South Fork Fire (2010) which served as a barrier to firespread.

Fuel Treatment Effectiveness

The LC Fire encountered two areas that had been treated for hazardous fuel reduction within the last 10 years on USFS lands and another area that had been treated 16 to 21 years ago but was still effective. First, thinning and fuelbreak projects were conducted in the Cochiti Mesa WUI area (2004 - 2008). These treated areas caused the fire to drop to the ground briefly. Second, thinning and fire treatments done in the Valle II Hazardous Fuels Reduction Project (2003 – 2009) created conditions in which firefighters were able to safely conduct burnout and holding operations to keep fire from spreading onto Los Alamos National Laboratory (LANL) property and into the community of Los Alamos. Third, thinning and prescribed fire treatments during the Blanco and Gallina projects (early to mid 1990s) along Forest Road 144 helped firefighters conduct successful burnout operations to keep fire from spreading further north.



Treatments had also been done around the LANL and the town of Los Alamos. The Valles Caldera National Preserve had no fuels treatments in the area except for a previous prescribed burn in the Valle Toledo grassland.

BAER Implementation

BAER treatments began around July 20, 2011 within the Santa Fe National Forest. Aerial seeding occurred on 5,200 acres and aerial mulching is underway on 1,100 acres. Road improvements and work in drainages is completed. Approximately 117 cultural sites were identified and treated by hand. The Valles Caldera has done some rehabilitation and hazard reduction, but no large scale projects. Santa Clara Pueblo is also conducting active restoration projects.

Las Conchas At-A-Glance

Date of Origin: Sunday June 26th, 2011

Size: 156,593 acres

Location (% of total acres burned): On Santa Fe National Forest (50%) in Sandoval, Los Alamos, and Rio Arriba Counties; Santa Clara Pueblo (11%); Jemez Pueblo (2%); Cochiti Pueblo; Santo Domingo Pueblo (<1%); Bandelier National Monument (14%); Valles Caldera National Preserve (19%); and state and private in-holdings (3%).

Cause: Human

Total Personnel: up to 2,196 (varied over time)

Resources: 9 Helicopters; 26 Engines; 28 Water Tenders; 6 Dozers

Structures Destroyed: 63 homes, 49 outbuildings

Suppression Cost: $40.9M (as of September 2011)