
US EPA ~ APPROVED
TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR THE
ANIMAS RIVER WATERSHED
[SAN JUAN RIVER TO SOUTHERN UTE INDIAN TRIBE BND]



SEPTEMBER 30, 2013

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LIST OF ABBREVIATIONS

4Q3	4-Day, 3-year low-flow frequency
6T3	Temperature not to be exceeded for 6 or more consecutive hours on more than 3 consecutive days
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general storm water permit
CoolWAL	Cool Water Aquatic Life
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
°C	Degrees Celsius
°F	Degrees Fahrenheit
HUC	Hydrologic unit code
j/m ² /s	Joules per square meter per second
km ²	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi ²	Square miles
mL	Milliliters
MCWAL	Marginal Coldwater Aquatic Life
MOS	Margin of safety
MOU	Memorandum of Understanding
MS4	Municipal separate storm sewer system
MSGP	Multi-sector general storm water permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SEE	Standard Error of the Estimate
SSTEMP	Stream Segment Temperature Model
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through April 30, 2012)
WBP	Watershed-based plan
WWTP	Wastewater treatment plant

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop Total Maximum Daily Load management plans for water bodies determined to be water quality limited. A Total Maximum Daily Load documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. Total Maximum Daily Loads are defined in 40 Code of Federal Regulations Part 130 as the sum of the individual Waste Load Allocations for point sources and Load Allocations for nonpoint source and background conditions. Total Maximum Daily Loads also include a Margin of Safety.

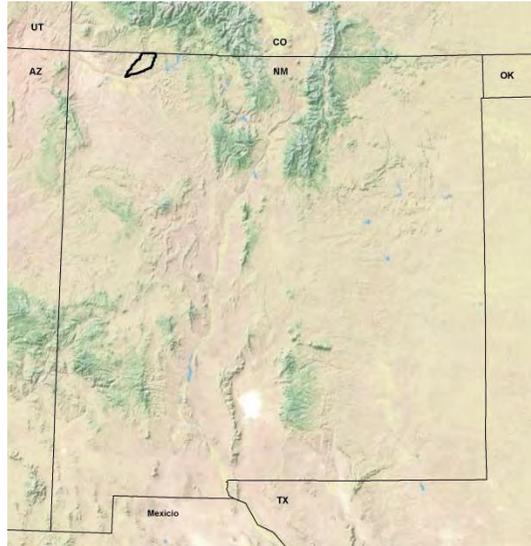
The Surface Water Quality Bureau conducted a water quality survey of the San Juan River basin of northwestern New Mexico in 2010. Water quality monitoring stations were located within the Animas watershed to evaluate the impact of tributary streams and ambient water quality conditions. As a result of assessing data generated during this monitoring effort, impairment determinations of New Mexico water quality standards included *E.coli* and temperature in the downstream stream segment and *E. coli* and total phosphorus in the upstream stream segment.

This Total Maximum Daily Load document addresses the above noted impairments as summarized in the tables below. The Surface Water Quality Bureau has prepared two other Total Maximum Daily Load documents for portions of the Animas River discussed in this document – the 2005 San Juan River Watershed (Part One, 2005) and the San Juan River Watershed (Part Two, 2006). The 2010 study identified other potential water quality impairments which are not addressed in this document due to additional data needs, assessment protocol revisions or re-application, or impending use attainability analyses. If the impairments are verified, subsequent Total Maximum Daily Loads will be prepared in a separate TMDL document.

The Surface Water Quality Bureau's Monitoring and Assessment Section will collect water quality data during the next rotational cycle. The next scheduled monitoring date for the San Juan Watershed is 2018, at which time Total Maximum Daily Load targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate category in the Integrated Report.

The Surface Water Quality Bureau's Watershed Protection Section will continue to work with watershed groups to develop Watershed-Based Plans to implement strategies that attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the Watershed-Based Plans will be done with participation of all interested and affected parties.

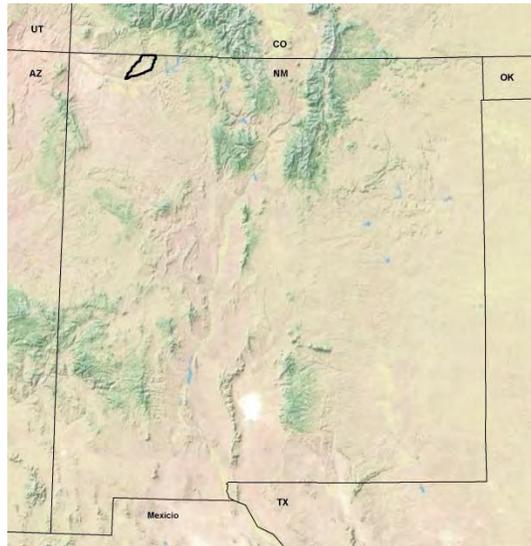
**TOTAL MAXIMUM DAILY LOAD FOR
ANIMAS RIVER (SAN JUAN RIVER TO ESTES ARROYO)**



New Mexico Standards Segment	20.6.4.403
Waterbody Identifier	NM-2403.A_00
Segment Length	16.8 miles
Parameters of Concern	<i>E. coli</i> , temperature
Uses Affected	Marginal Coldwater Aquatic Life, Primary Contact
Geographic Location	San Juan River Basin USGS Hydrologic Unit Code 14080104
Scope/size of Watershed	1356.6 mi ²
Land Type	Arizona/New Mexico Plateau (Ecoregion 22i)
Land Use/Cover	56% forest, 8% agriculture, 29% rangeland, 5% developed land, 1% water, and <1% each of wetlands and/or barren lands
Probable Sources*	Drought-related impacts, flow alterations from water diversions, municipal (urbanized high density area), municipal point source discharges, streambank modifications/destabilization*
Land Management	34% private, 60% BLM, and 6% State
IR Category	5/5A
Priority Ranking	High
TMDL for:	WLA_{TOTAL} + LA + MOS = TMDL
<i>E. coli</i>	$2.1 \times 10^{10} + 1.8 \times 10^{11} + 2.3 \times 10^{10} = 2.3 \times 10^{11}$ cfu/100mL/day
Temperature	46.13 + 102.68 + 16.53 = 165.34 J/m ² /s/day

* Additional Probable Sources noted during the 2010 water quality survey are listed in Tables 4.7 and 5.6.

**TOTAL MAXIMUM DAILY LOAD FOR
ANIMAS RIVER (ESTES ARROYO TO SOUTHERN UTE INDIAN TRIBE BND)**



New Mexico Standards Segment	20.6.4.404
Waterbody Identifier	NM-2404_00
Segment Length	18.8 miles
Parameters of Concern	<i>E. coli</i> , total phosphorus
Uses Affected	Coldwater Aquatic Life, Primary Contact
Geographic Location	San Juan River Basin USGS Hydrologic Unit Code 14080104
Scope/size of Watershed	1267.8 mi ²
Land Type	Colorado Plateaus (Ecoregion 20c), Arizona/New Mexico Plateau (Ecoregion 22i)
Land Use/Cover	56% forest, 8% agriculture, 29% rangeland, 5% developed land, 1% water, and <1% each of wetlands and/or barren lands
Probable Sources*	Channelization, drought-related impacts, irrigated crop production, loss of riparian habitat, municipal (urbanized high density area), rangeland grazing, streambank modifications/destabilization*
Land Management	34% private, 60% BLM, and 6% State
IR Category	5/5B
Priority Ranking	High
TMDL for:	WLA_{TOTAL} + LA + MOS = TMDL
<i>E. coli</i>	$4.8 \times 10^9 + 2.4 \times 10^{11} + 2.7 \times 10^{10} = 2.7 \times 10^{11}$ cfu/100mL/day
Total Phosphorus	0.8 + 41.1 + 4.7 = 46.6 pounds/day

* Additional Probable Sources noted during the 2010 water quality survey are listed in Tables 4.7 and 6.6.

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INTRODUCTION

Under Section 303 of the 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 Section 303(d)(1) of the CWA, states are required to develop a list of waters within a state that are impaired and establish a total maximum daily load (TMDL) for each pollutant. A TMDL is defined as “*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality 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 standards. It also allocates that load capacity to known point sources and nonpoint sources (NPS) at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for NPS and natural background conditions, and includes a margin of safety (MOS). This document provides TMDLs for assessment units (AUs) within the San Juan River Basin 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 1.0 provides background information on the location and history of the San Juan River basin, provides applicable water quality standards for the assessment units addressed in this document. Section 2.0 provides information on the water quality survey performed in the watershed in 2010 and the additional confirmation sampling performed in 2012. Section 3.0 provides detailed information on the Animas watershed and its impairments. Section 4.0 presents the TMDLs developed for bacteria in the San Juan River basin. Section 5.0 presents the TMDLs developed for temperature in the Animas watershed. Section 6.0 presents a TMDL developed for Total Phosphorus in the Animas watershed. Pursuant to Section 106(e)(1) of the Federal CWA, Section 7.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 8.0 discusses implementation of TMDLs and the relationship between TMDLs and Watershed Restoration Action Strategies (WRAS). Section 9.0 discusses assurance; Section 10.0 public participation in the TMDL process; and Section 11.0 provides references for this document. Appendices are referenced throughout and are found at the end of the document.

1.0 SAN JUAN RIVER BASIN BACKGROUND

1.1 Description and Land Ownership

The San Juan River basin encompasses portions of New Mexico, Colorado, Utah, and Arizona. The New Mexico portion extends into McKinley, San Juan, and Rio Arriba counties in the northwestern portion of the state. The geographic area of the 2010 Surface Water Quality Bureau (SWQB) study was the San Juan River between the Navajo Nation boundary at the Hogback to Navajo Dam, as well as several tributaries that enter the San Juan River in this area and nearby reservoirs. Land ownership and management in the New Mexico portion of the San Juan River

basin upstream of the Hogback includes the US Forest Service (USFS), US Bureau of Land Management (BLM), Native American (Navajo Nation, Ute Mountain Ute, Southern Ute, and Jicarilla Apache), State, and Private (Figure 1.1).

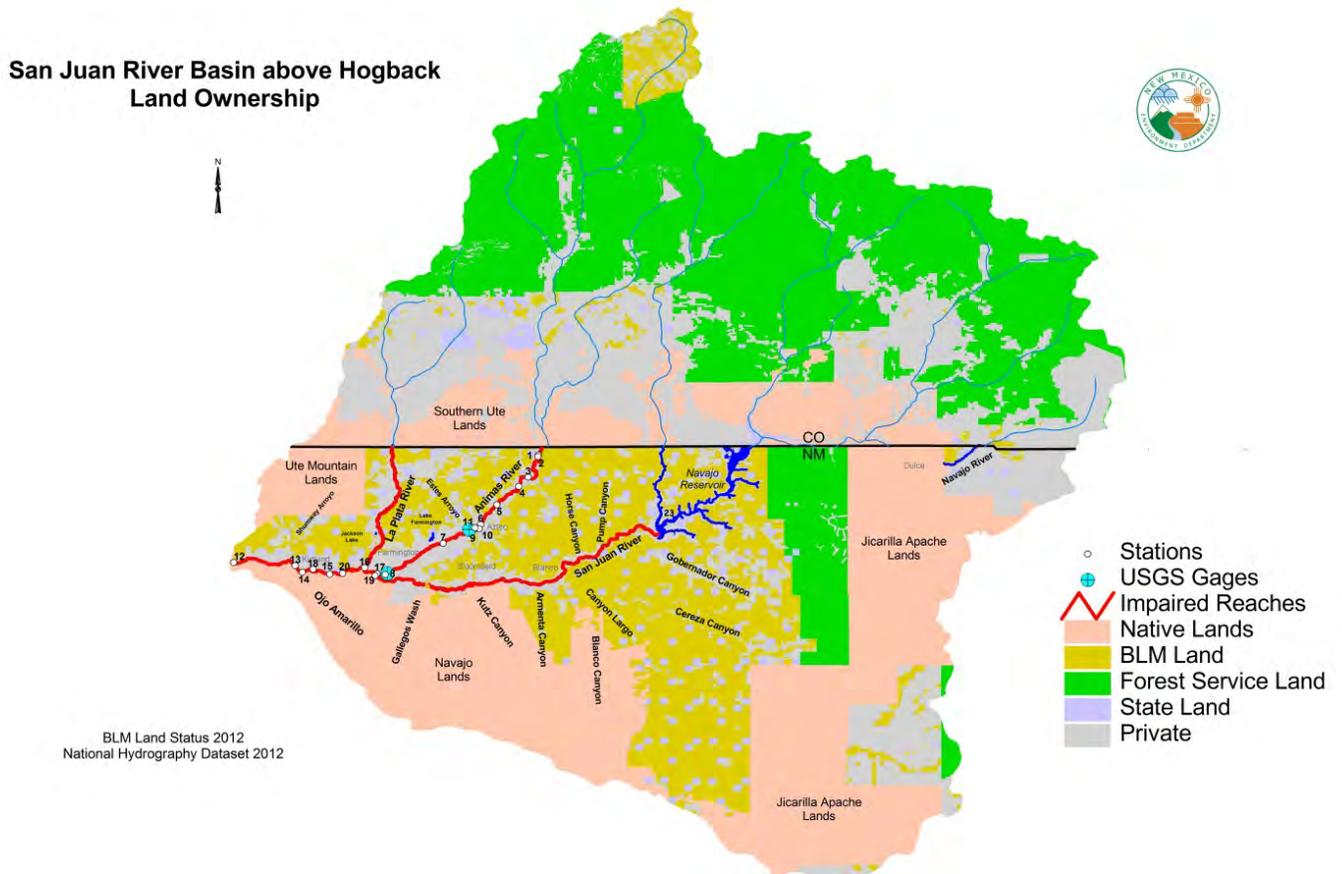


Figure 1.1 San Juan River Basin above Hogback

1.2 Geology

The San Juan Basin lies on the Colorado Plateau. The consolidated geology in the Animas watershed in the New Mexican portion of the San Juan River basin is composed of several formations of Tertiary and Cretaceous ages. The predominant geologic formation is the Nacimiento Formation of Tertiary age which underlies the area soils and crops out along most of the reach of the San Juan River valley east of Farmington (Blanchard et al. 1993). The Cretaceous Kirtland and Fruitland Formation and the Mancos Shale underlie the soils and are visible in outcrops west of the Hogback. These two formations underlie topsoil and compose the outcrop in most of the upland area south of the San Juan River. The Fruitland Formation is actively mined for sub-bituminous coal and alluvium. Near Farmington, Cretaceous rocks at the surface dip sharply in some areas, forming hogback ridges (Chronic 1987). The Animas River valley is in part composed of Quaternary unconsolidated sand, gravel, silt, clay, and terrace gravel and boulder deposits (Figure 1.2).

**Animas Watershed
HUC - 14080104
Geology**

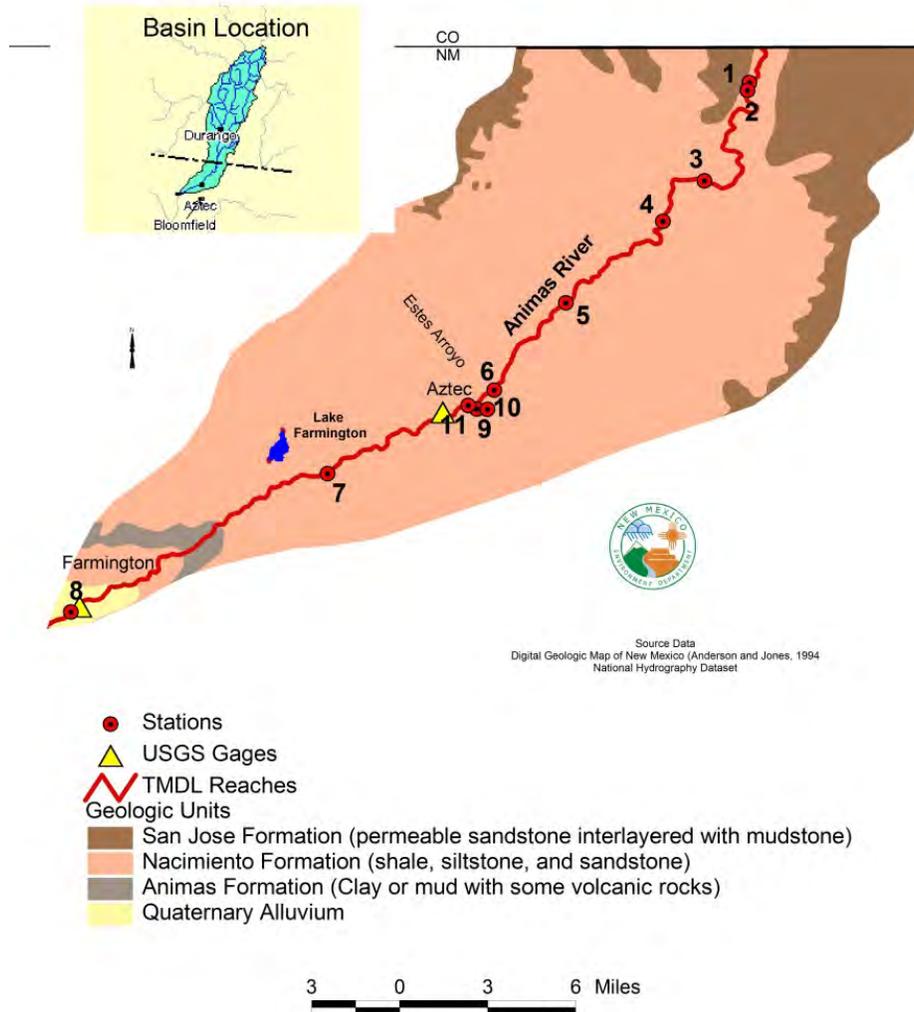


Figure 1.2 Geology of the Animas Watershed

Note: The gaging station located near Cedar Hill, NM is located outside of the figure's boundary; it lies approximately 2.5 miles north of the New Mexico stateline.

Soils in the San Juan River watershed are highly complex and variable. Valley soils are typically derived from sandstone, shale, siltstone, and mudstone and range from low to very high permeability and are generally well-drained (Soil Survey Staff 2013).

1.3 Water Quality Standards

Water quality standards (WQS) for all assessment units in this document are set forth in the following sections of *New Mexico Standards for Interstate and Intrastate Surface Waters* (NM Administrative Code [NMAC] 20.6.4) (NMAC 2013):

20.6.4.403 San Juan River Basin – The Animas River from its confluence with the San Juan upstream to Estes Arroyo.

- A. **Designated Uses:** public water supply, industrial water supply, irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, primary contact and warmwater aquatic life
- B. **Criteria:** the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses

20.6.4.404 San Juan River Basin – The Animas River from Estes Arroyo upstream to the New Mexico-Colorado line.

- A. **Designated Uses:** coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public water supply, industrial water supply 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 criterion applies: phosphorus (unfiltered sample) 0.1 mg/L or less.

NMAC 20.6.4.900 provides standards applicable to attainable to designated uses unless otherwise specified in an AU's specific section. NMAC 20.6.4.12 lists general standards that apply to all surface waters of the state at all times, unless a specified standard is provided elsewhere in NMAC.

Spatial and data analyses of the Animas River indicate that the designated aquatic life uses in water quality standards segments 20.6.4.403 NMAC and 20.6.4.404 NMAC may not be appropriate or attainable uses for this system because of naturally high temperatures and unfavorable river characteristics, including a wide, shallow morphology and location in semi-arid canyonlands and plateaus (Omernik 1987).

The Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AU currently has coldwater aquatic life (CWAL) assigned as a designated use. Analysis of sample results indicates that CWAL may not be an attainable use for the AU as a result of consistently high air temperatures and incompatible river characteristics, including a wide, shallow morphology and location in semi-arid canyonlands and plateaus (Omernik 1987). Therefore, a change in designated use is being considered in this AU from CWAL to Coolwater aquatic life (CoolWAL). This would increase the maximum temperature for the stream from 24°C to 29°C. After the appropriate aquatic life use designation is determined, this AU will be re-assessed for potential temperature impairment based on data to be collected in 2013. Therefore, a temperature TMDL for the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) will not be presented at this time.

NM's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC) 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. NM's antidegradation policy, which is based on the requirements of 40 CFR 131.12, describes how waters are to be protected from degradation (Subsection A of 20.6.4.8 NMAC) while the *Antidegradation Policy Implementation Procedures* establish the process for implementing the antidegradation policy (NMED/SWQB 2011b). 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, whether or not a segment is impaired, the State's antidegradation policy requirements, as detailed in the *Antidegradation Policy Implementation Procedure* (NMED/SWQB 2011b), must be met. TMDLs are consistent with this 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.

2.0 INTENSIVE WATER QUALITY SURVEY

The San Juan River basin was intensively sampled by the SWQB in 2010, with additional study during 2012. A brief summary of the survey and the hydrologic conditions during the intensive sample period is provided in the following subsections. The full 2010 Water Quality Survey Summary Animas Watersheds can be found online at <ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Surveys/SanJuanStudySummary-2010.pdf>.

2.1 Survey Design

Surface water quality samples were collected monthly between March and November for the 2010 intensive SWQB study. Surface water quality monitoring stations were selected to characterize water quality of stream reaches throughout the basin. See Figure 1.2 and Table 2.1 for stations relevant to this TMDL document. Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. Surface water grab sample from these stations were analyzed for a variety of chemical and physical parameters. Data results from grab sampling are housed in the SWQB provisional water quality database and uploaded to USEPA's Water Quality Exchange (WQX) database.

Table 2.1 SWQB 2010-2012 Animas River Watershed Sampling Stations

Station Number	Station ID	Station Name
1	66Animas055.8	Animas River at Colorado State Line
2	66Animas057.0	Animas River downstream of CO state line
3	66Animas046.2	Animas R upstream of HWY 550 bridge near Cedar Hill
4	66Animas042.3	Animas R about 2 miles d/s of Cedar Hill Bridge
5	66Animas 034.4	Animas R about 3.6 miles u/s of Aztec
6	66Animas028.1	Animas River above Estes Arroyo
7	66Animas017.4	Animas at CR 350 Bridge
8	66Animas001.7	Animas R at Farmington
9	66DrnDch000.0	Drainage Ditch at mouth on Animas River
10	66DrnDch000.5	Drainage Ditch at storage facility
11	NM0020168	Aztec Wastewater Treatment Plant

In 2012, additional pebble count data were obtained on the Animas and San Juan Rivers as part of the sediment data collection efforts to augment data from the 2010 survey in order to have additional confidence in the use attainment determinations.

All sampling and assessment techniques used during the 2010 intensive and 2012 additional data SWQB surveys are detailed in the *Quality Assurance Project Plan (QAPP)* (NMED/SWQB 2012), assessment protocols (NMED/SWQB 2011), and U.S. Department of Agriculture (USDA) National Sedimentation Lab (NSL) study (Heins *et al.*, 2004). As a result of the 2010 monitoring efforts, several surface water impairments were determined or confirmed. Accordingly these impairments were either added to or remained on the New Mexico's 2012-2014 CWA Integrated §303 (d)/305(b) list (NMED/SWQB 2012).

2.2 Hydrologic Conditions

There are several active, real-time U.S. Geological Survey (USGS) gaging stations in the San Juan River basin associated with the reaches presented in this document. The gages on the Animas River include USGS 09363500 (Animas River near Cedar Hill, NM), USGS 09364010 (Animas River below Aztec, NM), and USGS 09364500 (Animas River at Farmington, NM). Gage locations are presented in Figure 1.2. Daily stream flow for these USGS gages are presented graphically in Figures 2.1 through 2.3 for the 2010 calendar year. Flows during the 2010 survey year were below the average annual discharge since the beginning of gage operation, as recorded at relevant USGS gage stations. As stated in the SWQB Assessment Protocol (NMED/SWQB 2011), data collected during all flow conditions, including low flow conditions (i.e., flows below the 4Q3), were used to determine designated use attainment status during the assessment process. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

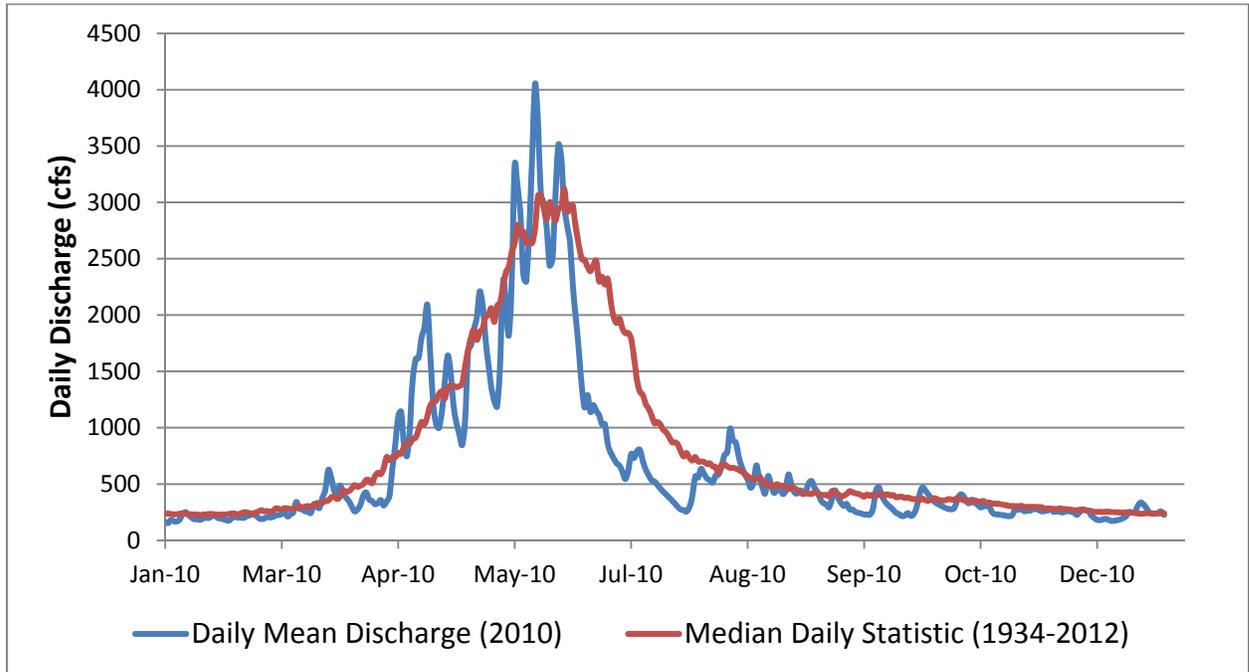


Figure 2.1 USGS 09363500 Animas River near Cedar Hill, NM

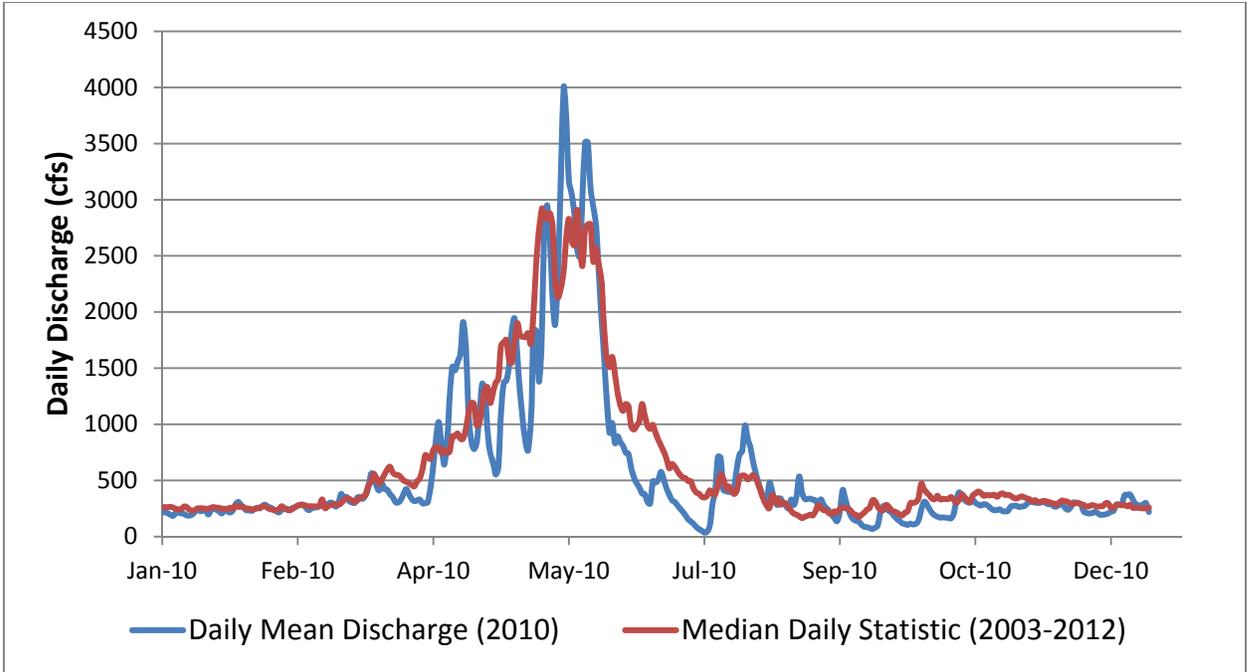


Figure 2.2 USGS 09364010 Animas River below Aztec, NM

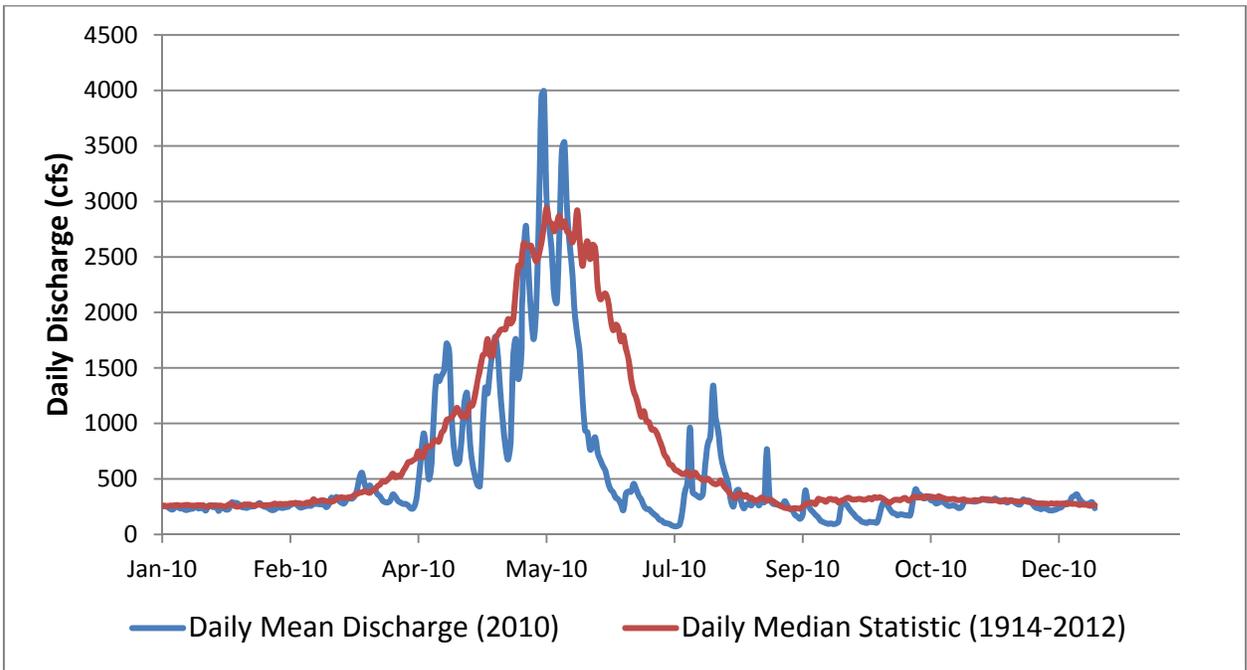


Figure 2.3 USGS 09364500 Animas River at Farmington, NM

3.0 INDIVIDUAL WATERSHED DESCRIPTIONS & IMPAIRMENTS

TMDLs have been developed for assessment units for which constituent or pollutant concentrations measured during the 2010 water quality survey, as combined with data from outside sources that meet quality standards, indicate impairment. Because characteristics of each watershed, such as geology, land use, and land ownership provide insight into probable sources of impairment, they are presented in this section for the individual 8-digit hydrologic unit code (HUC) watersheds within the San Juan River basin that are discussed in this document. In addition, the 2012-2014 Integrated §303(d)/§305(b) listings within the San Juan River basin are discussed (NMED/SWQB 2012).

3.1 Animas River Watershed (HUC 14080104)

The headwaters of the 1,357 square mile (mi²) Animas River watershed originate in Colorado. Available Geographic Information System (GIS) coverage indicates that the New Mexico portion of the watershed is approximately 227 mi² (17% of total watershed) and includes several ephemeral tributaries. As presented in Figure 1.1, land ownership is 34% private, 60% BLM, and 6% State. Land use includes 56% forest, 8% agriculture, 29% rangeland, 5% developed land, 1% water, and less than 1% wetlands and/or barren land (Figure 3.1). The geology of the Animas watershed is primarily comprised of the Tertiary Nacimiento Formation, with limited areas of the San Jose Formation outcropping near the northeast section of the of the watershed in New Mexico (Figure 1.2).

As discussed in the previous paragraph, the headwaters of the Animas River are located in the San Juan Mountains in Colorado. Prior to entering New Mexico, the Animas River travels through the State of Colorado and Southern Ute Indian Tribe land. The states of New Mexico and Colorado are authorized to maintain separate water quality standards and programs. According to the EPA, the Southern Ute Indian Tribe has not yet been granted authority by the EPA to conduct their own water quality program but is in the process of preparing their application. Table 3.1 lists the numeric criteria associated with each of the parameters discussed in this document for the entities in the Animas watershed.

Several Federal regulations have been promulgated to protect a downstream state's designated uses from less-stringent upstream water quality standards and criteria:

- 40 CFR 122.4 (d) provides that no National Pollutant Discharge Elimination System (NPDES) permit may be issued “[w]hen the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States”;
- 40 CFR 131.10 (b) provides that “In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters”; and
- CWA §303(d)(1)(c) and EPA's regulations at 130.7(c)(1) require the TMDL to be established at a level necessary to attain and maintain the applicable narrative and

numeric water quality standards. EPA interprets these provisions to include protection of downstream and adjacent water quality standards.

Table 3.1 Water Quality Standards in Upper Animas Watershed

Entity	<i>E. coli</i>	Temperature	Total Phosphorus
State of New Mexico	126/410 cfu/100mL	Maximum = 24°C 6T3^(a) = 20°C	0.1 mg/L (segment-specific numeric criterion)
State of Colorado	126 cfu/100mL	Daily Maximum (Apr-Oct) = 23.9°C (Nov-Mar) = 13°C MWAT^(b) (Apr-Oct) = 18.3°C (Nov-Mar) = 9°C	The State of Colorado has not promulgated final numeric total phosphorus criteria at this time; an interim standard of 110 ug/L has been approved by the Colorado Water Quality Commission with an allowable exceedence frequency of 1-in-5 years ^(c)
Southern Ute Indian Tribe	See previous paragraph		

- Notes: ^(a) 6T3 = temperature not to be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days.
- ^(b) MWAT = Maximum Weekly Average Temperature; an implementation statistic that is calculated from field monitoring data. The MWAT is calculated as the largest mathematical mean of multiple, equally-spaced temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day.
- ^(c) Interim standards as identified in the Colorado Department of Public Health and Environment Water Quality Control Commission Regulation #31.17, The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31); last amended September 11, 2012.

The TMDLs presented in the document were calculated based on the assumption that the upstream entities will address any water quality issues in order to conform to the above regulations. The State of New Mexico will continue to work with those entities. The following TMDLs include a discussion of the loading at the upstream station of the Animas River compared to the calculated loading capacity of the stream, where appropriate. The uppermost station of the Animas River in the State of New Mexico is located approximately 1.5 miles south of the stateline.

The New Mexico portion of the Animas River is divided into two AUs: Animas River (San Juan River to Estes Arroyo) and Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd). SWQB has established 2 primary stations in each AU; the process for selecting stations is detailed in the 2010 Field Sampling Plan, which was developed with opportunity for public input. Results of the survey are detailed in the Water Quality Survey Summary for the San Juan and Animas Watersheds (Navajo Nation at Hogback to the Colorado border) 2010, available online at <ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Surveys/SanJuanStudySummary-2010.pdf>. Data from these stations were combined with readily available data from other sources that met quality control objectives (NMED/SWQB 2012a) and assessed using established assessment protocols to determine whether or not designates uses were being met (NMED/SWQB 2011). As a result, the

Animas River (San Juan River to Estes Arroyo) was included in the Integrated 2012-2014 CWA §303(d)/§305(b) list for nutrients, *E. coli*, and temperature, and the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) was first included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for temperature, followed by *E. coli*, turbidity, and total phosphorus on the 2012-2014 list. Note that the downstream Animas reach was erroneously listed for turbidity in the 2012-2014 CWA §303(d)/§305(b) list as a result of changes to assessment protocol, but the listing has been corrected in the draft 2014-2016 CWA §303(d)/§305(b) list. The AUs have continued to be listed on the Integrated List in each listing cycle since 2004-2006 for varying parameters. A fecal coliform TMDL was developed in 2005 and total nitrogen and total phosphorus TMDLs were developed in 2006 for the AU Animas River (San Juan River to Estes Arroyo) (NMED/SWQB 2005).

The following TMDLs are presented in this document for the Animas River watershed:

- Animas River (San Juan River to Estes Arroyo): *E. coli*, temperature
- Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd): *E. coli*, total phosphorus

**Animas Watershed
HUC - 14080104
Land Use/Cover**

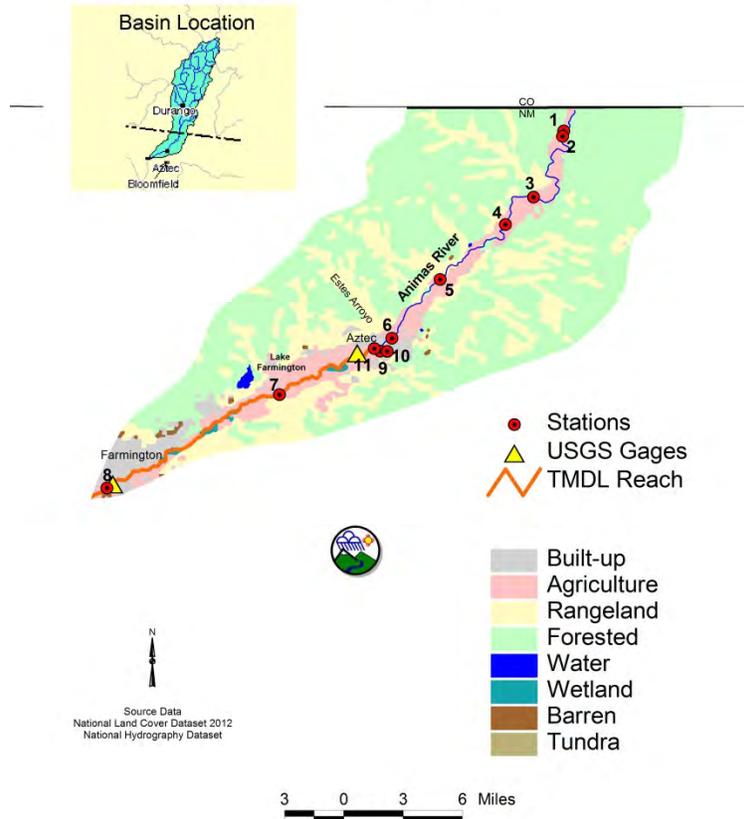


Figure 3.1 Animas Watershed Land Use

Note: The gaging station located near Cedar Hill, NM is located outside of the figure’s boundary; it lies approximately 2.5 miles north of the New Mexico stateline.

TOTAL MAXIMUM DAILY LOADS

4.0 BACTERIA

Assessment of the data from the 2010 SWQB water quality survey in the San Juan watershed identified exceedences of the New Mexico water quality standards for *E. coli* bacteria in the Animas River (San Juan River to Estes Arroyo) and Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AUs. Bacteria data collected for the above AUs, including data from external sources can be found in **Appendix C**.

As a result, these assessment units are listed on the 2012-2014 Integrated CWA §303(d)/ §305(b) List with *E. coli* as an impairment (NMED/SWQB 2012).

4.1 Target Loading Capacity

For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to achieve the numeric criterion associated with the primary contact designated use:

20.6.4.900 NMAC Subsection D – Primary Contact: The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.

The criterion for the primary contact designated use was used as it is the most stringent criteria of the designated uses identified for the affected 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 criteria of 410 cfu/100mL. Exceedences are presented in Table 4.1.

Table 4.1 Exceedences of *E. coli*

Assessment Unit	Criteria (single sample)	Number of Exceedences	Number of Samples
Animas River (San Juan to Estes Arroyo)	410 cfu/100mL	5	32
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	410 cfu/100mL	3	16

4.2 Flow

TMDLs are calculated at a specific flow, and bacteria concentrations vary as a function of flow. The critical flow condition for this TMDL was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. According the New Mexico Water Quality Standards, the low flow critical condition is defined as 4Q3 (NMAC 20.6.4.11.B.2).

SWQB determined streamflow and critical flows using available data from active USGS gages on the Animas River (Table 4.2) as input for DFLOW 3.1a software, developed by the USGS (USEPA 2006). The periods of record for the gages can be found in Table 4.2. There are three active USGS gages located on the Animas in the vicinity of the study area: the first is located approximately 2.5 miles above the top of the upstream AU; the second is sited below Aztec, New Mexico on the downstream AU; and the third is located just above the confluence of the San Juan and Animas Rivers in Farmington, New Mexico, also on the downstream AU. For the purpose of calculating the 4Q3 for *E. coli* loads, gages located near the bottom of the AUs were used. It has been SWQB's practice to use the 4Q3 at the bottom of AUs to calculate as it is thought that if the bottom of the AU is not impaired, the upper section of the AU is likely not impaired. The details about the gages and 4Q3 values are presented in Table 4.2

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. In the case of the downstream assessment unit, flows of zero were recorded for 13 days between 8 August and 23 August 1996 at the USGS gage near Farmington. Upon examination, it is likely that the portion of the AU located at the USGS gaging station was dry due to drought. Because drought is a natural occurrence and does not appear to have occurred regularly during the gaged period, each zero data point was changed to 0.01 cfs in order to retain the presence of those extreme low flows in the 4Q3 calculation.

Table 4.2 USGS Gages in Study Area

Gage	Name	Start Date	End Date	4Q3 (cfs ^(c))	4Q3 (MGD ^(b))
09364500	Animas River at Farmington, NM	Oct 1, 1913	Present	73.5	47.5
09364010	Animas River below Aztec, NM	Dec 17, 2002	Present	86.5	55.9
09363500	Animas River near Cedar Hill, NM ^(a)	Nov 1, 1933	Present	165	106.6

Notes: ^(a) Gage is located 2.5 miles north of the New Mexico stateline

^(b) MGD = Million Gallons per Day

^(c) cfs = cubic feet per second

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

- Animas River (San Juan River to Estes Arroyo) = 73.5 cfs (47.5 MGD); and
- Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) = 86.5 cfs (55.9 MGD).

It is important to remember that the TMDL itself is a value calculated at a defined critical condition as part of a planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the

changing flow. Management of the load to improve stream water quality should be a goal to be attained. Meeting the calculated TMDL at a given time may be a difficult objective.

4.3 Calculations

Bacteria standards are expressed as colony forming units (cfu) per unit volume, typically expressed as cfu per 100 mL (cfu/100mL). The *E. coli* geometric monthly mean criterion (126 cfu/100 mL) has been used to calculate the allowable stream loads for the impaired assessment units because it is the most conservative applicable criterion. Total maximum daily loads (TMDLs), or target loading capacities, for bacteria are calculated based on flow values, water quality standards, and a conversion factor with the following equation.

Equation 4.1

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

Where C = water quality criterion for bacteria

Q = the critical stream flow in million gallons per day (MGD)

The more conservative monthly geometric mean criterion is utilized in TMDL calculations to provide an implicit Margin of Safety (MOS). Furthermore, if the 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 4.3. The measured load was calculated using the arithmetic mean of the data. Because the arithmetic mean of a dataset is always greater than the geometric mean (Muirhead, 1903), the arithmetic mean acts as a component of the implicit MOS.

Table 4.3 TMDL/Target Loads – *E. coli*

Assessment Unit	4Q3 Flow (MGD)	<i>E. coli</i> geometric mean criteria (cfu/100mL)	Conversion Factor	TMDL ^(a) (cfu/day)
Animas River (San Juan River to Estes Arroyo)	47.5	126	3.79 x 10 ⁷	2.3 x 10 ¹¹
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	55.9	126	3.79 x 10 ⁷	2.7 x 10 ¹¹

Note: ^(a) TMDL = Target load capacity

The measured loads for *E. coli* were similarly calculated to the target loads. The arithmetic mean of the data used to determine the impairment was substituted for the criterion in Equation 4.1. The same conversion factor was used. Results are presented in Table 4.4.

Table 4.4 Measured Load – *E. coli*

Assessment Unit	4Q3 Flow (MGD)	<i>E. coli</i> Arithmetic Mean (cfu/100mL)	Conversion Factor	Measured Load (cfu/day)
Animas River (San Juan River to Estes Arroyo)	47.5	187.5	3.79×10^7	3.4×10^{11}
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	55.9	487.3	3.79×10^7	1.0×10^{12}

The samples collected and the 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 Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of percent reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the “percent reduction” value can be calculated in multiple ways and as a result can often be misinterpreted, therefore a percent reduction is not presented for *E. coli*.

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

There are three existing point sources with individual NPDES permits on the Animas River. The City of Aztec has outfalls to the downstream AU from its Water Treatment Plant and Waste Water Treatment Plant, permits NM0028762 and NM0020168, respectively. The City of Farmington’s Animas Steam Plant also has discharges to this reach of the Animas River (permit NM0000043). Neither the City of Aztec WTP nor the City of Farmington Animas Steam Plant has been allocated a portion of the *E. coli* TMDL. As indicated during the NPDES permitting process, *E. coli* is not believed to be present in the effluent. The identified point sources and relevant information are presented in Table 4.5.

There are four permittees identified by the US EPA as Phase II small Municipal Separate Storm Sewer Systems (sMS4) in the Animas watershed. This designation is typically applied to areas that have been identified by the Bureau of the Census as an “urbanized area” (UA) but with populations less than 100,000 (USEPA 2005). The four permittees have been identified as the City of Farmington, the City of Aztec, portions of San Juan County, and the New Mexico Department of Transportation (NMDOT). Stormwater from the sMS4s have the potential to impact both AUs discussed in this document. The *E. coli* contribution of the sMS4s to the AUs has been accounted for as a portion of the wasteload allocation of the TMDL. It has been calculated as a percentage of the TMDLs (Table 4.3) based on jurisdictional area within the greater watershed. The portion of the urbanized area contributing to the downstream AU has been assigned 8% of the TMDL, and the urbanized area that discharges to the upstream AU has

been assigned 2% of the TMDL to account for stormwater runoff. For more information regarding the allocation of SMS4 load, see **Appendix E**.

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 7.24 x 10⁸ cfu/sqmi/day in the Animas River (San Juan River to Estes Arroyo) AU and 1.29 x 10⁹ cfu/sqmi/day in the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AU. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be consistent with the overall goals of this TMDL it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

Additionally, excess bacteria concentrations may be a component of some storm water discharges covered under general NPDES permits, so the load for these dischargers will be addressed in this document as a component of the Load Allocation (LA).

Stormwater discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the National Pollutant Discharge Elimination System (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 possible to calculate individual WLAs for facilities covered by these 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 load allocation (LA). While these sources are not given individual allocations, they are addressed through other means, including BMPs, stormwater pollution prevention conditions, and other requirements.

Table 4.5 NPDES Permit Waste Load Allocations for *E. coli*

Assessment Unit	Facility	Design Capacity Flow (MGD)	Existing <i>E. coli</i> Effluent Limits (cfu/100mL)	Conversion Factor	Waste Load Allocations (cfu/day)
Animas River (San Juan River to Estes Arroyo)	NM0028762 City of Aztec WWTP Exp: 8/31/2014	1.0	126	3.79×10^7	4.8×10^9
	NM0020168 City of Aztec WTP Exp: 9/30/2014	Intermittent – no specific flow	None	3.79×10^7	0
	NM0000043 City of Farmington Animas Steam Plant Exp: 7/30/2016	Several outfalls – no provided design capacity flow ^(a)	None	3.79×10^7	0
	NMR04000 sMS4	None	None	NA	1.6×10^{10}
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	NMR04000 sMS4	None	None	NA	4.8×10^9

Note: ^(a) Design flow is not applicable to industrial discharges. The highest monthly average flow over 24 months is used in NPDES permitting.

4.4.2 Load Allocation

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

Equation 4.2

$$WLA + LA + MOS = TMDL$$

The MOS is estimated to be 10% of the target load calculated in Table 4.3. Results of the TMDL calculations are presented in Table 4.6. Additional details on the MOS chosen are presented in Section 4.7.

The extensive data collection and analyses necessary to determine background *E. coli* loads for the Animas and San Juan Rivers 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. The San Juan Watershed Group is currently conducting a microbial source tracking study in the watershed which may provide insight into potential contamination sources.

Table 4.6 TMDL for *E. coli*

Assessment Unit	NPDES WLA (cfu/day)	sMS4 WLA (cfu/day)	LA (cfu/day)	MOS (10%) (cfu/day)	TMDL ^(a) (cfu/day)
Animas River (San Juan River to Estes Arroyo)	4.8 x 10 ⁹	1.6 x 10 ¹⁰	1.8 x 10 ¹¹	2.3 x 10 ¹⁰	2.3 x 10 ¹¹
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	0	4.8 x 10 ⁹	2.4 x 10 ¹¹	2.7 x 10 ¹⁰	2.7 x 10 ¹¹

Note: ^(a) TMDL values are equivalent to the target load capacity; these values are displayed in Table 4.3.

It is important to note that WLAs and LAs are estimates based on a specific flow condition. Under differing hydrologic conditions, the loads will change. For this reason the load allocations given here are less meaningful than are the relative percent reductions. Although NMED believes that 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*. Furthermore, neither Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of percent reductions in TMDL documents. Successful implementation of this TMDL will be determined based on achievement of the *E. coli* standards as they are codified in the New Mexico Water Quality Standards.

4.5 Identification and Description of Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment (**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 groups, 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 will be reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period.

Although this procedure is subjective and qualitative, 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 4.7 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 Watershed-Based Plan (WBP).

Table 4.7 Probable Source Summary for *E. coli*

Pollutant Sources	Magnitude ^(a)	AU	Probable Sources ^(b)
<i>Point:</i>			
	4.8 x 10 ⁹ cfu/day	Animas River (San Juan River to Estes Arroyo)	NM0028762 City of Aztec WWTP
	1.6 x 10 ¹⁰ cfu/day	Animas River (San Juan River to Estes Arroyo)	sMS4
	4.8 x 10 ⁹ cfu/day	Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	sMS4
<i>Nonpoint:</i>			
	3.2x 10 ¹¹ cfu/day	Animas River (San Juan River to Estes Arroyo)	Drought-related impacts, urban runoff/storm sewers, flow alteration from diversions, streambank modifications and/or destabilization, <i>pavement/impervious surfaces, inappropriate waste disposal, site clearance (land development), channelization, dumping/garbage/trash/litter, hiking trails, waterfowl</i>
	1.0x 10 ¹² cfu/day	Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	Drought-related impacts, loss of riparian habitat, rangeland grazing, <i>pavement/impervious surfaces, site clearance (land development), fish stocking,</i>

Notes: ^(a) The magnitudes of point source probable sources are based on the NPDES permit and WLA assigned in the TMDL. The nonpoint source probable source magnitude is calculated by subtracting the point source load from the measured load.

^(b) Probable sources in italics have not been previously noted in the 303(b)/305(d) Integrated List; they were noted on Probable Source Sheets as identified in **Appendix B**.

Eight *E. coli* samples were collected at the northernmost New Mexico water quality station (66Animas057.1) during the 2010 field survey. Data can be found in **Appendix C**. There was one exceedence of the single sample criterion of 410 cfu/100 mL. The arithmetic mean concentration of these samples is 332.45 cfu/100mL, resulting in an estimated *E. coli* load of 1.34×10^{12} cfu/day entering New Mexico (Table 4.8). The target load for the AU has been calculated at 5.1×10^{11} cfu/day.

Table 4.8 Measured *E. coli* Load at 66Animas057.1 – Animas River downstream of stateline.

Station ID	4Q3 Flow (MGD)	<i>E. coli</i> Arithmetic Mean (cfu/100mL)	Conversion Factor	Measured Load (cfu/day)	Target Load at Stateline (cfu/day) ^(a)
66Animas057.1 Animas River downstream of stateline	106	332.45	3.79×10^7	1.34×10^{12}	5.1×10^{11}

Note: ^(a) Target load at the stateline was calculated by multiplying the 4Q3 at the top of the AU by the *E. coli* water quality criteria and a conversion factor.

4.6 Linkage of Water Quality and Pollutant Sources

Among the probable sources of bacteria in the upstream and downstream Animas watersheds are municipal point source discharges such as wastewater treatment facilities, poorly maintained, improperly installed, or missing septic tanks, livestock grazing of uplands and 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 storm water by the baseflows combined with the transitory nature of the events, the 4Q3 is considered a more conservative estimate of the long-term stream condition. Temperature can also play a role in bacteria concentrations. Howell et al. (1996) observed that bacteria growth increases as water temperature increases; this is of particular interest in these AUs as both have elevated temperatures.

The bacteria loading in the Animas River watershed probably originates from a combination of municipal point source discharges, including wastewater treatment plants located upstream in Colorado, and livestock, pet, and wildlife wastes. Habitat modifications including loss of riparian habitat, road maintenance and runoff, and land development or redevelopment, as well as other recreational pollution sources, may also be important contributors of bacteria.

In order to determine exact sources and relative contributions, further study is needed. One method of characterizing sources of bacteria is a Bacterial, or Microbial, Source Tracking (BST) study. The extensive data collection and analyses necessary to determine bacterial sources were

beyond the resources available for this study. However, the San Juan Watershed Group is currently performing sample collection and analysis to characterize bacteria sources in the San Juan Watershed, including sampling sites along the Animas River. While sufficient data currently exist to support development of *E. coli* TMDLs to address the stream standards exceedences, the BST dataset will likely prove useful in the future to better identify the sources of *E. coli* impacting the stream.

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and 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 do not readily degrade in the environment;
 - Basing the target load capacity on the geometric mean criterion rather than the higher-concentration single sample criterion; and
 - Calculating the measured load with the arithmetic mean rather than the geometric mean of the sample results produces a greater mean and therefore a more conservative load estimate.
- *Explicit recognition of potential errors*
 - There is inherent error in all flow measurements; a conservative MOS for this element is 10%.

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 of 2010 in order to ensure coverage of any potential seasonal variation in the system. Bacteria exceedences occurred during both higher and lower flows. Higher flows may flush 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. Additionally, the river is heavily diverted during the summer growing season, with approximately half of its flow diverted for an average of 22 days per year. In July 2003, a maximum diversion of 97% was observed between Cedar Hill, NM and Farmington, NM (BUGS 2007). A reduction in flows may result in an increased effective concentration of *E. coli*.

4.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2040. San Juan County population is projected to grow by an estimated 35% over the 2010-2040 period. As of 2011 however, San Juan County, had an estimated population of 128,200, which is down from the 2010 Census population of 130,044. The projected population of San Juan County in 2040 is 175,678 (NMBBER 2012).

According to data, bacterial loading is primarily due to diffuse nonpoint sources. Estimates of future growth in San Juan County, New Mexico are not anticipated to lead to a significant increase in bacteria in this watershed that cannot be controlled with best management practices (BMPs). However, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

It should also be noted that a large portion of the Animas watershed, including its headwaters, is located in Colorado. According to the Colorado Department of Local Affairs State Demography Office's Dashboard, the population in LaPlata County, Colorado is expected to grow by over 80% by 2040. The 2010 census population was recorded as 51,443; the projected population of La Plata County in 2040 is 93,368 (CODOLA 2013). While it is expected that the municipalities experiencing that growth would utilize BMPs and other necessary infrastructure improvements, including additional WWTP capacity, it is possible that additional non-point sources could impact the Animas River in New Mexico.

The Animas-La Plata Project (ALP) is a storage and diversion project that has been undertaken by the U.S. Bureau of Reclamation as a result of Tribal litigation. After a lengthy scoping and National Environmental Protection Act (NEPA) process, the Record of Decision (ROD) approved/recommended the preferred alternative which included the following components:

- Off-stream reservoir of 120,000 acre-feet total capacity, located in Colorado;
- 280 cfs pumping plant, also located in Colorado, would pump water from the Animas River;
- Pipeline from the pumping plant to the reservoir;
- Pipeline to transport Municipal and Industrial water to the Shiprock area for the benefit of the Navajo Nation; and
- \$40,000,000 acquisition fund for the Southern Ute Indian and Ute Mountain Ute Tribes to purchase existing water rights or to engage in other resource development activity.

As written in the Final Supplemental Environmental Impact Statement (FSEIS), the preferred alternative could result in a slight decrease in flow of the Animas River in Farmington under full project operation and some effects to water quality, although these were not considered to be significant. Modeling using conservative assumptions indicated that possible additional exceedences of total phosphorus (1), selenium (5), cadmium (4), and lead (2) could occur over the 45-year modeled period. The FSEIS goes on to state that "...concentrations would not to be exceeded more than once every three years. Therefore, the increase in these exceedences would not be significant." Additionally, stipulations in the ROD suggest that pumping to the reservoir from the Animas River would be limited during times of low flow or to protect ESA and downstream senior water rights' interests.

In 2009, an Intergovernmental Agreement established the Animas-La Plata Operations and Maintenance Association consisting of various governmental entities and political subdivisions, including the State of New Mexico, State of Colorado, and federally-recognized Tribes to carry out the operation, maintenance, and replacement activities and responsibilities outlined through

the NEPA process. Full operation of ALP is expected to be some time in the future, and the ultimate uses, timing, and locations of some project components have yet to be determined. It is expected that ALP activities would utilize BMPs. Additional information on the Animas-La Plata Project is available online: www.usbr.gov/uc/progact/animas.

Any future growth would be considered part of the existing load allocation, assuming persistence of the present hydrologic conditions.

5.0 TEMPERATURE

Monitoring for temperature was conducted by SWQB in 2010. Based on available data, several exceedences of the New Mexico WQS for temperature were noted throughout the Animas watershed. Thermographs (temperature data loggers) were set to record once every hour for several months during the warmest time of the year, typically May through October. Thermograph data were assessed using Appendix E of the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated CWA §303(d)/§305(b) Water Quality Monitoring and Assessment Report [Assessment Protocol]* (NMED/SWQB 2011). Based on the 2010 data, Animas River (San Juan River to Estes Arroyo) and Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) were listed for temperature in the 2012-2014 Integrated List. Temperature data from 2010 were used to develop a temperature TMDL for the Animas River (San Juan River to Estes Arroyo) AU, which has dual aquatic life uses of MCWAL and Warmwater Aquatic Life (WWAL). An Use Attainability Analysis (UAA) underway for the reach may result in a change in aquatic life use designation from MCWAL to CoolWAL or the MCWAL use may be removed leaving the AU designated as WWAL, pending the results of the UAA; the temperature TMDL presented for the downstream reach is protective of the Marginal Coldwater Aquatic Life designated use (MCWAL). The WWAL designated use was not impaired at the time of the 2010 data collection. The data would be reassessed pending a change in designated use.

5.1 Target Loading Capacity

For this TMDL document, target values for temperature are based on the reduction in solar radiation necessary to achieve numeric criteria as predicted by a temperature model. Increases in solar radiation in a given assessment unit can often be correlated to changes in shade and/or canopy cover. The Animas River (San Juan River to Estes Arroyo) AU is classified in NMAC 20.6.4.403 and NMAC 20.6.4.900. The 6T3 for MCWAL is 25°C with a maximum temperature of 29°C. A temperature TMDL has been prepared for the MCWAL designated use for Animas River (San Juan River to Estes Arroyo).

According to the 2011 Assessment Protocols, an AU is not supporting of the Marginal Coldwater use if “*Instantaneous (hourly) temperature exceeds 29.0°C (or the segment-specific maximum temperature) or temperatures exceed 25.0°C (or the segment-specific 6T3 temperature) for six or more consecutive hours in a 24-hour cycle for more than three consecutive days (6T3)*”.

The 2011 Assessment Protocols were used to determine impairment of the waterbody addressed in this section; thus a maximum temperature of 29°C (84.2°F) and a 6T3 temperature of 25°C (77°F) was applied to assess for the MCWAL. Table 5.1 highlights the 2010 thermograph deployments on the Animas River. This TMDL addresses the southernmost reach where temperatures exceeded the criterion.

Animas River (San Juan River to Estes Arroyo): One thermograph was deployed on this AU in 2010 at Farmington (66Animas001.7). Temperatures recorded between 23 June 2010 and

21 September 2010 exceeded the MCWAL 6T3 of 25°C; the maximum temperature criterion of 29°C was exceeded 15 of 2169 times (0.7%).

Table 5.1 Thermograph Deployments in 2010

Station ID	Site Name	Deployment Dates
66Animas001.7	Animas at Farmington, NM	23 June – 21 September 2010
66Animas028.1	Animas abv Estes Arroyo	23 June – 21 September 2010
66Animas055.8	Animas blw CO bnd	23 June – 21 September 2010

5.2 Flow

The critical flow condition for this TMDL was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. According the New Mexico Water Quality Standards, the low flow critical condition is defined as 4Q3 (NMAC 20.6.4.11.B.2). Low flow was chosen as the critical flow because of the negative effect low flows have on temperatures.

When available, USGS gages are used to estimate flow. There were 3 active gages located on the Animas in the vicinity of the study area at the time of data collection (Table 5.2). One gage is located above the upstream reach of the Animas; two are located on the downstream reach. Because gaged flow data was available, DFLOW 3.1a was used to model the critical flow. DFLOW is a Windows-based tool developed to estimate user-selected design stream flows for low-flow analysis by utilizing algorithms based on Log Pearson Type III distribution. Thomas *et al.* (1997) was also used as a check of the validity of using DFLOW on the stream.

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. In the case of the downstream assessment unit, flows of zero were recorded for 13 days between 8 August and 23 August 1996 at the USGS gage near Farmington. Upon examination, it is likely that the portion of the AU located at the USGS gaging station was dry due to drought. Because drought is a natural occurrence and does not appear to have occurred regularly during the gaged period, each zero data point was changed to 0.01 cfs in order to retain the presence of those extreme low flows in the 4Q3 calculation.

The specific inflow and outflow values used in the Stream Segment Temperature (SSTEMP) model are discussed in detail in **Appendix D**.

Table 5.2 Active USGS Gages in Study Area

Gage	Name	Start Date	End Date
09364500	Animas River at Farmington, NM	Oct 1, 1913	Present
09364010	Animas River below Aztec, NM	Dec 17, 2002	Present
09363500	Animas River near Cedar Hill, NM ^(a)	Nov 1, 1933	Present

Note: ^(a) Gage is located 2.5 miles north of the New Mexico stateline.

5.3 Calculations

The SSTEMP Model, Version 2.0.8, developed by the USGS Biological Resource Division (Bartholow 2002) was used to predict stream temperatures based on watershed geometry, hydrology, and meteorology. The model predicts mean, minimum, and maximum daily water temperatures throughout a stream reach by estimating the heat gained or lost from a parcel of water as it passes through a stream segment (Bartholow 2002). The predicted temperature values are compared to actual thermograph readings measured in the field in order to calibrate the model. The SSTEMP model identifies current stream and/or watershed characteristics that control stream temperatures. The model also quantifies the maximum loading capacity of the stream to meet water quality criteria for temperature (Figure 5.1). The model is important for estimating the effects of changes to the parameters controlling stream temperature. It can also be used to identify possible implementation activities, including BMPs, to improve the temperature impairment by identifying which parameters are the most influential to the impairment.

5.3.1 Model Assumptions

As is typical with analytical models, a series of assumptions are associated with the SSTEMP run conditions. Running the model outside of these assumptions will often result in inaccuracies or model instability. The assumptions used in the development of SSTEMP that are most relevant to the development of the presented TMDLs are listed below. For a complete list of assumptions and model deficiencies, please see the SSTEMP user manual (Bartholow 2002).

- Water in the system is instantaneously and thoroughly mixed at all times; there is no lateral temperature distribution across channel OR vertical gradients in pools;
- Stream geometry is characterized by mean conditions;
- Solar radiation and other meteorological and hydrological variables are 24-hour means;
- Distribution of lateral inflow is uniformly apportioned throughout the segment length;
- Manning's n and travel time do not vary as functions of flow;
- Modeled/representative time periods must be long enough for water to flow the full length of the segment; and
- SSTEMP is not able to model cumulative effects; for example, adding or deleting vegetation mathematically is not the same as in real life.

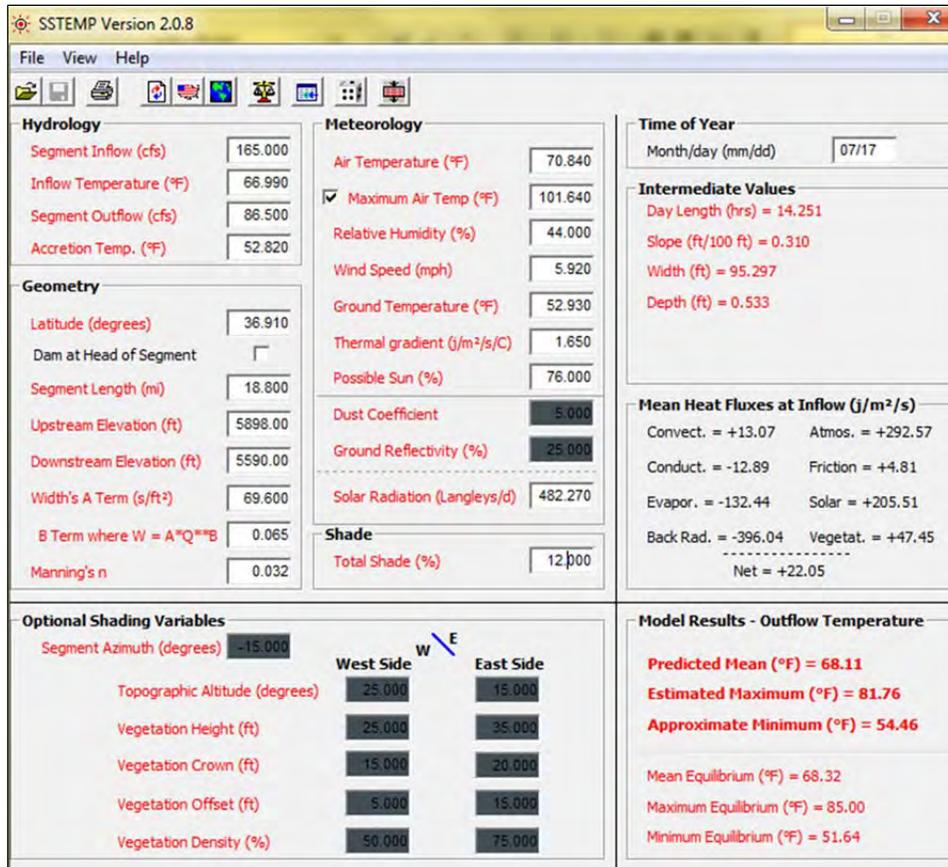


Figure 5.1 Example of SSTEMP Output

5.4 Waste Load Allocations and Load Allocations

5.4.1 Waste Load Allocation

There are several point sources located along the Animas River in New Mexico. The Farmington Steam Plant, the City of Aztec WWTP, and the City of Aztec Water Treatment Plant (WTP) have permits with discharges to the Animas (San Juan River to Estes Arroyo). The City of Aztec WWTP discharges directly to the Animas River (San Juan River to Estes Arroyo) AU; no effluent temperature limitations were included in the NPDES permit effective September 1, 2009. This permit will expire on August 31, 2014. The City of Aztec WTP discharges to the Lower Animas Ditch which discharges to the Animas River (San Juan River to Estes Arroyo) AU. No effluent temperature limitations were included in the NPDES permit, effective October 1, 2009. This permit will expire on September 30, 2014. The City of Farmington Animas Steam Plant discharges to Willett Ditch thence the Animas River. Its permit limits and monitoring are at the terminus of Willett Ditch.

As Figure 5.2 indicates, water temperature measured at the Aztec WWTP is slightly higher than the 25°C maximum temperature used to assess the downstream Animas AU. However, the temperatures measured downstream of the outfall location were found to be lower than those

above, suggesting that the current WWTP effluent is not negatively impacting the temperature of the waterbody as a whole.

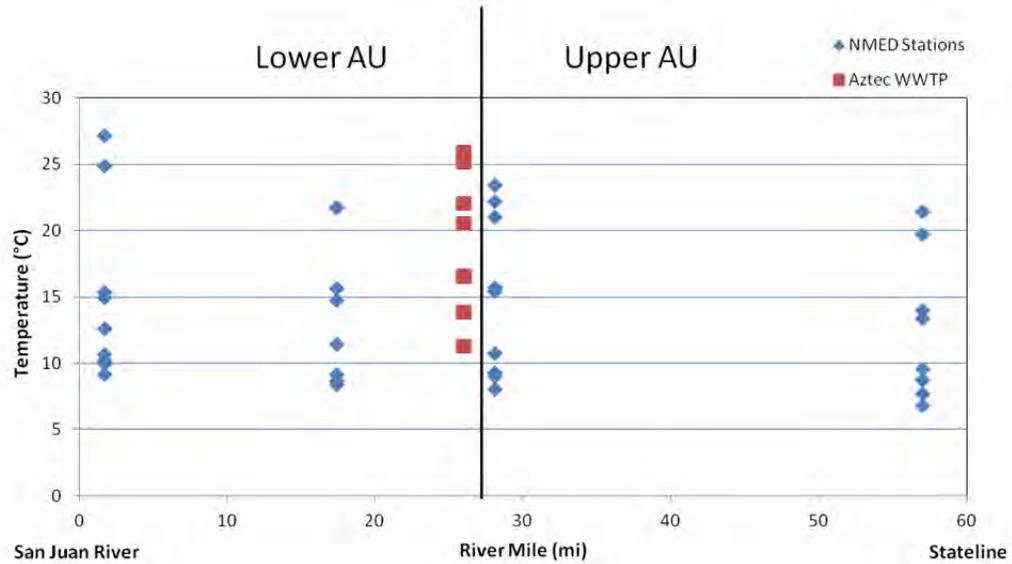


Figure 5.2 Temperatures on the Animas River during 2010 survey

The Farmington Steam Plant NPDES permit has a daily maximum effluent limitation of 84°F (29°C), which corresponds to the maximum temperature associated with the MCWAL designated use. The permit does not take into account the more conservative 6T3 temperature of 25°C. The effluent is discharged first to Willett Ditch and then into the Animas River (San Juan River to Estes Arroyo). The current permit went into effect on October 1, 2011; it will expire September 30, 2016. Based on the maximum monthly average flow of 11.69 MGD used in the permit application to assess reasonable potential, plus an additional 0.025 MGD expected upon completion of Outfall 004, a WLA of 25% of the TMDL, less the MOS, has been assigned to the steam plant. This percentage has been applied to the WLA because the maximum monthly average flow plus the expected 0.025 MGD of Outfall 004, 11.7 MGD is 25% of the 4Q3 of the Animas River (San Juan River to Estes Arroyo) AU. Currently, the plant is not discharging under its NPDES permit, but expects to resume doing so in the near future.

As discussed in Section 4.4, the downstream Animas River AU has the potential to be impacted by stormwater discharges from the watershed's sMS4s. As such, the sMS4s have been assigned WLAs in the temperature TMDL. The sMS4 area impacting the Animas River (San Juan River to Estes Arroyo) AU has been assigned a WLA of 8%. The details of the percentage assignment, based on the Jurisdictional Percentage approach, are discussed in **Appendix E**.

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 0.41 J/m²/s/sqmi/day. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be

consistent with the overall goals of this TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

5.4.2 Load Allocation

Water temperature can be expressed as heat energy per unit volume. SSTEMP provides an estimate of heat energy expressed in joules per square meter per second ($\text{j/m}^2/\text{s}$) and Langley's per day. The following information relevant to the model runs used to determine temperature TMDLs is taken from the SSTEMP documentation (Bartholow 2002). Please refer to the SSTEMP User's Manual for complete text. Various notes have been added below in brackets to clarify local sources of input data.

The program will predict the minimum, mean, and maximum daily water temperature for the set of variables input into the model. The theoretical basis for the model is strongest for the mean daily temperature. The maximum is largely an estimate and likely to vary widely with the maximum daily air temperature. The minimum is computed by subtracting the difference between maximum and mean from the mean; but the minimum is always positive (Bartholow 2002).

SSTEMP may be used to compute, one-at-a-time, the sensitivity input values. This simply increases and decreases most active input by 10% and displays a screen for changes to mean and maximum temperatures. The "Relative Sensitivity" schematic graph that accompanies the display gives an indication of which variables most strongly influence the results (Bartholow 2002). See Figure 5.3 for an example of a sensitivity analysis.

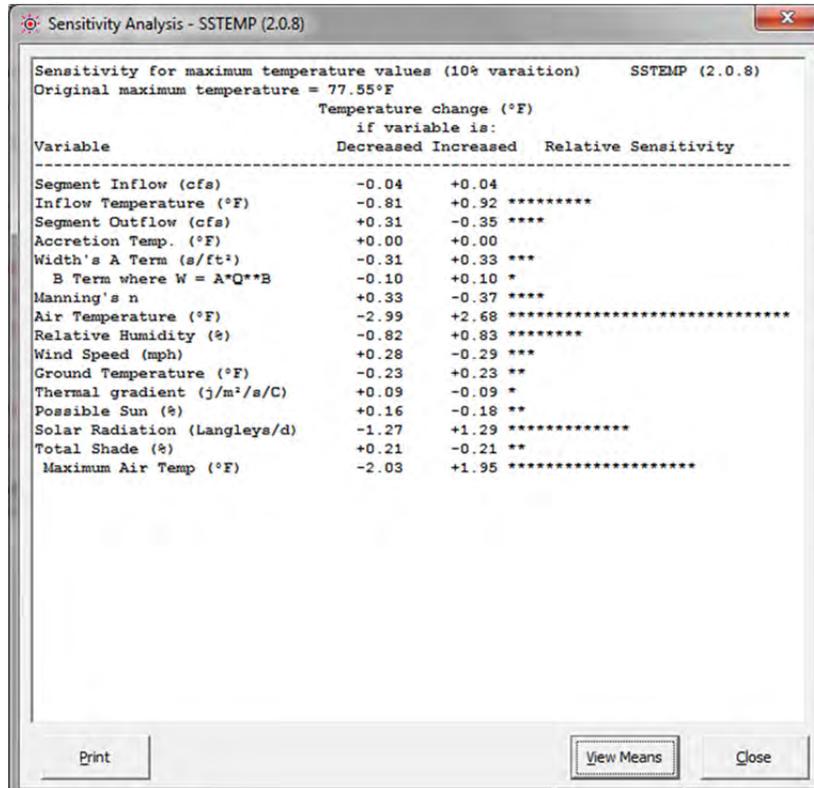


Figure 5.3 SSTEMP Sensitivity Analysis

5.4.2.1 Temperature Allocations as Determined by % Total Shade

According to the sensitivity analysis, the maximum water temperature was most affected by changes in air temperature and solar radiation. The amount of solar radiation reaching the waerbody can be related to shade. As such, shade was used as the independent variable during model runs. Table 5.3 details model outputs for segments on the Animas River. SSTEMP was first calibrated against thermograph data to determine the standard error of the model. Initial conditions were determined. As the percent total shade was increased, the maximum 24-hour temperature decreased until the appropriate temperature criterion was achieved. The calculated 24-hour solar radiation component is the maximum solar load that can occur in order to meet the WQS (i.e., the target capacity). In order to calculate the actual load allocation (LA), the waste load allocation (WLA) and margin of safety (MOS) were subtracted from the target capacity (TMDL) following Equation 5.1.

Equation 5.1

$$WLA + LA + MOS = TMDL$$

The allocations for the assessment unit requiring a temperature TMDL are provided in tables in the following sections.

Temperature Load Allocation for Animas River (San Juan River to Estes Arroyo)

For Animas River (San Juan River to Estes Arroyo), the MCWAL WQS for temperature of 25°C is achieved when the percent total shade is increased from 17.4 to 22%. According to the SSTEMP model, the actual Load Allocation of 165.34 j/m²/s/day, which includes an MOS of 10%, is achieved when the shade is further increased to 29.2% (Table 5.3).

The sensitivity analysis indicates that air temperature, inflow temperature, and solar radiation have the most influence on the estimated stream temperatures.

Table 5.3 Animas River (San Juan River to Estes Arroyo) - MCWAL

WQS 6T3 (MCWAL)	Model Run Date	Segment Length (miles)	Solar Radiation Component per 24-Hours (+/-)	% Total Shade	Modeled Temperature °C (24 hour)
25°C (77°F)	7/17/2010	16.8	Current Field Condition: +192.90	17.4	Minimum: 15.40 Mean: 20.35 Maximum: 25.31
TEMPERATURE ALLOCATIONS FOR Animas River (San Juan River to Estes Arroyo) ^(a) 24-HOUR ACHIEVEMENT OF SURFACE CRITERION FOR TEMPERATURE ^(b) 24-HOUR LOAD ALLOCATION (LA) NEEDED TO ACHIEVE SURFACE CRITERION WITH A 10% MARGIN OF SAFETY			Run 1 +182.16 ^(a) j/m ² /s	22	Minimum: 15.28 Mean: 20.14 Maximum: 25.00
Actual reduction in solar radiation necessary to meet surface WQS for temperature: Current Condition –Load Allocation = 192.90 – 107.74 = 85.16 j/m ² /s/day			Run 2 +165.34 ^(b) j/m ² /s	29.2	Minimum: 15.10 Mean: 19.80 Maximum: 24.50

The estimate of total shade used in the model calibration was based on densitometer readings (field notes) and confirmed by examination of aerial photographs. Target loads as determined by the modeling runs are summarized in Table 5.3. The MOS is estimated to be 10% of the target load calculated by the modeling runs. Results are summarized in Table 5.4. Additional details on the MOS are presented in Section 5.7 below.

The load reductions that would be necessary to meet the target load were calculated to be the difference between the calculated target load and the measured load (i.e., current field condition in Table 5.3), and are shown in Table 5.5.

Table 5.4 Temperature TMDL

Assessment Unit	Aquatic Life Use	NPDES WLA (25% ^(c)) (j/m ² /s/day)	sMS4 WLA (8% ^(d)) (j/m ² /s/day)	LA (j/m ² /s/day)	MOS (10% ^(a)) (j/m ² /s/day)	TMDL (j/m ² /s/day)
Animas River (San Juan River to Estes Arroyo)	MCWAL ^(b)	37.2	8.93	102.68	16.53	165.34

Notes: ^(a) Actual MOS values may be slightly greater than 10% because the final MOS is back calculated after the Total Shade value is increased enough to reduce the modeled solar radiation component to a value less than the target load minus 10%.
^(b) TMDL is based on the MCWAL 6T3 temperature of 25°C as an inherent component of the MOS.
^(c) NPDES WLA value is 25% of the TMDL value, less the MOS. The derivation of this percentage is discussed in Section 5.4.1.
^(d) sMS4 WLA value is 8% of the TMDL value, less the MOS and NPDES WLA. Please see **Appendix E** for more information on this derivation.

Table 5.5 Temperature Load Reduction

Assessment Unit	Aquatic Life Use	Target Load ^(a) (j/m ² /s/day)	Measured Load (j/m ² /s/day)	Load Reduction (j/m ² /s/day)	Percent Reduction ^(b)
Animas River (San Juan River to Estes Arroyo)	MCWAL	+165.34	+192.90	27.56	14.29%

Notes: ^(a) Target Load = LA+WLA
^(b) Percent reduction is the percent the existing measured load must be reduced to achieve the target load, and is calculated as follows: (Measured Load – Target Load)/Measured Load x 100.

5.5 Identification and Description of Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment (**Appendix B**). The approach for identifying “Probable Sources of Impairment” was recently modified by SWQB to include additional 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. The draft probable source list will be reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period.

Although this procedure is subjective and qualitative, SWQB has concluded that it provides the best available information for the identification of probable sources of impairment in a watershed. 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 for each impairment. Table 5.6 displays pollutant sources that may contribute to each segment as determined by field reconnaissance and evaluation. Probable sources of temperature impairments will be evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

A thermograph was deployed at one of the northernmost New Mexico water quality stations (66Animas055.8) between 23 June and 21 September 2010. The Animas assessment unit adjacent to Colorado and the Southern Ute boundary is currently undergoing a UAA to determine the appropriate aquatic life use. Because a TMDL has not been prepared for this assessment unit, the temperature loading at the stateline has not been modeled and any necessary reduction has not been calculated at this time.

5.6 Linkage of Water Quality and Pollutant Sources

Water temperature influences the metabolism, behavior, and mortality of fish and other aquatic organisms. Natural temperatures of a waterbody fluctuate daily and seasonally. These natural fluctuations do not eliminate indigenous populations, but may affect existing community structure and geographical distribution of species. In fact, such temperature cycles are often necessary to induce reproductive cycles and may regulate other aspects of life history (Mount 1969). Behnke and Zarn (1976), in a discussion of temperature requirements for endangered western native trout recognized that populations cannot persist in waters where maximum temperatures consistently exceed 21-22°C, but they may survive brief daily periods of higher temperatures (25.5-26.7°C). Anthropogenic impacts can lead to modifications of these natural temperature cycles, often leading to deleterious impacts on the fishery. Such modifications may contribute to changes in geographical distribution of species and their ability to persist in the presence of introduced species. Of all the environmental factors affecting aquatic organisms in a waterbody, temperature is always a factor. Heat, which is a quantitative measure of the energy of molecular motion that is dependent on the mass of an object or body of water is fundamentally different than temperature, which is a measure (unrelated to mass) of energy intensity. Organisms respond to temperature, not heat.

As observed in SWQB thermograph data, there are temperatures in the study areas that exceed the State Standards for the protection of aquatic habitat, namely the MCWAL designated use. Through monitoring and pollutant source documentation, it has been observed that the most probable cause for these temperature exceedences are due to the alteration of the stream’s hydrograph, removal of riparian vegetation and natural causes including ecoregion. Alterations can be historical or current in nature. A list of probable sources for the AU is available in Table 5.6.

Table 5.6 Probable Source Summary for Temperature

Pollutant Sources	Magnitude ^(a) (j/m2/s/day)	Location	Probable Sources ^(b)
<i>Point:</i>			
	37.2	Animas River (San Juan River to Estes Arroyo)	City of Farmington Animas Power / Steam Plant
	8.93	Animas River (San Juan River to Estes Arroyo)	sMS4
<i>Nonpoint:</i>			
	146.77	Animas River (San Juan River to Estes Arroyo)	streambank modifications/destabilization, baseflow depletion from surface water withdrawals, drought-related impacts, <i>site clearance (land development), irrigated crop production</i>

Notes: ^(a) Magnitudes of point sources are based on waste load allocations; magnitude of nonpoint source probable sources is calculated by subtracting the point source magnitude from the measured load.

^(b) Probable sources in italics have not been previously noted in the §303(b)/§305(d) Integrated List; they were noted on Probable Source Sheets as identified in **Appendix B**.

A variety of factors impact stream temperature (Figure 5.4). Decreased effective shade levels result from reduction of riparian vegetation. When canopy densities are compromised, thermal loading increases in response to the increase in incident solar radiation. Likewise, it is well documented that many past hydromodification activities have led to channel widening. Wider stream channels also increase the stream surface area exposed to sunlight, thereby increasing heat transfer. Riparian area and channel morphology disturbances are attributed to past and, to some extent current, rangeland grazing practices that have resulted in reduction of riparian vegetation and streambank destabilization. These nonpoint sources of pollution primarily affect the water temperature through increased solar loading by: (1) increasing stream surface solar radiation and (2) increasing stream surface area exposed to solar radiation.

Riparian vegetation, stream morphology, hydrology, climate, geographic location, and aspect all influence stream temperature. Although climate, geographic location, and aspect are outside of human control, the condition of the riparian area, channel morphology, and hydrology can be affected by land use activities. Specifically, the elevated summertime stream temperatures attributable to anthropogenic causes in the Animas watershed result from the following conditions:

-
1. Channel widening (i.e., increased width to depth ratios) that has increased the stream surface area exposed to incident solar radiation;
 2. Riparian vegetation disturbance that has reduced stream surface shading, riparian vegetation height and density; and
 3. Reduced summertime base flows that result from instream withdrawals and/or inadequate riparian vegetation. Base flows are maintained with a functioning riparian system so that loss of a functioning riparian system may lower and sometimes eliminate baseflows. Although removal of upland vegetation has been shown, in some cases, to increase water yield, studies show that removal of riparian vegetation along the stream channel subjects the water surface and adjacent soil surfaces to wind and solar radiation, partially offsetting the reduction in transpiration with evaporation. In losing stream reaches, increased temperatures can result in increased streambed infiltration, which can result in lower base flow (Constantz et al. 1994).

Analysis presented in the Animas River (San Juan River to Estes Arroyo) AU TMDL demonstrates that the target loading capacities will result in attainment of New Mexico WQS. Specifically, the relationship between shade and water temperature was demonstrated. Vegetation density increases will provide necessary shading, as well as encourage bank-building processes in severe hydrologic events. However, the presentation of percent total shade in Table 5.3 is only one avenue which may be pursued to decrease water temperature and ultimately meet WQS. Changes in geomorphological parameters might also prove useful. SWQB encourages stakeholders to pursue whichever options seem to be the best fit for each particular watershed or project with the ultimate goal being that the stream temperature meets the WQS.

Where available data are incomplete or where the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

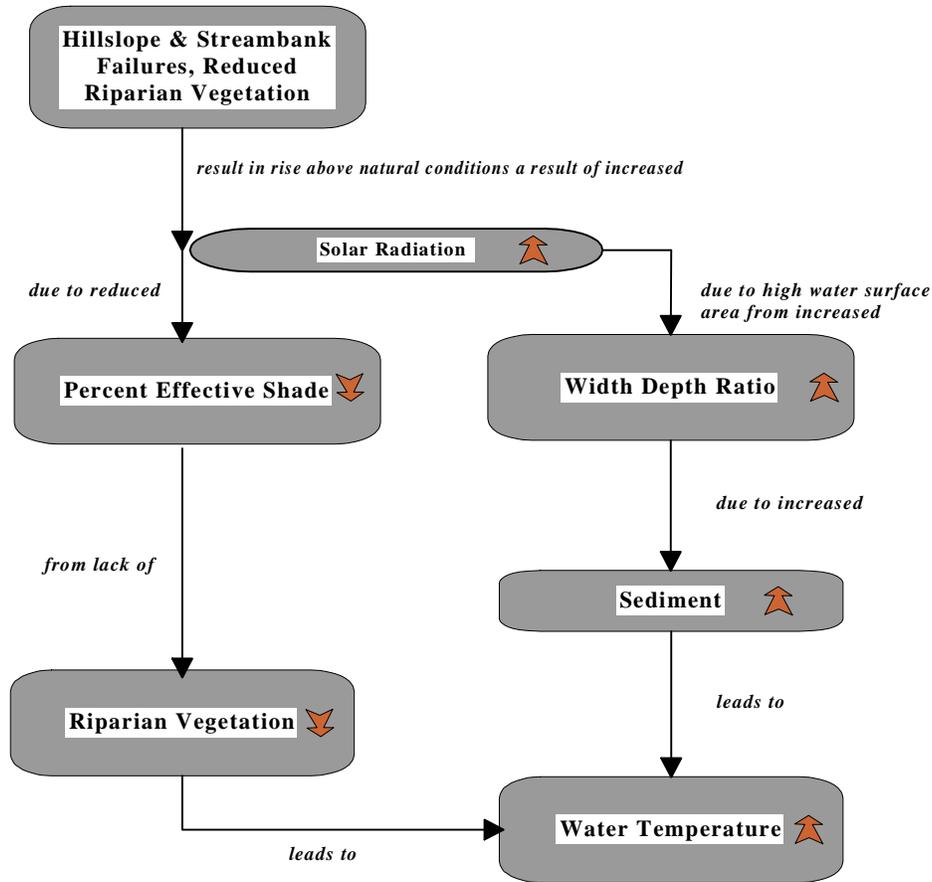


Figure 5.4 Factors Impacting Stream Temperature

5.7 Margin of Safety (MOS)

The CWA requires that each TMDL be calculated with a MOS. This statutory requirement that TMDLs incorporate a MOS is intended to account for uncertainty in available data or in the actual effect controls will have on loading reductions and receiving water quality. A MOS may be expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions or effectiveness of proposed management actions). The MOS may be implicit, utilizing conservative assumptions for calculation of the loading capacity, WLAs, and LAs. The MOS may also be explicitly stated as an added separate quantity in the TMDL calculation.

In order to develop this temperature TMDL, the following conservative assumptions were used to parameterize the model:

- Data from the warmest time of the year were used in order to capture the seasonality of temperature exceedences.
- Critical upstream and downstream low flows were used because assimilative capacity of the stream to absorb and disperse solar heat is decreased during these flow conditions.

-
- Thermal inputs from the Animas Steam Plant were calculated based on the average flows from the plant's outfalls, combined with the daily maximum temperature included in the facility's permit. It was assumed that 100% of the discharge was at the maximum temperature.
 - Low flow was modeled using formulas developed by the USGS and DFLOW. See **Appendix D** for details.
 - The WLA for the Animas Steam Plant was calculated using the percentage of the maximum average monthly discharge from Outfall 001 as determined during the permitting process and the projected discharge from as-yet-unbuilt Outfall 004 . This discharge represents an extreme case for the plant, thus resulting in a conservative and protective WLA.

As detailed in **Appendix D**, a variety of hydrologic, geomorphologic, and meteorological data were used to parameterize the SSTEMP model. Because of the quality of data and information that was put into this model and the continuous field monitoring data used to verify these model outputs, an explicit MOS of 10% is assigned to this TMDL.

5.8 Consideration of Seasonal Variation

Section 303(d)(1) of the CWA requires TMDLs to be "established at a level necessary to implement the applicable WQS with seasonal variations." Both stream temperature and flow vary seasonally and from year to year. Water temperatures are coolest in winter and early spring months.

Thermograph records show that temperatures exceed State of New Mexico WQS in summer and early fall. The warmest stream temperatures corresponded to prolonged solar radiation exposure, warmer air temperature, and low flow conditions. These conditions occur during late summer and early fall and promote the warmest seasonal instream temperatures. It is assumed that if critical conditions are met, coverage of any potential seasonal variation will also be met.

5.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2040. San Juan County population is projected to grow by an estimated 35% over the 2010-2040 period. As of 2011 however, San Juan County, had an estimated population of 128,200, which is down from the 2010 Census population of 130,044.

Estimates of future growth in San Juan County, New Mexico are not anticipated to lead to a significant increase in temperature loading in this watershed that cannot be controlled with best management practices (BMPs). However, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

It should also be noted that a large portion of the Animas watershed, including its headwaters, is located in Colorado. According to the Colorado Department of Local Affairs State Demography Office's Dashboard, the population in LaPlata County, Colorado is expected to grow by over 80% by 2040. While it is expected that the municipalities experiencing that growth would utilize

BMPs and other necessary infrastructure improvements, it is possible that additional nonpoint sources could impact the Animas River in New Mexico. The Animas-La Plata Project (ALP), a diversion and storage project which is under development, is discussed in detail in Section 4.9. It is not expected that ALP operations would impact the temperature loading in the AU.

Any future growth would be considered part of the existing load allocation, assuming persistence of the present hydrologic conditions.

6.0 TOTAL PHOSPHORUS

Assessment of data from the 2010 SWQB water quality survey in the San Juan River watershed identified exceedences of the New Mexico water quality criterion for Total Phosphorus (TP) in:

- Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd).

Consequently, the AU was listed on the 2012-2014 Integrated CWA §303(d)/ §305(b) List for Total Phosphorus (NMED/SWQB 2012). A numeric site-specific total phosphorus criterion of 0.1 mg/L applies to this AU.

Phosphorus is essential for proper functioning of aquatic ecosystems. Nuisance levels of algae and other aquatic vegetation (macrophytes) can develop rapidly in response to nutrient enrichment when other factors (e.g., light, temperature, substrate, etc.) are not limiting. The intent of a numeric standard for phosphorus is to control the excessive growth of attached algae and higher aquatic plants that can result from the introduction of plant nutrients into streams. A numeric standard is necessary to control the amount of nutrients in the stream and prevent excessive plant growth, to establish targets for TMDLs, to develop water quality-based permit limits and source controls plans, and to support designated uses within the Animas River.

6.1 Target Loading Capacity

The target value for this phosphorus TMDL is based on the segment-specific criteria in 20.6.4.404 NMAC: 0.1 mg/L or less. Exceedences are presented in Table 6.1.

Table 6.1 Total Phosphorus Exceedences of Segment-Specific Criterion

Assessment Unit	Associated Criterion	Exceedence Ratio
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	0.1 mg/L	4/17

6.2 Flow

The critical flow condition for this TMDL was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. According the New Mexico Water Quality Standards, the low flow critical condition is defined as 4Q3 (NMAC 20.6.4.11.B.2). The presence of total phosphorus in a stream can vary as a function of flow. As flow decreases, the stream cannot effectively dilute its constituents, which causes the concentration of phosphorus to increase. Thus, this TMDL is calculated for each assessment unit at a specific flow.

SWQB determined streamflow and critical flow by using data from active USGS gages on the Animas River. More information on 4Q3 calculation is available in **Appendix D**. It is important

to remember that the TMDL itself is a value calculated at a defined critical condition that is calculated as part of the planning process designed to achieve water quality standards. The critical flow condition for this TMDL occurs when the ratio of total phosphorus to stream flow is the greatest, which was obtained using a 4Q3 regression model program, DFLOW. The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years.

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. Upon examination of the gage data for the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AU, all recorded flows were non-zero.

Since flows vary throughout the year, and from year to year, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained.

6.3 Calculations

This section describes the relationship between the numeric target and the allowable pollutant load by determining the waterbody's total assimilative capacity, or loading capacity, for total phosphorus. The loading capacity is the maximum amount of pollutant that a waterbody can receive, at a specific flow, while meeting its water quality objectives. This TMDL was developed based on simple dilution calculations using the 4Q3 flow, the segment-specific criterion, and a unit conversion factor (Equation 6.1, Table 6.2).

Equation 6.1

$$\text{Critical Flow (4Q3)} \times \text{WQS} \times \text{Unit Conversion Factor} = \text{Target Loading Capacity}$$

Table 6.2 TMDL / Target Load for Total Phosphorus

Assessment Unit	4Q3 (MGD)	WQS Criterion (mg/L)	Unit Conversion Factor	TMDL ^(a) (lbs/day)
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	55.9	0.1	8.34	46.6

Note: ^(a) TMDL = Target load capacity

By applying Equation 6.1 to total phosphorus, it is determined that Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) can transport approximately 46.6 lbs/day of total phosphorus during critical low-flow conditions, and instream concentrations will not exceed 0.1 mg/L.

The measured load for TP was similarly calculated. In order to achieve comparability between the target and measured loads, the same flow value was used for both calculations. The

arithmetic mean of the collected data was substituted for the numeric target in the above equation. The same unit conversion factor was utilized. Measured Load results are in Table 6.3.

Table 6.3 Total Phosphorus Measured Load

Assessment Unit	4Q3 (MGD)	Arithmetic Mean Concentration (mg/L)	Unit Conversion Factor	Measured Load(lbs)/day)
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	55.9	0.24	8.34	111.9

6.4 Waste Load Allocations and Load Allocations

6.4.1 Waste Load Allocation

There are no existing point sources along this assessment unit. The SMS4 area that may impact the AU has been assigned a WLA of 2% based on the percent jurisdictional approach. For more information regarding this approach and how it was applied, see **Appendix E**.

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 0.22 lbs/sqmi/day. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be consistent with the overall goals of this TMDL it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, 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 stormwater permit (CGP) requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. In addition, the current CGP also includes state-specific requirements to implement best management practices (BMPs) that are designed to prevent to the maximum extent practicable, an increase in sediment, or a parameter that addresses sediment (e.g., TSS, turbidity, siltation, stream bottom deposits, etc.) and flow velocity during and after construction compared to pre-construction conditions. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Other industrial stormwater facilities are generally covered under the current NPDES Multi Sector General Storm Water Permit (MSGP). This permit also requires the preparation of an SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In addition, the current MSGP also includes state-specific requirements to further limit (or eliminate pollutant loading to water quality impaired/water quality limited waters from facilities where there is a reasonable potential to contain pollutants for which the receiving water is impaired. In this case, 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 these General Permits at this time using 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 load allocation (LA). While these sources are not given individual allocations, they are addressed through other means, including BMPs, stormwater pollution prevention conditions, and other requirements.

6.4.2 Load Allocation

In order to calculate the load allocation (LA) for phosphorus, the WLA and margin of safety (MOS) were subtracted from the target load (TMDL) using the following Equation 6.2.

Equation 6.2

$$WLA + LA + MOS = TMDL$$

Or

$$LA = TMDL - WLA - MOS$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors. The explicit MOS is 10%; see Section 6.7 for details.

6.4.3 TMDL Calculation

The TMDL was allocated per Equation 6.2. Table 6.4 presents how the TMDL was allocated between point sources, nonpoint sources, and the MOS.

Table 6.4 TMDL for Total Phosphorus

Assessment Unit	WLA NPDES (lbs/day)	WLA sMS4 (lbs/day)	LA (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	0	0.8	41.1	4.7	46.6

Note: ^(a) TMDL value is equivalent to the target load capacity, displayed in Table 6.2.

The load reductions that would be necessary to meet the target loads were calculated to be the difference between the calculated Target Load (Table 6.2) and the measured load (Table 6.3) are shown in Table 6.5.

Table 6.5 Percent Reduction for Total Phosphorus

Assessment Unit	Target Load (lbs/day)	Measured Load (lbs/day)	Load Reduction (lbs/day)	Percent Reduction (%) ^(a)
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	46.6	111.9	65.3	58.4%

Note: ^(a) Percent reduction is the existing measured load must be reduced to achieve the TMDL and is calculated as follows: (Measured Load-TMDL)/Measured Load x 100.

6.5 Identification and Description of Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment (**Appendix B**). The approach for identifying “Probable Sources of Impairment” was recently modified by SWQB to include additional 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. The draft probable source list will be reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period.

Although this procedure is subjective and qualitative, SWQB has concluded that it provides the best available information for the identification of probable sources of impairment in a watershed. 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 6.6 displays pollutant sources that may contribute to each segment as determined by field reconnaissance and evaluation. Probable sources of temperature impairments will be evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

Table 6.6 Probable Source Summary for Total Phosphorus

Pollutant Sources	Magnitude ^(a)	AU	Probable Sources ^(b)
<i>Point:</i>			
	0.8 lbs/day	Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	sMS4 City of Aztec and San Juan County
<i>Nonpoint:</i>			
	111.1lbs/day	Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	Drought-related impacts, site clearance (land development), pavement/impervious surfaces, fish stocking, irrigated crop production

Notes: ^(a) Magnitudes of point sources are based on waste load allocations; magnitude of nonpoint source probable sources is calculated by subtracting the point source magnitude from the measured load.

^(b) Probable sources in italics have not been previously noted in the 303(b)/305(d) Integrated List; they were noted on Probable Source Sheets as identified in **Appendix B**.

Seven total Phosphorus samples were collected at the northernmost New Mexico water quality station of the Animas River during the 2010 intensive field survey. Data can be found in **Appendix C**. Two of these samples exceeded the segment-specific total phosphorus criterion of 0.1 mg/L. The arithmetic mean concentration of these samples is 0.47 mg/L, resulting in an estimated load of 415.5 lbs/day that enters New Mexico. The target load at the top of the AU has been calculated at 88.4 lbs/day.

Table 6.7 Measured Total Phosphorus Load at 66Animas057.1 – Animas River downstream of stateline

Station ID	4Q3 (MGD)	Arithmetic Mean Concentration (mg/L)	Unit Conversion Factor	Measured Load (lbs/day)	Target Load at stateline (lbs/day) ^(a)
66Animas057.1 Animas River downstream of stateline	106	0.47	8.34	415.5	88.4

Note: ^(a) Target load at the stateline was calculated by multiplying the 4Q3 at the top of the AU by the segment-specific total phosphorus water quality criteria and a unit conversion factor.

6.6 Linkage between Water Quality and Pollutant Sources

The source assessment phase of TMDL development identifies sources of nutrients that may contribute to both elevated nutrient concentrations and the stimulation of algal growth in a waterbody. Where data gaps exist or the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

Phosphorus, along with nitrogen, generally drives the productivity of algae and macrophytes in aquatic ecosystems, and is widely regarded as one of the primary limiting nutrients in freshwaters. The main reservoirs of natural phosphorus are geologic formations 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). After it has been incorporated into plant or algal tissue, phosphorus primarily moves through the food web as organic phosphorus, which may be released as phosphate in urine or other waste by heterotrophic consumers and reabsorbed by plants or algae to start another cycle (Nebel and Wright 2000). Anthropogenic sources of phosphorus include improperly maintained septic systems, wastewater treatment plants, storm water, soil erosion, pet wastes, misapplication of fertilizer, and phosphorus-containing detergents (NYCDEP 2013).

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, they can be taken up by algae, macrophytes, and microorganisms either in the water column or in 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 described in Section 6.2, the presence of phosphorus in a stream can vary as a function of flow. As flow decreases through water diversions and/or drought-related stressors, the stream cannot effectively dilute its constituents, which causes the concentration of total phosphorus to increase. Conversely, the increased flows from stormwater runoff have been associated with an increase in phosphorus, probably as a result of increased sediment loading (BUGS 2011). Total phosphorus generally reaches a waterbody from land uses that are in close proximity to the stream because the hydrological pathways are shorter and have fewer obstacles than land uses located away from the riparian corridor. However, during the growing season (i.e., in agricultural return flow) and in storm water runoff, distant land uses can become hydrologically connected in the stream, thus transporting nutrients from the hillslopes to the stream during these time periods.

In addition to agriculture, there are several other human-related activities that influence nutrient concentrations in rivers and streams. Residential areas contribute phosphorus from septic tanks, landscape maintenance, and backyard livestock (e.g., cattle, horses, chickens) and pet wastes. Urban development contributes total phosphorus by disturbing the land and consequently increasing soil erosion, by increasing the impervious area within the watershed, and by directly applying TP to the landscape. Recreational activities such as hiking and biking can also contribute TP to the stream by reducing plant cover and increasing soil erosion (e.g., train network, streambank destabilization), direct application of human waste, campfires, wildfires, and dumping trash near the riparian corridor.

Phosphorus levels as measured during the 2010 sample collection indicate that TP levels in the Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) AU exceed just below the stateline, at the top of the AU. This may indicate that while nonpoint sources are very likely impacting waters from within the AU, the inflow may already have TP concentrations above the segment-specific water quality standard of 0.1 mg/L. Studies cited in the 2011 Animas River Watershed Based Plan indicate that the largest contributors of total phosphorus north of the stateline are 4 sewage treatment plants (BUGS 2011).

Undeveloped or natural landscapes can deliver TP to a waterbody through decaying plant material, soil erosion, and animal waste. Another geographically occurring nutrient source is atmospheric deposition, which adds TP directly to the waterbody through dryfall and rainfall. Atmospheric phosphorus can be found in both organic and inorganic particles, such as pollen and dust. Additionally, phosphorus concentrations may be increased as a result of wildland fires through ash deposition (Spencer and Hauer 1991 as referenced in BUGS 2011), increased sediment loading, and increased surface flows (Minshall 1997 as referenced in BUGS 2011 and Rieman and Clayton 1997 as referenced in BUGS 2011). The Missionary Ridge Fire of 2002 continued to produce sediment flows via several drainages into the Animas north of New Mexico through at least 2007 (Anderson 2007, as referenced in BUGS 2011), potentially impacting the 2010 sampling event. The contributions from these natural sources are generally considered to represent background levels.

6.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source loading estimates, and the modeling analysis. The MOS can be expressed implicitly, explicitly, or a combination of the two. 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 nutrient TMDLs, the MOS was developed using a combination of conservative assumptions and explicit portion of the TMDL in recognition of potential errors. Therefore, this MOS is the sum of the following two elements:

- *Conservative Assumptions*
 - Treating phosphorus as a pollutant that does not readily degrade in the environment;
 - Using the 4Q3 critical low flow “worst case scenario” to calculate the allowable loads; and
 - Using the arithmetic mean of the data for a conservative measured load.
- *Explicit Recognition of Potential Errors*
 - A level of uncertainty exists in sampling nonpoint sources of pollution. Accordingly, an explicit MOS of 10% was assigned to this TMDL.

6.8 Consideration of Seasonal Variability

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Data used in the calculation of this TMDL were collected during spring, summer, and fall in order to ensure coverage of any potential seasonal variation in the system. Exceedences were observed during the spring and late summer, which may reflect flow alterations related to snowmelt, agricultural diversions, and summer monsoonal rains. The critical condition used for calculating the TMDL was low flow; it is assumed that if critical conditions are met during this time, coverage of any potential seasonal variation will also be met.

Additionally, the river is heavily diverted during the summer growing season, with approximately half of its flow diverted for an average of 22 days per year. In July 2003, a maximum diversion of 97% was observed between Cedar Hill, NM and Farmington, NM (BUGS 2007). A reduction in flow is likely to result in an increased effective concentration of total phosphorus.

6.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2040. San Juan County population is projected to grow by an estimated 35% over the 2010-2040 time period. As of 2011 however, San Juan County, had an estimated population of 128,200, which is down from the 2010 Census population of 130,044. The projected population of San Juan County in 2040 is 175,678 (NMBBER 2012).

According to the data, bacterial loading is primarily due to diffuse nonpoint sources. Estimates of future growth in San Juan County, New Mexico are not anticipated to lead to a significant increase in total phosphorus in this watershed that cannot be controlled with best management practices (BMPs). However, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

It should also be noted that a large portion of the Animas watershed, including its headwaters, is located in Colorado. According to the Colorado Department of Local Affairs State Demography Office's Dashboard, the population in LaPlata County, Colorado is expected to grow by over 80% by 2040. The 2010 census population was recorded as 51,443; the projected population of La Plata County in 2040 is 93,368 (CODOLA 2013). While it is expected that the municipalities experiencing that growth would utilize BMPs and other necessary infrastructure improvements, it is possible that additional nonpoint sources could impact the Animas River in New Mexico.

The Animas-La Plata Project (ALP), a diversion and storage project under development, is discussed in detail in Section 4.9. It is not expected that ALP operations would significantly impact total phosphorus loading in the AU; the FSEIS indicated that one additional exceedence of the water quality criterion for total phosphorus could be possible over a 45-year period.

Any future growth would be considered part of the existing load application, assuming persistence of the present hydrologic conditions.

7.0 Monitoring Plan

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

The monitoring strategy establishes 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 utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every eight years. The next scheduled monitoring date for the San Juan Watershed is 2018. 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 2012a). In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program. Current priorities for monitoring in the SWQB are driven by the CWA Section 303(d) list of streams requiring TMDLs. Short-term efforts were directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997), however NMED/SWQB completed the final remaining TMDL on the consent decree in December 2006 and USEPA approved this TMDL in August 2007. The U.S. District Court dismissed the Consent Decree on April 21, 2009.

Once assessment monitoring is completed, those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority assessment units (including biological assessments), and compliance monitoring of industrial, federal, and municipal dischargers, as specified in the SWQB Standard Operating Procedures (NMED/SWQB 2010). Long-term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited approximately every seven years. This information will provide time relevant information for use in CWA §303(d) listing and 305(b) report assessments and to support the need for developing TMDLs. The approach provides:

- A systematic, detailed review of water quality data which allows for a more efficient use of valuable monitoring resources;
- Information at a scale where implementation of corrective activities is feasible;
- An established order of rotation and predictable sampling in each basin which allows for enhanced coordinated efforts with other programs; and

-
- Program efficiency and improvements in the foundations for management decisions.

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

8.0 Implementation of TMDLs

8.1 Point Sources – NPDES Permitting

8.1.1 *E. coli*

There are three existing point sources with individual NPDES permits on the Animas River. The City of Aztec has outfalls to the downstream AU from its Water Treatment Plant and Waste Water Treatment Plant, permits NM0028762 and NM0020168, respectively. The City of Farmington's Animas Steam Plant also has a discharge to the Willett Ditch thence the Animas River (San Juan River to Estes Arroyo) AU, permit NM0000043, although there is not an *E. coli* limit on its effluent. The WLA that has been assigned to the City of Aztec WWTP, per its existing NPDES permit, is 4.8×10^9 cfu/day.

There is one urbanized area identified in the 2010 US Census with four entities designated by the US EPA as Phase II small Municipal Separate Storm Sewer Systems (sMS4) within the New Mexico portion of the Animas watershed. The four permittees – the City of Farmington, the City of Aztec, portions of San Juan County, and NMDOT have the potential to impact the Animas River. The *E. coli* contribution of the sMS4s to the AUs has been accounted for as a portion of the load allocation of the TMDL. It has been calculated as a percentage of each of the TMDLs presented in this document based on jurisdictional area within the greater watershed. The urbanized area allocated to the downstream AU has been assigned 8% of the TMDL, and the urbanized area in the upstream AU drainage area has been assigned 2% of the TMDL to account for stormwater runoff.

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 7.24×10^8 cfu/sqmi/day in the Animas River (San Juan River to Estes Arroyo) AU and 1.29×10^9 cfu/sqmi/day in the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AU. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be consistent with the overall goals of this TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

For more information regarding the allocation of sMS4 load, see **Appendix E**.

8.1.2 Temperature

It would be expected that upon renewal of the City of Farmington's Animas Steam Plant permit, or any other permits in the Animas watershed requiring temperature limits and monitoring, the temperature limits will be reassessed based on the 6T3 of the designated aquatic life use, along with a current average flow for the facility. At this time, the temperature criteria listed in the permit is based on the MCWAL maximum temperature of 84°F (29°C), with a reporting requirement of the 6T3 in deference to the more stringent 6T3 temperature of 25°C, upon which the Animas River (San Juan River to Estes Arroyo) TMDL is based. The current NPDES permit has temperature limits at the end of Willett Ditch, however, the permit-limited maximum daily temperature of 29°C is not protective of the 6T3 temperature. The way the permit is currently written suggests that the plant could discharge to capacity at the AU's maximum temperature.

With respect to the Animas Steam Plant, documentation of the plant's effluent characteristics indicate that the average temperature of the effluent is 55.1°F (12.8°C), with a maximum of 60°F (15.5°C). Therefore, it is not unreasonable to assume that the plant would be more than capable of maintaining a maximum effluent temperature of 25°C at the point of discharge to the Animas River under its present operating conditions. Upon revision, it is expected that the permit will contain language setting the maximum temperature of the plant's discharge at 25°C.

The SMS4 has been assigned a WLA of 8% based on the percent jurisdictional approach outlined in **Appendix E**. If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 0.41 J/m²/sqmi/day. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be consistent with the overall goals of this TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

8.1.3 Total Phosphorus

There are no existing point sources along the Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) assessment unit which will be impacted by the TMDL for total phosphorus. There is one Phase II SMS4 area that may impact the AU, which includes the City of Aztec and portions of San Juan County. The SMS4 has been assigned a WLA of 2% based on the percent jurisdictional approach. If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted using a per area loading of 0.22 lbs/sqmi/day. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA. As this change would be consistent with the overall goals of this TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit. For more information regarding this approach and how it was applied, see **Appendix E**.

8.2 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 Watershed-based Plan (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. A San Juan Basin Management (WBP) was initially prepared in 2005, although it was not inclusive of all of the necessary components of a WBP and was not reviewed by EPA. In the future, an updated WBP should be drafted that meets the requirements and includes identified impairments and 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 will include the San Juan Watershed Group and others currently active in the watershed.

8.3 Clean Water Act §319(h) Funding

The Watershed Protection Section of the SWQB can potentially provide USEPA §319(h) funding to assist in implementation of BMPs to address water quality problems on reaches listed as category 4 or 5 waters on the Integrated §303(d)/ §305(b) list. These monies are available to all private, for-profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, Federal agencies, or agencies of the State. 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 from the CWA §319(h) can be found at the SWQB website: www.nmenv.state.nm.us/swqb.

8.4 Other Funding Opportunities and Restoration Efforts in the San Juan River Basin

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 §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 USDA Forest Service aligns their mission to protect lands 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.

9.0 Applicable Regulations and Stakeholder Assurances

New Mexico's Water Quality Act (Act) authorizes the WQCC to "promulgate and publish regulation to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Water Quality Act also states in §74-6-12(a):

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

In addition, the State of New Mexico Surface Water Quality Standards (see Subsection C of 20.6.4.6 NMAC) (NMAC 2012) states:

Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

New Mexico's CWA §319 Program has been developed in a coordinated manner with the State's 303(d) process. All 319 watersheds that are targeted in the annual RFP process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a 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 §319 of the Clean Water Act. 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 land, NMED has established Memoranda of Understanding (MOUs) with various federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other state agencies, such as the New Mexico 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 10-20 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 SWQB, and other parties identified in the WBP. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

10.0 Public Participation

Public participation was solicited in development of this TMDL. The draft Animas River TMDL was first made available for a 30-day comment period beginning on May 20th and ending on June 20th, 2013. Response to comments are attached as **Appendix F** to the final draft of this document. 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 June 5th, 2013 at the Farmington Civic Center from 6-8pm.

Once the TMDL was approved by the Water Quality Control Commission and EPA Region 6, the next step for public participation is development of a WBP, as described in **Section 8.2**, and participation in watershed protection projects including those that may be funded by Clean Water Act §319(h) grants. The WBP development process is open to any member of the public who wants to participate.

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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:

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

Conversion Factor Derivation:

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

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

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

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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 (TMDL’s), and Watershed-Based Plans (WBP’s) 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 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., TMDL’s, WBP’s, 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.

Literature Cited:

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Probable Source Development Process

303(d)/305(b) Integrated List

New impaired waters list "unknown" as the default Probable Source. Existing listings retain historic Probable Sources. *Public comment on Probable Sources list sought during the public comment period every two years for the new Integrated List.*

Water Quality Surveys

Public comment solicited by SWQB staff during the pre-survey public meeting(s) held in the watershed.

SWQB staff complete Probable Source Identification form throughout the course of the water quality survey.

TMDL Development

TMDL staff work with Watershed Protection staff in order to solicit input from stakeholders in the watershed during TMDL development.

TMDL staff solicit input from stakeholders during the TMDL public meetings held during the TMDL public comment period.

Watershed Groups & WBP Development

SWQB staff continue to refine the Probable Source List through the development of watershed groups and/or WBP documents in the watershed with continued input by the public.

All input received will be included on the next 303(d)/305(b) Integrated Report and subsequent TMDLs.



New Mexico Environment Department
Surface Water Quality Bureau

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

Revised 02Aug12

Figure B2. Probable Source Identification Sheet for the Public

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

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

APPENDIX C
ANIMAS RIVER CHEMICAL DATA - 2010

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<i>E. coli</i> - Animas River (San Juan River to Estes Arroyo)			
Date	Concentration (cfu/100mL)	Flow (cfs)	Sampling Station
3/16/2010	19.9	322	66Animas017.4
3/17/2010	27.5	342	Animas River at Farmington
4/13/2010	96	910	66Animas017.4
4/14/2010	73.3	772	Animas River at Farmington
5/11/2010	124.6	1780	66Animas017.4
5/12/2010	73.3	1620	Animas River at Farmington
6/15/2010	67.7	943	66Animas017.4
6/16/2010	517.2	918	Animas River at Farmington
7/20/2010	191.8	73	66Animas017.4
7/21/2010	224.7	75	Animas River at Farmington
8/17/2010	307.6	267	Animas River at Farmington
8/17/2010	461.1	267	66Animas017.4
10/13/2010	187.2	196	66Animas017.4
10/14/2010	117.8	188	Animas River at Farmington
11/1/2010	38.4	297	66Animas017.4
11/1/2010	32.3	297	Animas River at Farmington
USGS <i>E. coli</i> - Animas River (San Juan River to Estes Arroyo)			
3/29/2006	33	260	Animas River at Farmington
7/27/2006	140	322	Animas River at Farmington
9/26/2006	1	529	Animas River at Farmington
11/21/2006	18	456	Animas River at Farmington
4/11/2007	96	980	Animas River at Farmington
7/18/2007	630	393	Animas River at Farmington
12/9/2008	43	323	Animas River at Farmington
2/24/2009	24	361	Animas River at Farmington
4/29/2009	76	1380	Animas River at Farmington
12/8/2009	48	252	Animas River at Farmington
12/8/2009	10	252	Animas River at Farmington
5/18/2010	140	1600	Animas River at Farmington
5/18/2010	120	1600	Animas River at Farmington
7/27/2010	960	383	Animas River at Farmington
7/28/2010	1100	361	Animas River at Farmington
12/7/2010	2	265	Animas River at Farmington
<i>E. coli</i> - Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)			
Date	Concentration (cfu/100mL)	Flow (cfs)	Sampling Station
3/16/2010	15.8	337	Animas River above Estes Arroyo
3/16/2010	2	337	Animas River downstream of stateline
4/13/2010	45.7	1020	Animas River above Estes Arroyo
4/13/2010	55.4	1020	Animas River downstream of stateline
5/11/2010	60.2	1940	Animas River downstream of stateline
5/11/2010	67	1940	Animas River above Estes Arroyo
6/15/2010	2419.6	926	Animas River above Estes Arroyo
6/15/2010	48	926	Animas River downstream of stateline
7/20/2010	224.7	36	Animas River above Estes Arroyo
7/20/2010	36.4	36	Animas River downstream of stateline
8/17/2010	344.8	340	Animas River above Estes Arroyo
8/17/2010	2419.6	340	Animas River downstream of stateline
10/13/2010	1986.3	188	Animas River above Estes Arroyo
10/13/2010	35	188	Animas River downstream of stateline
11/1/2010	3	284	Animas River downstream of stateline
11/1/2010	33.6	284	Animas River above Estes Arroyo

Total Phosphorus - Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)			
Date	Concentration (mg/L)	Flow (cfs)	Sampling Station
3/16/2010	0.164	289	Animas River above Estes Arroyo
3/16/2010	0.079	289	Animas River downstream of state line
4/13/2010	0.294	1140	Animas River above Estes Arroyo
4/13/2010	0.266	1140	Animas River downstream of state line
5/11/2010	0.088	2090	Animas River above Estes Arroyo
5/11/2010	0.074	2090	Animas River downstream of state line
6/15/2010	0.039	1180	Animas River downstream of state line
7/20/2010	0.01	256	Animas River above Estes Arroyo
7/20/2010	0.011	256	Animas River downstream of state line
8/17/2010	0.032	570	Animas River above Estes Arroyo
8/17/2010	2.83	570	Animas River downstream of state line
10/4/2010	0.035	243	Animas River above Estes Arroyo
10/13/2010	0.033	347	Animas River above Estes Arroyo
10/13/2010	0.013	347	Animas River downstream of state line
11/1/2010	0.042	297	Animas River above Estes Arroyo

Notes:

Highlighted cells indicate an exceedence of the applicable water quality criterion.

APPENDIX D
HYDROLOGY, GEOMETRY, AND METEOROLOGICAL
INPUT DATA FOR SSTEMP

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D 1.0 INTRODUCTION

This appendix provides site-specific hydrology, geometry, and meteorological data for input into the Stream Segment Temperature (SSTEMP) Model (Bartholow 2002). Hydrology variables include segment inflow, inflow temperature, segment outflow, and accretion temperature. Geometry variables are latitude, segment length, upstream and downstream elevation, Width's A-term, Width's B-term, and Manning's n. Meteorological inputs to SSTEMP Model include air temperature, relative humidity, windspeed, ground temperature, thermal gradient, possible sun, dust coefficient, ground reflectivity, and solar radiation. In the following sections, these parameters are discussed in detail for each assessment unit to be modeled using SSTEMP Model. The assessment units were modeled on the day of the maximum recorded air temperature at the Aztec Ruins weather station, according to the New Mexico State University's Climate Network. The assessment units and modeled dates are defined as follows:

Table D.1 Assessment Units and Modeled Dates

Assessment Unit ID	Assessment Unit Description	Modeled Date
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	7/17/2010

D 2.0 HYDROLOGY

D 2.1 Segment Inflow

This parameter is the *mean daily* flow at the top of the stream segment. If the segment begins at an effective headwater, the flow is entered into SSTEMP Model as zero. Flow data from USGS gages were used when available. To be conservative, the lowest four-consecutive-day discharge that has a recurrence interval of three years but that does not necessarily occur every three years (4Q3) was used as the inflow instead of the mean daily flow. These critical low flows were used to decrease assimilative capacity of the stream to adsorb and disperse solar energy. The 4Q3 will be determined for gaged sites using Version 3.1a DFLOW, a Windows-based tool developed by USGS to estimate user-selected design stream flows for low-flow analysis by utilizing algorithms based on Log Pearson Type III distribution. The following gages were used to determine 4Q3:

Table D.2 USGS Gages on Animas River

Gage	Name	Start Date	End Date
09364500	Animas River at Farmington, NM	Oct 1, 1913	Present
09364010	Animas River below Aztec, NM	Dec 17, 2002	Present
09363500	Animas River near Cedar Hill, NM ^a	Nov 1, 1933	Present

Notes: ^a Gage is located in Southern Ute Indian Tribe

Because USGS Gage 09363500 is located 2.5 miles north of the Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) assessment unit, methods from Thomas *et al.* (1997) (Equation D.1) were used to estimate the flow at the station location for the upstream assessment unit. The 4Q3 calculated from Thomas *et al.* (1997) and from DFLOW had an approximate 1% difference. As such, the DFLOW number was used in further calculations.

Equation D.1:

$$Q_u = Q_g \left(\frac{A_u}{A_g} \right)^{0.5}$$

Where,

- Q_u = Area weighted 4Q3 at the ungaged site (cubic feet per second [cfs])
- Q_g = 4Q3 at the gaged site (cfs)
- A_u = Drainage area at the ungaged site (square miles [mi^2])
- A_g = Drainage area at the gaged site (mi^2)

Drainage areas for assessment unit to which this method was applied are summarized in the following table:

Table D.3 Drainage Areas for Estimating Flow using Thomas *et al.* 1997

Assessment Unit ID	USGS Gage	Drainage Area from Gage (mi ²)	Drainage Area from Top of AU (mi ²)	Drainage Area from Bottom of AU (mi ²)	Ratio of DA of Ungaged (upstream) to Gaged Site	Ratio of DA of Ungaged (downstream) to Gaged Site
NM-2404_00	09363500	1091.404	1096.949	--	--	101%

Based on the use of DFLOW as described above, the following values were estimated for inflow:

Table D.4 Segment Inflow

Assessment Unit ID	Assessment Unit Description	Inflow (cfs)
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	86.5

D 2.2 Inflow Temperature

This parameter represents the *mean daily* water temperature at the top of the segment. Data from thermographs deployed from 2010 at the top of the assessment unit were used when possible. The following inflow temperatures for impaired assessment units were modeled in SSTEMP:

Table D.5 Mean Daily Water Temperature

Assessment Unit ID	Upstream Thermograph Location	Inflow Temperature ^a (°C)	Inflow Temperature (°F)
NM-2403.A_00	Animas abv Estes Arroyo ^b	20.54	68.97

Notes: °C = Degrees Celsius

°F = Degrees Fahrenheit

^a Mean daily average for 2010 water thermograph data

^b Thermograph from downstream Animas (Estes Arroyo to Southern Ute Indian Tribe Bnd)

^c Thermograph from upstream Animas (Estes Arroyo to Southern Ute Indian Tribe Bnd)

D 2.3 Segment Outflow

Flow data from USGS gages were used when available. To be conservative, the 4Q3 was used as the segment outflow. These critical low flows were used to decrease assimilative capacity of the stream to adsorb and disperse solar energy. Outflow was estimated using the methods described in Section D2.1. The following table summarizes 4Q3s used in the SSTEMP Model:

Table D.6 Segment Outflow

Assessment Unit ID	Assessment Unit Description	Outflow (cfs)^a
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	73.5

Notes: a cfs = cubic feet per second

D 2.4 Accretion Temperature

The temperature of the lateral inflow, barring tributaries, generally should be the same as groundwater temperature. In turn, groundwater temperature may be approximated by the mean annual air temperature. Mean annual air temperatures for 2010 were used in the absence of measured annual data. The following table presents the mean annual air temperature for each assessment unit:

Table D.7 Mean Annual Air Temperature as an Estimate for Accretion Temperature

Assessment Unit ID	Mean Annual Air Temperature (°C)	Mean Annual Air Temperature (°F)
NM-2403.A_00	11.57	52.82

Notes: °C = Degrees Celsius

°F = Degrees Fahrenheit

Weather Station Data from New Mexico State University Climate Network (NWS Cooperative Observer Program, Aztec Ruins, NM station, Latitude 36.84N, Longitude 108.00W), 2010.

D 3.0 GEOMETRY

D 3.1 Latitude

Latitude refers to the position of the stream segment on the earth's surface. Latitude is generally determined in the field with a global positioning system (GPS) unit. Latitude for each assessment unit is summarized below:

Table D.8 Assessment Unit Latitudes

Assessment Unit	Assessment Unit Description	Latitude (decimal degrees)
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	36.78

D 3.2 Dam at Head of Segment

Neither of the assessment units have a dam at the upstream end of the segment.

D 3.3 Segment Length

Segment length was determined with National Hydrographic Dataset Reach Indexing GIS tool. The segment lengths are as follows:

Table D.9 Segment Lengths

Assessment Unit	Assessment Unit Description	Length (miles)
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	16.8

D 3.4 Upstream Elevation

The following upstream elevations were determined with National Hydrographic Dataset Reach Indexing GIS tool.

Table D.10 Upstream Elevations

Assessment Unit	Assessment Unit Description	Upstream Elevation (feet)
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	5574

D 3.5 Downstream Elevation

Table D.11 Downstream Elevations

Assessment Unit	Assessment Unit Description	Downstream Elevation (feet)
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	5249

D 3.6 Width's A and Width's B Term

Width's B Term was calculated as the slope of the regression of the natural log of width and the natural log of flow. Width versus flow regression analyses were prepared by entering cross-section field data into a Windows-Based Stream Channel Cross-Section Analysis (WINXSPRO 3.0) Program (U.S. Department of Agriculture [USDA] 2005). Theoretically, the Width's A Term is the untransformed Y-intercept. However, because the width versus discharge relationship tends to break down at very low flows, the Width's B Term was first calculated as the slope, and Width's A Term was estimated by solving for the following equation:

$$W = A \times Q^B$$

Where,

- W =Known width (feet)
- A =Width's A Term (seconds per square foot)
- Q =Known discharge (cfs)
- B =Width's B Term (unitless)

The following table summarizes Width's A and B Terms for assessment units requiring temperature TMDLs:

Table D.12

Assessment Unit ID	Assessment Unit Description	Width's A Term	Width's B Term
NM-2403.A_00	Animas River (San Juan River to Estes Arroyo)	49.6	0.0724

The following figure presents the detailed calculations for the Width's B-Term. Measurements were collected via boatable EMAP within the assessment unit and averaged to result in one cross-section. The regression of natural log of width and natural log of flow is as follows:

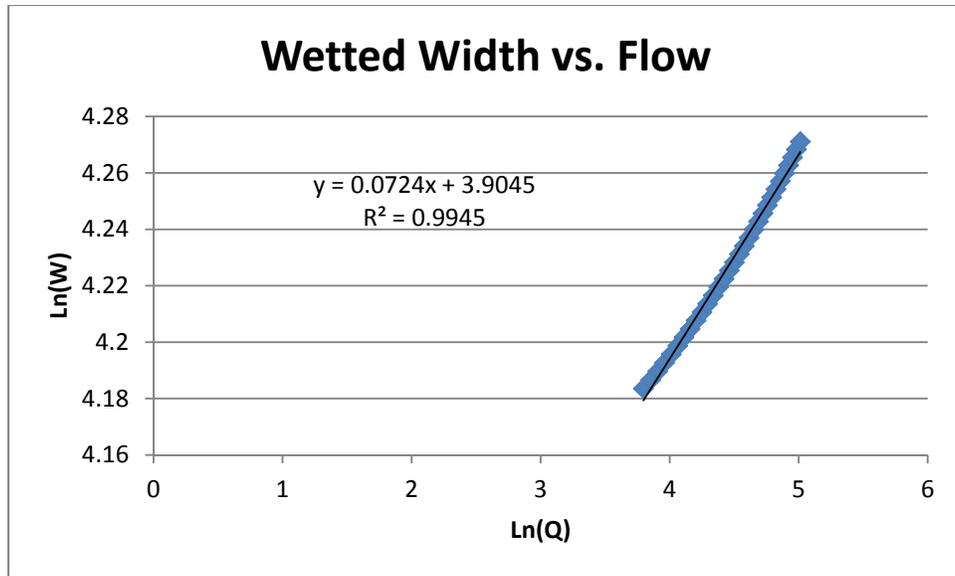


Figure D.1 Wetted Width versus Flow for Assessment Unit NM-2403.A_00

D 3.7 Manning's n or Travel Time

Site-specific values were calculated using Stickler's equation to estimate Manning's roughness (Manning's n) based on prevailing sediment sizes in the streambed:

$$n = \frac{(d_{50})^{\frac{1}{6}}}{21.0}$$

where d_{50} is the median sediment size in meters.

The following table summarizes the Manning's n input values for each assessment unit:

Table D.13 Manning's n values

Assessment Unit	d_{50} (in meters)	Manning's n
NM-2403.A_00	0.080	0.031

D 4.0 METEOROLOGICAL PARAMETERS

D 4.1 Air Temperature

This parameter is the mean daily air temperature for the assessment unit (or average daily temperature at the mean elevation of the assessment unit). Air temperature will usually be the single most important factor in determining mean daily water temperatures. Air temperatures are usually measured with air thermographs located in the shade and adjusted to what the temperature would be at the mean elevation of the assessment unit. No air thermographs were deployed in 2010. Instead, the mean air temperature for the month of July was obtained from a dataset created using the PRISM climate mapping system. PRISM uses point measurements to produce continuous, digital grid climatic estimates (PRISM 2007). A representative temperature for the AU was determined by averaging the PRISM temperature at the top and bottom of the AU.

Table D.14 Air Temperature

Assessment Unit	Measured Mean July Air Temperature (°C)	Adjusted Mean July Air Temperature (°F)
NM-2403.A_00	22.6	72.68

Notes: °C = Degrees Celsius
°F = Degrees Fahrenheit

D 4.2 Maximum Air Temperature

Unlike the other variables, the maximum daily air temperature overrides only if the check box is checked. If the box is not checked, the SSTEMP Model estimates the maximum daily air temperature from a set of empirical coefficients (Theurer et al., 1984 as cited in Bartholow 2002) and will print the result in the grayed data entry box. A value cannot be entered unless the box is checked. Because of the nature of the arid climate and the resulting large diurnal temperature swing, the maximum temperature estimate resulting from the empirical coefficients discussed above result in a substantially lower maximum temperature than was observed for the model day. As such, a maximum temperature was entered into the SSTEMP Model box after applying the elevation correction below.

The adiabatic lapse rate was used to correct for elevation differences between the AUs and the met station:

$$T_a = T_0 + C_t \times (Z - Z_0)$$

Where,

- T_a = air temperature at elevation E (°C)
 T_0 = air temperature at elevation E_0 (°C)
 C_t = moist-air adiabatic lapse rate (-0.00656 °C/meter)
 Z = mean elevation of segment (meters)
 Z_0 = elevation of met station (meters)

Table D.15 Adjusted Maximum Temperature

Assessment Unit	Measured Maximum Air Temperature (°C)	Adjusted Maximum Air Temperature (°C)	Adjusted Maximum Air Temperature (°F)
NM-2403.A_00	38.88	39.35	102.83

D 4.3 Relative Humidity

Relative humidity data were obtained from the New Mexico State University Climate Network (<http://weather.nmsu.edu/data/data.htm>). The data were corrected for elevation and temperature using the following equation:

$$R_h = R_0 \times (1.0640^{T_0 - T_a}) \times \left(\frac{T_a + 273.16}{T_0 + 273.16} \right)$$

Where,

- R_h = relative humidity for temperature T_a (decimal)
 R_0 = relative humidity at met station (decimal)
 T_a = air temperature at segment (°C)
 T_0 = air temperature at met station (°C)

The following table presents the adjusted mean daily relative humidity for the assessment unit:

Table D.16 Mean Daily Relative Humidity

Assessment Unit	Mean Daily Air Temperature at Weather Station (°C)	Mean Daily Air Temperature at AU (°C)	Mean Daily Relative Humidity at Weather Station (%)	Mean Daily Relative Humidity for AU (%)
NM-2403.A_00	26.17	20.46	30	42

Note: Weather Station Data are from New Mexico State University Climate Network (Albino Canyon RAWS, Latitude 36.977N, Longitude 107.628W), modeled dates in 2010.

D 4.4 Wind Speed

Average daily wind speed data were obtained from the New Mexico State University Climate Network (<http://weather.nmsu.edu/data/data.htm>). The following table presents the mean daily wind speed for the assessment unit:

Table D.17

Assessment Unit	Mean Daily Wind Speed (mph)
NM-2403.A_00	5.92

Note: Weather Station Data are from New Mexico State University Climate Network (Cuba RAWS, Latitude 35.942 N, Longitude 107.077W), modeled dates in 2010.

D 4.5 Ground Temperature

Mean annual air temperature data for 2010 were used in the absence of measured data. The following table presents the mean annual air temperature for each assessment unit:

Table D.18

Assessment Unit	Mean Annual Air Temperature (°C)	Mean Annual Air Temperature (°F)
NM-2403.A_00	11.63	52.93

Notes: °C = Degrees Celsius

°F = Degrees Fahrenheit

Weather Station Data from New Mexico State University Climate Network (NWS Cooperative Observer Program, Aztec Ruins, NM station, Latitude 36.84N, Longitude 108.00W), 2010.

D 4.6 Thermal Gradient

The default value of 1.65 was used in the absence of measured data.

D 4.7 Possible Sun

Percent possible sun for Albuquerque is found at the Western Regional Climate Center web site (<http://www.wrcc.dri.edu/htmlfiles/westcomp.sun.html#NEW%20MEXICO>). The percent possible sun is 76 for the month of July.

D 4.8 Dust Coefficient

If a value is entered for solar radiation, SSTEMP Model will ignore the dust coefficient and ground reflectivity and “override” the internal calculation of solar radiation. Solar radiation data are available from the New Mexico State University Climate Network (see Section D 4.10).

D 4.9 Ground Reflectivity

If a value is entered for solar radiation, SSTEMP Model will ignore the dust coefficient and ground reflectivity and “override” the internal calculation of solar radiation. Solar radiation data are available from the New Mexico State University Climate Network (see Section D 4.10).

D 4.10 Solar Radiation

Because solar radiation data were obtained from an external source of ground level radiation, it was assumed that about 90% of the ground-level solar radiation actually enters the water. Thus, the recorded solar measurements were multiplied by 0.90 to calculate the solar radiation value entered into the SSTEMP Model.

D.19 Solar Radiation

Assessment Unit ID	Date	Mean Solar Radiation (MJ/m²)	Mean Solar Radiation (L/day)	Mean Solar Radiation x 0.90 (L/day)
NM-2403.A_00	7/17/2010	22.43	535.85	482.27

D 5.0 SHADE

Percent shade was estimated for the assessment unit using canopy measurements collected during the 2010 survey. Densimeter readings were collected along both reaches during boatable EMAP surveys. The value in Table D.20 reflects 2 measurements taken at 11 cross-sections (total of 22 measurements) within the AU. The measurements may have also been compared with visual estimates using USGS digital orthophoto quarter quadrangles downloaded from New Mexico Resource Geographic Information System Program (RGIS), online at <http://rgis.unm.edu/>. This parameter refers to how much the segment is shaded by vegetation, cliffs, etc. The following table summarizes percent shade:

Table D.20 Percent Shade

Assessment Unit ID	Site	Date	Percent Shade
NM-2403.A_00	66Animas001.7	10/8/2010	17.4

D 6.0 REFERENCES

- Bartholow, J.M. 2002. SSTEMP for Windows: The Stream Segment Temperature Model (Version 2.0). U.S. Geological Survey computer model and documentation. Available online at www.fort.usgs.gov. Revised August 2002.
- U.S. Department of Agriculture (USDA). 2005. WinXSPRO 3.0. A Channel Cross Section Analyzer. WEST Consultants Inc. San Diego, CA & Utah State University.
- Theurer, Fred D., Kenneth A. Voos, and William J. Miller. 1984. Instream Water Temperature Model. Instream Flow Inf. Pap. 16 Coop. Instream Flow and Aquatic System Group. U.S. Fish & Wildlife Service, Fort Collins, CO.
- Thomas, Blakemore E., H.W. Hjalmarson, and S.D. Waltemeyer. 1997. Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States. USGS Water-Supply Paper 2433.

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APPENDIX E
JURISDICTIONAL AREA APPROACH

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EPA released a memo entitled “Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs” in November 2002 clarifying EPA regulations regarding Waste Load Allocations (WLA) and Municipal Separate Storm Sewer Systems (MS4s) in TMDLs; a revision to the memo was released in 2010. In November 2008, EPA released the draft TMDLs to Stormwater Handbook to provide guidance to states as to how to include WLAs for MS4s in TMDLs. The handbook provides a number of options for states to consider when developing TMDLs that include MS4 allocations. One of the waterbody-based approaches to TMDL development includes the jurisdictional area approach:

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

The excerpts from the TMDLs to Stormwater Handbook provide the framework from which SWQB developed the WLA for the Phase II sMS4 permittees for each impaired Assessment Unit. The following explanation provides additional detail on these jurisdictional area calculations to supplement the information provided in Section 4.4.1, 5.4.1, and 6.4.1.

Table E.1 Jurisdictional Areas

	Animas River (San Juan River to Estes Arroyo) (mi ²)	Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) (mi ²)
Urbanized Area within New Mexico portion of Animas Watershed	21.96	3.5
Total Contributing Watershed Area ^(a)	275.32	186.5
Percent Jurisdictional Area (%)	8.00	1.9

Notes: ^(a) Total Contributing Watershed Area is based on the areas of the HUC12s that lie at least partially within New Mexico. For detail, see Figure E.1.

^(b) Urbanized Areas were determined using GIS data associated with the 2010 Census – 2010 TIGER Files

Determination of Contributing Watershed Area

For the purposes of the sMS4 WLA determinations, the contributing watershed is considered to be the Animas drainage from just above the New Mexico-Southern Ute Indian Tribe boundary to the San Juan River (Figure E.1). This contributing drainage includes the USGS Hydrologic Unit Code (HUC) 14080104. The total contributing area from the HUC was determined to be 275.32 sq. mi. This area is based on the cumulative area of the smaller HUC12 units that lie at least partially in New Mexico. This is delineated in Figure E.1.

Phase II Permit Jurisdictional Area Approach

The four sMS4 permittees eligible for coverage under the general Phase II MS4 permit are discussed in Section 4.4.1. The Phase II sMS4 permit (NMR04000) reads:

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

The Urbanized Areas (UA) upstream from the San Juan River within the Animas River drainage in New Mexico was determined from GIS coverage to be 25.46 sq. mi; 21.96 sq. mi. fall into the Animas River (San Juan River to Estes Arroyo) AU and 3.5 sq. mi. fall into the Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) AU. For the purposes of the MS4 WLA determinations, the contributing watershed is considered to be the Animas River drainage from its confluence with the San Juan River to just above the Southern Ute Indian Tribe bnd, determined by HUC 12. This contributing drainage includes the USGS Hydrologic Unit Code 14080104 (HUC) displayed in Figure E.1. The total contributing area from the HUC is 275.32 sq. mi as delineated in Figure E.1.

Therefore, for the Animas River (San Juan River to Estes Arroyo) AU, the Phase II sMS4 WLA is calculated as follows (see Table E.1):

$$\begin{aligned} \text{Total jurisdictional area} / \text{Total contributing drainage area} &= \\ 21.96 \text{ sq. mi.} / 275.32 \text{ sq. mi.} &= 8.00\% \end{aligned}$$

The Phase II sMS4 WLA for the Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) AU is calculated as follows (see Table E.1):

$$\begin{aligned} \text{Total jurisdictional area} / \text{Total contributing drainage area} &= \\ 3.5 \text{ sq. mi.} / 186.5 \text{ sq. mi.} &= 1.9\% \end{aligned}$$

**Animas Watershed
HUC - 14080104
Urbanized Area 2010**

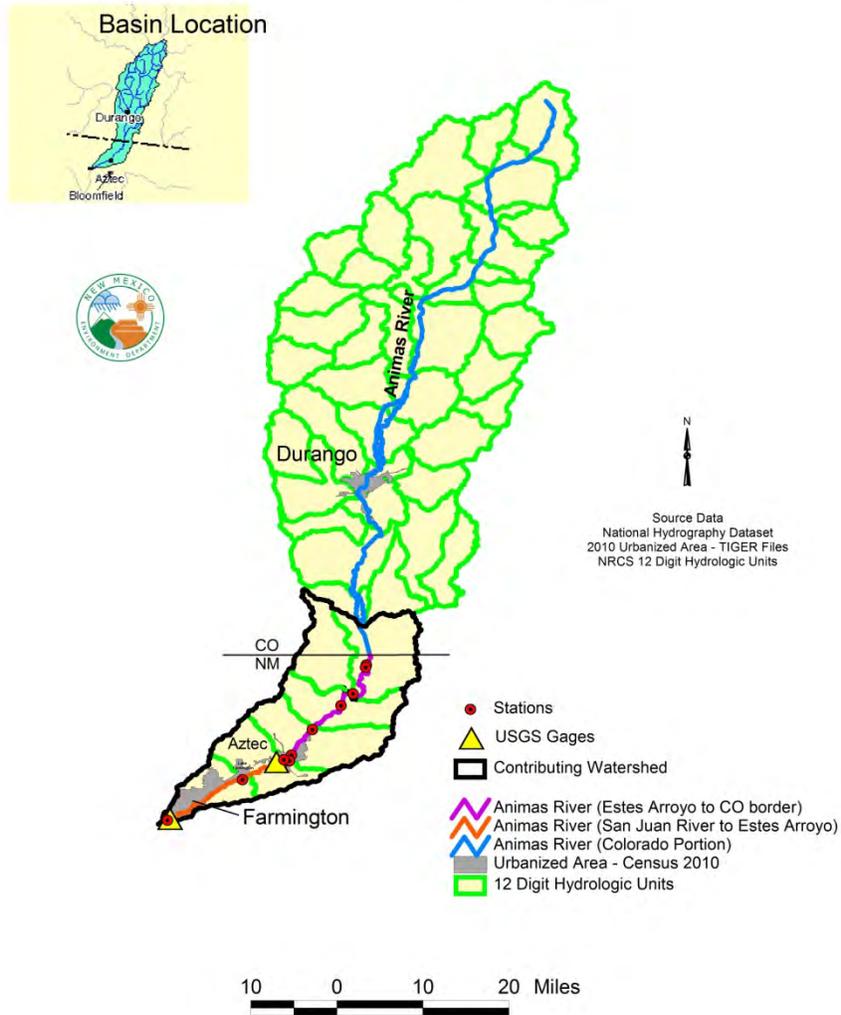


Figure E.1 Urbanized areas in the Animas River watershed

These calculations are summarized in Section 4.4.1. The Phase II sMS4 WLA values used in the TMDL document were rounded from these percent jurisdictional estimates to 8% and 2%, respectively.

Without rounding of these estimated values, the Animas River (San Juan River to Estes Arroyo) WLA is 8.00% and the Animas River (Estes Arroyo to Southern Ute Indian Tribe Bnd) WLA is 1.9%. In evaluating the potential impact, SWQB finds that this approach results in a slightly

larger overall allocation for sMS4 permittees within the Animas watershed, providing the permittees a larger WLA with which to work.

The remaining percentage was designated for nonpoint sources and natural background as the LA. The WLA values for NMR040000 (Phase II sMS4s) are listed in Table 4.5.

The TMDLs were calculated as described in Table 4.6. From this calculated TMDL value, the Margin of Safety (MOS) and the NPDES permits were subtracted. In order to calculate the Phase II sMS4 permit WLAs, the percentages derived using the jurisdictional area approach were applied to the remaining TMDL quantity (Table 4.6). For example, the *E. coli* WLA for the Animas River (San Juan River to Estes Arroyo) AU was calculated as follows:

$$\text{TMDL} - \text{MOS}^* - \text{NPDES WLA}^{**} = \text{LA}$$

$$2.3 \times 10^{11} - 2.3 \times 10^{10} - 4.8 \times 10^9 = 2.0 \times 10^{11} \text{ cfu/day}$$

**as discussed in Section 4.7*

***note: WLA for NM0028762*

The MS4 WLAs were assigned as a percentage of the LA.

Phase II sMS4 WLA = 8%, therefore;

$$\text{NMR040000 WLA} = 0.08 \times 2.0 \times 10^{11} \text{ cfu/day} = 1.6 \times 10^{10} \text{ cfu/day}$$

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

$$\text{TMDL} - \text{MOS} - \text{NPDES WLA} - \text{MS4 WLA} = \text{LA}$$

$$2.3 \times 10^{11} - 2.3 \times 10^{10} - 4.8 \times 10^9 - 1.6 \times 10^{10} = 1.8 \times 10^{11} \text{ cfu/day}$$

The sMS4 WLA allocations for temperature and total phosphorus were calculated similarly.

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA presented in the associated TMDL can be adjusted using a per area loading. This adjustment maintains the overall TMDL and a consistent per area watershed loading and transfers load between the LA and WLA. As this change would be consistent with the overall goals of the TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

The loading factor was calculated by dividing the combined existing sMS4 allocation and load allocation by the contributing watershed area. The following equation was used for the calculation:

$$\text{Loading Factor} = (\text{sMS4 WLA} + \text{LA}) / \text{Contributing Area}$$

The parameters and values used in the calculation are in Table E.2. The calculated loading factors are in Table E.3.

Table E.2 Contributing Areas and sMS4 WLA+LA

Assessment Unit	Total Contributing Area (sqmi)	<i>E. coli</i> sMS4 WLA + LA (cfu/day)	Temperature sMS4 WLA + LA (J/m ² /s/day)	Total Phosphorus sMS4 WLA + LA (lbs/day)
Animas River (San Juan River to Estes Arroyo)	275.32	1.99 x 10 ¹¹	111.6	NA
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	186.5	2.40 x 10 ¹¹	NA	41.96

Notes: NA = not applicable

Table E.3 Loading Factors per Square Mile

Assessment Unit	<i>E. coli</i> loading (cfu/sqmi/day) ^(a)	Temperature (J/m ² /s/day/sqmi) ^(b)	Total Phosphorus (lbs/sqmi/day) ^(c)
Animas River (San Juan River to Estes Arroyo)	7.24 x 10 ⁸	0.41	NA
Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd)	1.29 x 10 ⁹	NA	0.22

Notes: ^(a) cfu/sqmi/day = colony forming units per square mile per day
^(b) J/m²/s/day/sqmi = Joules per square meter per second per day per square mile
^(c) lbs/sqmi/day = pounds per square mile per day
 NA = not applicable

References:

US EPA, 2002. “Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs.” Washington, D.C. Available online at <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/final-wwtmdl.pdf>.

US EPA, 2008. TMDLs to Stormwater Permits Handbook (draft). Washington, D.C. Available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/tmdl-sw_permits11172008.pdf.

APPENDIX F
PUBLIC COMMENTS

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SWQB hosted a public meeting in Farmington, NM on June 5, 2013 to discuss the Public Comment Draft Animas River TMDL document. Notes from the public meeting are available in the SWQB Administrative Record.

The following changes were made to the Final Draft document in response to public comment received at the meeting and afterwards:

1. Questions were raised during the public meeting regarding Colorado's nutrient criteria. SWQB received clarification and adjusted Section 3.1 to reflect interim values.
2. EPA R6 noted discrepancies between WLA values in *E. coli* Tables 4.5 and 4.7 and Temperature tables 5.4 and 5.6. These discrepancies have been corrected.
3. SWQB Point Source Regulation Section staff noted an incorrect discharge volume for the City of Farmington Animas Steam Plant in Section 5.4.1. The discharge has been corrected, resulting in a change to the WLA for the facility.
4. EPA R6 noted that an incorrect number of SMS4 permittees and urbanized areas were identified in the document. This has been corrected throughout the document to reflect that there are 4 SMS4 permittees and one urbanized area at the time of publication.

Written comments received during the 30-day public comment period:

- A. Jimmie R. Newton, Jr., Chairman, Southern Ute Indian Tribal Council
- B. L. Randy Kirkpatrick, San Juan Water Commission
- C. Andrew Galloway, Chief Operator for City of Aztec
- D. Adam T. Reeves and Jeffrey M. Kane, Maynes, Bradford, Shipps & Sheftel, LLP for Southwestern Water Conservation District

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Comment Set A

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SOUTHERN UTE INDIAN TRIBE

June 12, 2013

Meghan Bell
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502
meghan.bell@state.nm.us

Via regular mail and email



Re: Comments on the Draft TMDL for the Animas River watershed in New Mexico

Dear Ms. Bell:

The Southern Ute Indian Tribe appreciates this opportunity to comment on the New Mexico Environment Department ("NMED") *DRAFT Total Maximum Daily Load (TMDL) for the Animas River Watershed [San Juan River to Southern Ute Indian Tribe Bnd]* ("Draft TMDL"). As the Draft TMDL acknowledges, the Tribe anticipates seeking Treatment as a State status from the EPA for purposes of establishing water quality standards once its revised water quality standards have undergone public review and comment. In preparing the Tribe's forthcoming water quality standards, the Tribe's Water Quality Program ("WQP") staff has collected a great deal of data to support the designation of uses for its waters, including the Animas River. The Tribe's WQP staff also administers Section 319 grants from the EPA and has completed several stream restoration and BMP implementation projects, including on the Animas River. In addition, the Tribe serves as a member of the Animas Watershed Partnership ("AWP"), which works closely with the San Juan Watershed Group, and provides technical assistance and support to the AWP on a regular basis. The Tribe looks forward to coordinating its efforts with those of New Mexico to protect and improve water quality on the Animas River and other waters that cross the Southern Ute Indian Reservation before entering New Mexico.

At the outset, the Tribe wishes to voice its appreciation that the NMED, in its final *2012 - 2014 State of New Mexico CWA §303(d)/§305(B) Integrated List and Report*, endeavored to properly acknowledge the upstream jurisdictional authority of the Tribe. The NMED changed the names of the Assessment Units of the most upstream segments of the Animas River and the La Plata River to indicate the Southern Ute Indian Reservation forms the upstream boundary. This clarification

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will assist the public in understanding the roles of the respective sovereigns in protecting water quality on those rivers.

SWQB Response: SWQB appreciates your comments and looks forward to coordinating with the Southern Ute Indian Tribe in the future.

The following are the Tribe's specific comments on the Draft TMDL: First, the Tribe strongly supports the NMED's plan to consider changing the aquatic life use designation for the Animas River segment downstream of the Reservation (Draft TMDL at p. 8). Because the Clean Water Act and its implementing regulations require an upstream state or Indian tribe to take into consideration the water quality standards of downstream waters and to provide for their attainment and maintenance, it is vital to the Tribe that New Mexico set its use designations, numeric criteria, and TMDLs based on a sound scientific evaluation of adequate data. The Tribe's temperature data for the Animas River immediately upstream of New Mexico, some of which has been shared in graphical format with the NMED before, indicates that the current "coldwater aquatic life" designated use for that assessment unit probably is unattainable and, therefore, inappropriate. Just as informative, fish community composition data from surveys of the River upstream of New Mexico also indicate that the River does not regularly support a cold-water fishery. The Tribe's data and analyses support the NMED's proposal to consider changing the designated use rather than to prepare a TMDL for temperature for that segment at this time. The Tribe would be open to sharing its data and analysis if it may assist the NMED in that process.

SWQB Response: SWQB notes the Tribe's support. SWQB is happy to accept data from outside sources provided they meet the QA/QC requirements outlined in the QAPP. More information can be found at www.nmenv.state.nm.us/swqb/DataSubmittals. Temperature and fish data will be especially useful for the continued UAA development. SWQB will request formal public comment on the Animas River UAA proposal during the upcoming Triennial Review process.

Second, while the Tribe supports the NMED's efforts to improve water quality through the analyses and recommendations in the Draft TMDL and understands New Mexico's obligations under the Clean Water Act, the Tribe has concerns about limitations in the data and analyses in the Draft TMDL. Specifically, the estimates of loads for each pollutant are based on a limited number of measurements from a single year, 2010. The Tribe questions, therefore, how representative those data may be of water quality conditions in general, and whether they are sufficient to estimate loads among point and nonpoint pollutant sources and to establish what background loads and an appropriate margin of safety might be for the Animas River in New Mexico. The Tribe recommends collecting and incorporating additional monitoring data for those pollutants before the TMDL is finalized.

SWQB Response: Thank you for your comment. SWQB recognizes the concern regarding limited data. However, the SWQB Assessment Protocols in place at the time of the 2010 survey assessment state that: "A minimum of two data points for field and chemical parameters is

necessary to apply the procedures in Section 3.0 in order to determine attainment status for an associated designated use in a particular AU.”

The assessment protocols that SWQB uses to determine impairment of waterbodies are revised periodically. The revision process includes a public comment period, during which stakeholders are encouraged to comment and make suggestions on the proposed protocols. The reach was listed as impaired for total phosphorus for the first time on the 2012-2014 Integrated List of Assessed Surface Waters. The Integrated List was subject to public review and comment during the public comment period, which took place from December 15, 2011 to January 30, 2012. Additionally, details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2012-2014 State of New Mexico CWA §303(d)/ §305(b) Integrated List public record.

TMDLs are typically calculated by multiplying the water quality criteria (20.6.4 NMAC) by the critical flow value. Water quality data is not used in the calculation of the TMDL or its allocations. Additional data collection could be relevant during assessments and impairment determination, but additional data would not change the actual calculated TMDL. Background loads are, in this TMDL, considered a part of the load allocation. In most cases, waste load allocations for point sources are calculated using the water quality criterion and design capacity of the facility. For some parameters, it may be more effective to assign a point source an allocation, but identify more specific or appropriate actions in the Implementation Section (Section 8.0) to include in the NPDES permit. The temperature WLA for the City of Farmington’s Animas Steam Plant is an example of this. The assessment unit that is adjacent to the Southern Ute-New Mexico boundary does not have any NPDES point sources identified, and the allocation for the SMS4 permittees in the AU was determined using the EPA-approved percent jurisdictional area approach, as outlined in Appendix D of the TMDL document.

Water quality data is used to discuss load reductions, but neither Section 303 of the Clean Water Act nor Title 40, Part 130.7 of the Code of Federal Regulations requires states to include discussions of load reductions in TMDL documents. Although NMED believes that it is often useful to discuss the magnitude of water quality exceedences in the TMDL, the “percent reduction” value can be calculated in multiple ways and as a result can often be misinterpreted. The calculation of measured loads of contaminants is meant to offer an estimate of conditions, and SWQB acknowledges the limitations and approximate nature of those loads.

Third, reliance on measurements of total phosphorus concentrations alone is inadequate to characterize or allocate loads of this nutrient in the Animas River. While the Tribe supports the goal of minimizing and reducing nutrient loads to the Animas River where practicable, we recommend that the NMED include analysis of additional parameters related to phosphorus in the Draft TMDL to determine the extent to which attainment of designated uses may be achieved by reducing phosphorus loads. As the Draft TMDL acknowledges, it is the symptoms of nutrient enrichment that may impair aquatic life and other uses, not excessive levels of nutrients in and of themselves. Therefore, to characterize the effects of nutrient loading, prescribe management actions, and monitor changes in water quality it is

necessary also to assess parameters directly related to nutrient enrichment, such as dissolved oxygen, pH, and algal cover. Measuring such parameters may also help identify sources of nutrients, assess the degree to which other related variables (e.g., riparian shade, flow alterations, channel morphology, channel substrate composition, wildfires, drought) influence the effects of phosphorus loads, identify the parameters or pollutants that may be most directly resulting in any designated use impairments, and establish water quality benchmarks that are of most concern to the public (e.g., water clarity, taste and odor, fishery health).

SWQB Response: We understand that you are concerned that the waterbody is not impaired for nutrients. SWQB has been working with EPA and stakeholders to address nutrient impairment. Additionally, New Mexico has developed a Nutrient Assessment Protocol for perennial, wadeable streams which addresses both cause and response variables and utilizes a weight-of-evidence approach. SWQB has outlined its process of developing nutrient criteria in its Nutrient Criteria Development Plan. More information regarding this process can be found at: www.nmenv.state.nm.us/swqb/Nutrients.

The Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) AU has a segment-specific Total Phosphorus numeric criterion of 0.1 mg/L that has been included in the New Mexico Water Quality Standards since 1973, and this TMDL was developed for this particular parameter, not nutrients as a whole. Data collected during the 2010 stream survey indicates that the waterbody is impaired using the Assessment Protocols in place at the time of assessment. The reach was listed as impaired for total phosphorus for the first time on the 2012-2014 Integrated List of Assessed Surface Waters, although it had been historically listed for plant nutrients. At the time of the 2010 survey, the Animas River was classified as a non-wadeable river, thus the Nutrient Assessment Protocol was not applicable; SWQB is currently developing a nutrient assessment protocol that would apply to non-wadeable, or large, streams.

The assessment protocols that SWQB uses to determine impairment of waterbodies are revised periodically. As previously mentioned, the revision process includes a public comment period, during which stakeholders are encouraged to comment and make suggestions on the proposed protocols.

Fourth, the Tribe looks forward to providing input to the NMED for any forthcoming Watershed-based Plan to reduce pollutant loadings to the Animas River. In particular, the Tribe would support the NMED in developing a framework to facilitate pollutant "trading" between pollutant sources, whether point or nonpoint. The Tribe has ongoing nonpoint source pollution reduction projects in the Animas River watershed, and additional nonpoint source management projects could be implemented on the Reservation that would reduce pollutant loads in the Animas River in New Mexico. A trading framework could provide additional resources for the Tribe's established program and reduce loading immediately above New Mexico, benefitting the environment of both the Tribe and New Mexico.

The Tribe began implementing stream restoration projects using Clean Water Act Section 319 funds in 1999. The Tribe has implemented ten stream restoration projects restoring over six miles of creek and river channel and surrounding riparian area enhancements. The Tribe has completed one stream restoration project on the Animas River near Bondad Hill in 2011. That project is estimated to prevent approximately 330 tons of sediment from entering the Animas River annually. The Tribe also put a grazing moratorium in place to improve the health of and protect the surrounding riparian area.

In 2004, the Tribe began implementing agricultural Best Management Practices using Clean Water Act Section 319 funds. The Tribe's program supplies improved irrigation equipment, riparian exclusion fencing, field filter strips, and off stream watering sources to reduce nonpoint source pollution from agricultural land use on the Reservation. The program serves both Tribal and non-Tribal land owners and managers within the exterior boundary of the Reservation. To date, the Tribe's Section 319 BMP program has 34 active cost share projects that cover more than 760 acres within the Reservation, significantly reducing loads of nitrogen, phosphorus, and sediment to Reservation waters on an ongoing basis.

SWQB Response: Thank you for your comment. SWQB looks forward to receiving the Tribe's input on the WBP once development is underway and coordinating with the Tribe on watershed planning where appropriate. Section 8 of the TMDL discusses TMDL implementation and the efforts of the Watershed Protection Section of SWQB.

Finally, the Tribe wishes to note that the potential for impacts to water quality from operation of the Animas-La Plata Project, discussed on pages 26 and 51 of the Draft TMDL, should be characterized and evaluated more accurately or deleted altogether. Chapter 3.3 of the Animas-La Plata Project *Final Supplemental Environmental Impact Statement* (FSEIS) assessed its potential impacts to water

quality. That analysis predicted that under full project operation there would be some effects to water quality in the New Mexico portion of the Animas River, primarily for concentrations of certain metals, but those projected increases were not determined to be significant (*see* enclosure, Tables 3.3-6 of the FSEIS). Further, the FSEIS relied on multiple conservative assumptions regarding the type and place of use of Project water and the associated depletions therewith. The ultimate uses, timing, and location of use remain to be determined, which for much of the Project supply will likely be years away. It could be that future Project releases from Lake Nighthorse actually increase flows in Animas River during the most water-short periods, especially given that the San Juan Water Commission, the La Plata Conservancy District, and the Navajo Nation are each expected to receive Project deliveries of water stored in Lake Nighthorse via the Animas River in New Mexico. In sum, the potential effects to the water quality of the Animas River from the operation of the Animas-La Plata Project are speculative at best and are likely years away. Therefore, discussion of the potential impacts of the Project would not appear to be relevant to this Draft TMDL.

SWQB Response: Thank you for your comment. SWQB appreciates clarification of the impacts to be expected from the full operation of the Animas-La Plata Project. A requirement of the TMDL process is to discuss potential future growth in the watershed which could impact surface water quality. While full operation is expected to be some distance in the future, it is a foreseeable use and is therefore relevant to the TMDL. EPA requires that TMDLs include a discussion about potential future growth, and SWQB has determined that this represents potential future growth. The sections referenced in the comment have been updated with more detailed and accurate information.

Once again, thank you for the opportunity to submit these comments. Please contact our Water Quality Program Manager, Sal Valdez, at 970.563.0135 if the Tribe can provide any additional information. The Tribe looks forward to coordinating its efforts with those of New Mexico to protect and improve water quality in the Animas River and other waters that cross the Southern Ute Indian Reservation before entering New Mexico.

Sincerely,



Jimmy R. Newton, Jr., Chairman
Southern Ute Indian Tribal Council

enclosure

cc: Sadie Hoskie, EPA Region 8 Water Program Director (via email:
hoskie.sadie@epamail.epa.gov)
Steve Gunderson, Director, Colorado Water Quality Control Division (via
email: steve.gunderson@state.co.us)
Peter Butler, Chair, Colorado Water Quality Control Commission (via email:
cdphe.wqcc@state.co.us)

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San Juan Water Commission

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MEMBERS

City of Artec
City of Bloomfield
City of Farmington
San Juan County

S.J. County Rural Water Users Association

June 18, 2013

Ms. Meghan Bell
Assessment & TMDL Team
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502

*Via e-mail (meghan.bell@state.nm.us)
and U.S. mail*

Re: Comments of San Juan Water Commission on SWQB's Draft Total Maximum Daily Load (TMDL) for the Animas River Watershed

Dear Ms. Bell:

Pursuant to the Surface Water Quality Bureau's ("SWQB") public notice inviting comments on its Draft Total Maximum Daily Load (TMDL) for the Animas River Watershed ("TMDL Discussion Draft"), I hereby submit the following general comments on behalf of San Juan Water Commission ("SJWC").

As you may already be aware, SJWC has been an active participant in Triennial Reviews and TMDL's, and we plan to play an active role in the next Triennial Review as well. We look forward to working with you and other SWQB personnel during the entire TMDL process. With that goal in mind, SJWC would like to thank you for your invitation to attend the stakeholder meetings you held in Farmington on June 5, 2013. The information you provided concerning SWQB's TMDL Draft was very enlightening and has enabled SJWC to more easily determine its initial position on each of SWQB's proposals. We hope you will continue SWQB's dialogue with interested parties throughout the TMDL process.

GENERAL COMMENTS

SJWC appreciates SWQB's effort to address the Waste Load Allocations through the TMDL process, Section 303(d) of the Federal Clean Water Act ("TMDL Discussion Draft") for load capacity to known point sources and nonpoint sources at a given flow. This is much needed. SJWC also appreciates both the very thorough explanations provided in the "TMDL" document throughout the Draft and the attached explanatory attachments on complex subjects. SJWC strongly supports the continuation of this practice, which clarifies SWQB's intent and supporting rationale. This practice is a real benefit to anyone reviewing the Draft TMDL for the Animas River Watershed.

SWQB Response: Thank you for your comments and for your attendance at the June 5 public meeting in Farmington. SWQB appreciates the continued support of the SJWC.

Ms. Meghan Bell
June 18, 2013
Page 2

SPECIFIC COMMENTS

Section 2.2 Hydrologic Conditions

Animas River near Cedar Hill, NM and Animas River at Farmington “were used to determine designated use attainment status during the assessment process”

SWQB Response: It should be noted that the two gages in this comment were not used to determine attainment status during the assessment process. The TMDL states that “...data collected during all flow conditions, including low flow conditions (i.e., flows below the 4Q3), were used to determine designated use attainment status during the assessment process.” The comment above suggests that the gage data were used to determine attainment during the assessment process.

Comment:

1. The Animas River near Cedar Hill (09363500) in the **Water-Data Report 2012** “the estimated daily discharges, which are poor. Slight regulation by Lemon Dam about 30 mi upstream on Florida River since Nov. 1963”.
2. In addition, flows at Animas River at Farmington (09364500) are also altered due to the fact the last ditch diverts water before the gage and returns into the San Juan River.
3. The altered flow may affect DFLOW 3.1a output and ultimately change the calculation the 4Q3 results.

SWQB Response:

- 1) Thank you for relating the estimate confidence information for the USGS Gage Animas River near Cedar Hill. It is unclear from the report whether the daily estimates throughout the gage operation period of 99 years are poor or for the 2012 water year only. Based on the data downloaded from the USGS website, 451 of the 32,598 data points have been documented by the USGS as estimated, which is approximately 1.4%. While ideally none of the data would be estimated, SWQB considers 1.4% to be sufficiently low to rely on the dataset as a whole.

Thank you for the information about regulation on the Florida River. Construction of the Lemon Dam was completed in 1963, and there are no active gages located on the Florida River or immediately below the confluence on the Animas River to quantify how the regulation itself may have impacted the 4Q3 of the Animas River in New Mexico.

-
- 2) *The gage reflects the streamflow at the point of the gage, resulting in a 4Q3 that is derived from measured streamflow values. Using available gage data from the USGS Gage, Animas River at Farmington, results in a 4Q3 which is more likely to be representative of conditions than the other 4Q3 calculation options available. There are several diversions on the Animas River in New Mexico, and it is not clear from the comment which diversion this refers to or the location of the diversion in relation to the gage.*
- 3) *SWQB relies on measured flow where available in order to obtain a 4Q3 that is most representative of field conditions. Because of the representative nature of gaged data, the 4Q3 obtained using that data incorporates upstream diversions.*

Section 5.0 Temperature

Comment:

1. The San Juan Water Commission supports the Use Attainability Analysis (UAA) on the Animas River (Estes Arroyo to Southern Ute Indian Tribe). The SJWC believes the standard for temperature is unattainable and is confident the UAA will demonstrate that attaining the assigned designated use is not feasible due to one of the factors listed in 40 CFR 131.10(g).

SWQB Response: SWQB thanks the SJWC's support in its endeavors to determine appropriate and attainable designated uses to waterbodies. SWQB will request formal public comment on the Animas River UAA proposal during the upcoming Triennial Review process.

Section 6.9 Future Growth

SWQB suggest the Animas-La Plata Project "is expected to decrease flow to the Animas River in New Mexico"

Comment:

On March 4, 2009 through an Intergovernmental Agreement (IGA) established the Animas – La Plata Operation and Maintenance Association. *"The Durango Pumping Plant would be operated in a manner that insures that its operations do not violate the flow recommendations. Pumping would be decreased or stopped during certain periods in order to meet the recommendations. When there have been no endangered fish releases from*

Navajo Dam for two years and the planned release for the current year is the minimum release specified in the flow recommendation report, the Durango Pumping Plant would be turned off during June, increasing flow in the Animas River by an additional 280 cfs to meet flow recommendations for endangered fish below the Animas River confluence in the San Juan River¹. After satisfying all downstream senior water rights demands and downstream ALP Project water demands, pumping would be further limited to allow the following bypass flows in the Animas River at the pumping plant intake: October through November - 160 cfs; December through March - 125 cfs; and April through September - 225 cfs." – Animas – La Plata Final Supplemental Environmental Impact Statement. Chapter 3 p. 3-12.

In addition, during critical dry times if there is a request for additional water from Association Members; the Association general manager will release water from Lake Nighthorse for the Association members which will enhance river flows below Basin Creek.

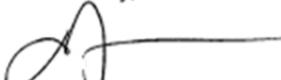
SWQB Response: Thank you for your comment. SWQB appreciates clarification of the potential impacts from full operation of the Animas-La Plata Project. After reviewing the comment information, along with that provided by other commenters, the section referenced in the comment has been updated with more detailed and accurate information.

CONCLUSION

SJWC generally is supportive of SWQB's TMDL document, as discussed above, and looks forward in reviewing SWQB's additional TMDL document. Should SWQB decide to substantively modify its draft TMDL document, SJWC would appreciate the opportunity to review the changes and discuss them with SWQB.

If you have any questions about these comments, please do not hesitate to give me a call.

Sincerely,



L. Randy Kirkpatrick

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Comments Regarding: TMDL Animas River Watershed

Meeting date: June 5th 2013

I have read the draft on the TMDL for the Animas River Watershed. It seems to me that the only point source on the river from the Colorado Line to Farmington is the Aztec Waste Water Plant. It is my understanding that this document will be used by the EPA when setting discharge limits on the Aztec Waste Water Plant. The citizens of Aztec have spent over 10 million dollars in upgrades to meet the existing permit limits. To lower the limits would cause undue hardship on the citizens of Aztec. I do not believe that one entity should be held accountable for the whole river's wellbeing. There are many non-point source contributors that should bear the load.

How to control non-point sources seems to be the big question that should be answered before tighter limits are put upon a single entity. There is also the problem of not controlling what is put in the river before it crosses the New Mexico - Colorado state line. My understanding is there are no limits in Colorado for phosphorus on the Animas River. If you are trying to repair the health of the river, it should be to fix the whole river not just a portion of it.

I do not believe there is an easy answer to the problem, but I urge you not to take the easy path and lower the limits on the point source entities. I would like to see you take steps to control the non-point contributors.

Thank You

Andrew Galloway
Chief Operator
City of Aztec

SWQB Response: Thank you for your comment. The TMDLs presented in this document do not recommend changing discharge limits for the Aztec Waste Water Plant.

SWQB recognizes that the issues in the Animas River watershed are complex due to the multiple jurisdictions, presence of point and non-point sources, and impacts from natural and anthropogenic land uses. The health of the entire river is, indeed, a concern; however, the State of New Mexico is only able to develop TMDLs for its jurisdictional waters at this time. SWQB looks forward to coordinating with other jurisdictions to improve and protect water quality in the Animas River watershed.

SWQB has updated the TMDL to reflect Colorado's recent adoption of statewide control regulations for nutrients, including total phosphorus, and technology-based requirements as part of a 10-year plan. Please note that these regulations have not been accepted by EPA at the time of publication. Additionally, Colorado will be renewing its statewide general MS4 permit this year, which is likely to result in compliance with existing or additional BMPs and monitoring plans. Further information can be found in the Colorado Department of Public Health and Environment Water Quality Control Commission's Regulation #85, Nutrients Management Control Regulation (5 CCR 1002-85).

In most cases, waste load allocations for point sources are calculated using the water quality criterion and design capacity of the facility. The permittee is only responsible for meeting the assigned WLA and is not responsible for other allocations or upstream contributions. Section 8 of the TMDL discusses TMDL implementation and the efforts of the Watershed Protection Section of SWQB in regards to non-point source contributions.

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June 20, 2013

via regular mail and email

Meghan Bell
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
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meghan.bell@state.nm.us

Re: Comments on the Draft TMDL for the Animas River in New Mexico

Dear Ms. Bell:

On behalf of the Southwestern Water Conservation District (the "SWCD") our firm submits the following comments regarding the *DRAFT Total Maximum Daily Load (TMDL) for the Animas River Watershed (San Juan River to Southern Ute Indian Tribe Bnd)* (the "Draft TMDL") prepared by the Surface Water Quality Bureau of the New Mexico Environment Department (the "SWQB"). Please include these comments in the administrative record for the proposed TMDLs. Please also inform the SWCD of any further opportunities to comment or other proposed actions by the SWQB related to the Animas River at the address above.

The SWCD is a political subdivision of the State of Colorado created by statute in 1941 to promote the conservation, use, and development of the waters of the San Juan and Dolores River basins in Southwestern Colorado. The SWCD has statutory authority to participate in the formulation and implementation of nonpoint source water pollution control programs related to agricultural practices. Therefore, the SWCD is very interested in promoting improved water quality in the Animas River, and has dedicated considerable funding and resources to watershed monitoring and planning, as well as to participating in water quality-related regulatory efforts. In recent years the SWCD has provided funding to the Animas River Stakeholders Group and Animas Watershed Partnership, to projects researching mine seepage and remediation in the upper Animas River basin, to nutrient loading and control planning in the Animas River basin, and to a study of sediment loading in Lightner Creek, a tributary to the Animas River. The

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SWCD has also helped fund analyses of fish tissue for mercury and other contaminants in reservoirs throughout southwestern Colorado, including Lake Nighthorse, in cooperation with the Colorado Water Quality Control Division. The SWCD is also a member of the Animas Watershed Partnership. Accordingly, the SWCD looks forward to coordinating and participating in cooperative efforts with New Mexico to monitor and control point and nonpoint source pollution in southwestern Colorado.

Because the Clean Water Act and its implementing regulations require an upstream state to take into consideration the water quality standards of downstream waters, it is essential to Colorado entities and landowners that New Mexico set its use designations, numeric criteria, and TMDLs based on a sound scientific evaluation of adequate and representative data. Absent rigorous technical justification, any proposed regulatory limitations risk the expenditure of substantial public and private funds on efforts that may prove ineffective at achieving improvements in water quality. For example, proposed modest increases in nutrient treatment at only relatively large wastewater treatment plants in Colorado were estimated to cost approximately \$2.4 billion in 2012, without even factoring in finance and land acquisition costs.¹

The Animas River generally has very good water quality downstream of the legacy mining impacts at its headwaters. Its hydrology is little regulated compared to most western rivers, the population in the watershed is relatively small, and there is little urbanization. In the City of Durango the River is used for drinking water and is very popular for recreation. The River's good water quality is also demonstrated by the fact that all designated uses on the lower segments of the Animas River in Colorado are fully supported.

The SWCD supports voluntary, stakeholder-driven efforts to minimize pollution and to protect the water quality of the Animas River. However, the SWCD also has grave concerns about basing proposed speculative pollutant load reductions on a paucity of data and an oversimplistic analysis of complex environmental variables and processes. Because the SWQB relied on relatively little data and a simplistic analysis of pollutant concentrations in the Draft TMDL and it is not clear that any designated uses are actually impaired in New Mexico, the SWCD has serious concerns regarding the efficacy of the proposed TMDLs. Given the potentially enormous costs to dischargers from promulgating unsupported and likely ineffective TMDLs, the SWCD respectfully requests that the SWQB not finalize these TMDLs until such time as it can collect sufficient data pursuant to statistically-valid study designs to demonstrate actual use impairment, the cause(s) of any such impairment, and supportable load reductions reasonably required to restore any such impairments.

SWQB Response:

Thank you for your comments. The Surface Water Quality Bureau (SWQB) appreciates comments from all stakeholders in the Animas River watershed, including those in the State of Colorado. SWQB respectfully disagrees with your request that these Total Maximum Daily Loads (TMDLs) not be finalized. Your comments concern proper impairment determinations and the simplistic analysis provided in the TMDLs. The impairment determination was made based on the most current State of New Mexico water quality standards and SWQB assessment protocols and was approved by the Water Quality Control Commission (WQCC) in 2012. The TMDLs, while perhaps simplistic, were developed in accordance with the State of New Mexico's Water Quality Management Plan (WQMP), Federal Regulation and related Environmental Protection Agency (EPA) guidance. Finalization of the TMDL also allows watershed groups to become eligible for funding to do watershed planning where they can collect data targets to determine specific sources of impairment. For further discussion, please see below.

The TMDLs contained in this document were developed as a result of sample collection, assessment, and determination of impairment of water quality standards in line with SWQB's Assessment Protocols (APs) and EPA guidance. The impairments discussed in the TMDL are included on the 2012-2014 State of New Mexico Clean Water Act (CWA) §303(d)/ §305(b) Integrated List and were approved by the WQCC on March 13, 2012 and by EPA on May 8, 2012. The impairments noted in the TMDL are based on the application of the EPA-approved water quality standards (WQS) and the Procedures for Assessing Water Quality Attainment for the State of New Mexico CWA §303(d)/ §305(b) Integrated Report: Assessment Protocol). Both the Assessment Protocol revisions and Integrated List approval process involve stakeholder participation.

SWQB appreciates your concerns that this decision relied on a small dataset to determine impairments. However, the size of the datasets used in the assessment of impairment and listings in the Animas River watershed are adequate according to EPA guidance and the SWQB Assessment Protocols approved at the time of the 2010 survey.

The SWQB attempts to maximize the data collected each year at any given site within the limits of available resources while ensuring that all surface waters are surveyed. To increase the data available for assessment, SWQB releases a call for data, typically in the spring of every odd numbered year, in preparation for the development of the next draft Integrated List. Potential data providers, however, may submit data at any time that is convenient for them. Further information on data submittals can be found at: <http://www.nmenv.state.nm.us/swqb/DataSubmittals/>. Assessment of streams occurs on a biennial basis; if data indicate that a stream segment is not impaired for a previously listed cause, it will be delisted.

New Mexico TMDLs are calculated with the critical flow of the stream segment and the water quality criterion to determine the loading capacity of the stream. According to 40 CFR 130, TMDLs are the sum of the individual waste load allocations (WLAs), load allocations (LAs), background, and a margin of safety (MOS). In New Mexico TMDLs, waste load allocations for point sources are determined using existing permit limits, where available, and where those limits are protective of the applicable water quality standards. In cases where point source permits either do not have limits for a specific parameter or those limits are not protective of standards, an appropriate waste load allocation is determined. Load allocations are comprised of all non-point sources, background load, and future growth. Probable sources, while included in the TMDL document, have not been quantified or prioritized. Public input on the probable sources will continue during the public comment process for the Integrated List as well as during development of any future Watershed Based Plans (WBPs). It is important to note that a TMDL alone does not change the Federal regulatory requirements (as stated above) for an upstream state to protect the water quality standards of a downstream state; rather it establishes the maximum pollutant load for the stream segment.

With that general comment, the SWCD provides the following specific comments:

1. The data and analyses in the Draft TMDL have significant limitations such that the efficacy of the proposed load allocations is doubtful and the proposed TMDLs should not be finalized and should be given a low priority until more data and more rigorous analyses can be incorporated.

While the SWCD supports the SWQB's efforts to improve water quality and it is aware of New Mexico's obligations under the Clean Water Act, the SWCD has concerns about limitations in the data and analyses in the Draft TMDL. The SWQB generally only collects monitoring data every 8 years (i.e., in 2002, 2010, 2018, etc.) and the number of samples is very limited. The Draft TMDL uses phosphorus measurements collected on only eight dates in 2010 to estimate loads and recommended load reductions in the Draft TMDL. Similarly, even incorporating samples collected by USGS between 2006 and 2010, there were so few samples of *E. coli* that the SWQB could not assess whether New Mexico's multiple-sample criterion (i.e., based on a two-month geometric mean) for *E. coli* was attained. Phosphorus and *E. coli* concentrations in the Animas River vary widely throughout the year due to both seasonal variables (e.g., spring runoff, irrigation season, algal growing season) and stochastic variables (e.g., rainstorms, wildfires). The SWQB's data in Appendix C demonstrate this. Samples of phosphorus and *E. coli* vary widely at the same site between dates, and widely between sites on the same date. This means that the SWQB cannot reliably estimate loads and assign allocations using such a limited data set and, especially, without a statistically valid study design for the calculation of representative pollutant loads.

The SWCD questions, therefore, how representative those data may be of water quality conditions in general as well as when use attainment may be at risk. The data do not appear to be sufficiently representative or to have been collected in accordance with a statistically valid study design for the purpose of estimating loads among point and nonpoint pollutant sources or for establishing what background loads and an appropriate margin of safety might be for the Animas River in New Mexico. The SWCD recommends collecting and incorporating additional monitoring data for those pollutants before a TMDL is finalized, and giving these TMDLs a low priority until such time as representative data and more rigorous analyses can be incorporated. In particular, as acknowledged in the Draft TMDL, the results from the intensive study of *E. coli* concentrations and sources would provide much better data upon which to assess use attainment and, if necessary, to establish a TMDL.

SWQB Response:

SWQB disagrees with your assertions that the TMDLs should not be finalized and given low priority. As discussed above, TMDLs are calculated using a critical flow of the stream and the water quality standard. Waste load allocations are based on permit limitations, where available. Nonpoint sources contributing to the load allocation are not quantified separately. Thus, additional data would not change the calculation of the TMDL, although implementation of the TMDL through nonpoint source management projects could provide more information on sources and enable the impairments to be addressed. Delaying the TMDL would also delay the availability of nonpoint source management funds to watershed groups. For further discussion, please see below.

SWQB is charged with sampling surface water quality of the entire state of New Mexico. As such, our current resources allow for an approximately 8-year rotational watershed survey schedule. The amount of data collected in 2010 for the Animas River is adequate for assessment and listing purposes according

to EPA guidance. EPA does not recommend a minimum sampling (see below excerpt from our Assessment Protocol available at:

<ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Protocols/AssessmentProtocol.pdf>):

“USEPA does not recommend the use of rigid, across the board, minimum sample size requirements in the assessment process (USEPA 2009). Target sample sizes should not be applied in an assessment methodology as absolute exclusionary rules (USEPA 2003, 2005). The use of limited data sets is acceptable to USEPA as limited financial, field, and laboratory resources often dictate the number of samples that can be collected and analyzed (USEPA 2002a).”

As previously noted, the development of a TMDL alone does not change the regulatory requirements of surface water users in upstream states (i.e., outside of the TMDL watershed). Rather, it calculates the amount of pollutant that a waterbody is able to contain without exceeding water quality standards after a water has been identified as having impaired designated uses on the CWA §303(d) Integrated List of Assessed Surface Waters.

TMDLs are typically calculated by multiplying the water quality criteria (20.6.4 NMAC) by the critical flow value. Water quality data is not used in the calculation of the TMDL or its allocations. Waste load allocations for point sources (within the TMDL watershed) are calculated using the water quality criterion and design capacity of the facility, where available. Thus, additional data collection could be relevant during assessments and impairment determination and could assist in the development of non-point source management projects to implement a TMDL, but would not change the actual calculated TMDL.

2. The Draft TMDL does not evaluate the actual symptoms of nutrient enrichment so it does not relate loads of phosphorus to use impairment such that useful benchmarks, monitoring plans, and management actions can be implemented.

Reliance on measurements of total phosphorus concentrations alone is inadequate to characterize or allocate loads of this nutrient. While the SWCD supports the goal of minimizing and reducing nutrient loads to the Animas River where practicable, the SWQB must analysis of additional parameters related to phosphorus to determine the extent to which attainment of designated uses may be achieved by reducing phosphorus loads. As the Draft TMDL acknowledges (at p. 43), it is the symptoms of nutrient enrichment that may impair aquatic life and other uses (e.g., excessive algal or plant growth), not excessive levels of nutrients in and of themselves.

To characterize the effects of phosphorus loading, prescribe management actions, and monitor changes in water quality it is necessary also to assess parameters directly related to nutrient enrichment, such as dissolved oxygen, pH, and algal cover. Measuring such parameters may also help identify sources of nutrients, assess the degree to which other related variables

(e.g., riparian shade, flow alterations, channel morphology, channel substrate composition, wildfires, drought) influence the effects of phosphorus loads, identify the parameters or pollutants that may be most directly resulting in any designated use impairments, and establish water quality benchmarks that are of most concern to the public (e.g., water clarity, taste and odor, fishery health). In addition, DO and pH can also be monitored continuously, providing much more revealing data regarding the effects of nutrients on water chemistry and aquatic life. Therefore, the proposed TMDL for phosphorus should not be finalized until data on DO and pH are analyzed.

SWQB Response:

This comment is not applicable to the total phosphorus TMDL presented in this document. The total phosphorus TMDL was based on a segment-specific numeric criterion for total phosphorus of 0.1 mg/L (20.6.4.404 NMAC), and was not in response to nutrient impairment determination based on the narrative nutrient criteria (20.6.4.13 NMAC). For determination of nutrient impairment, SWQB does require the use of the type of bioconfirmation suggested, specifically including excessive algal growth, DO and pH, as suggested in this comment – but as stated previously, this TMDL is based on a segment specific numeric criterion so such approaches are not appropriate. For further discussion, please see below.

The Animas River (Estes Arroyo to Southern Ute Indian Tribe bnd) Assessment Unit (AU) has a segment-specific Total Phosphorus numeric criterion of 0.1 mg/L that was adopted into the New Mexico Water Quality Standards in 1973, and New Mexico reserves the rights provided by the Clean Water Act to adopt its own Water Quality Standards. In the administrative record for the WQCC Hearing on Water Quality Standards – 6/21/1973, a letter documents that water quality surveys in high mountain streams indicated exceptional water quality, resulting in stringent total phosphorus standards to “accurately define the existing good quality.”

Data collected during the 2010 stream survey indicates that the waterbody is impaired for total phosphorus using the Assessment Protocols in place at the time of assessment. The assessment protocols that SWQB uses to determine impairment of waterbodies are revised periodically. The revision process includes a public comment period, during which stakeholders are encouraged to comment and make suggestions on the proposed protocols. The reach was listed as impaired for total phosphorus for the first time on the 2012-2014 Integrated List of Assessed Surface Waters. The Integrated List was subject to public review and comment during the public comment period, which took place from December 15, 2011 to January 30, 2012. Additionally, details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2012-2014 State of New Mexico CWA §303(d)/ §305(b) Integrated List public record.

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3. The fact that the Animas River is not listed as impaired for DO, pH, or a narrative standard violation related to nutrient enrichment in either New Mexico or Colorado indicates that preparing and implementing a TMDL to meet the numeric criterion for phosphorus should be a low priority until actual use impairment from phosphorus can be demonstrated and a reliable relationship between phosphorus concentrations and impacts to designated uses in the Animas River can be developed.

The numeric criterion for phosphorus, upon which the load reduction analysis is based, is a generic value that has not been demonstrated to be valid or protective for preventing nutrient-enrichment impacts in the Animas River. Accordingly, it may have little or no correlation with any actual impacts to designated uses attributable to phosphorus in the Animas River in New Mexico. DO and pH measurements would provide a more reliable indicator of whether, when, and by what mechanism any beneficial use impairment from nutrients is occurring in the Animas River. Accordingly, calculating phosphorus load targets to meet an arbitrary numerical criterion should be a low priority and the efficacy of the criterion should be reevaluated using parameters related to nutrient enrichment impacts, such as DO and pH.

SWQB Response:

As previously stated, the TMDL was not developed to address a general nutrient impairment, but instead a segment-specific numeric criterion. The downstream assessment unit, Animas River (San Juan River to Estes Arroyo) is listed for nutrients, and a nutrient TMDL was approved by the WQCC in 2005 [TMDL for the San Juan River Watershed Part Two (Navajo Nation Boundary at the Hogback to Navajo Dam)]. Approval of the TMDL may aid in funding procurement for watershed restoration projects, which would improve the overall health of the stream and address the existing impairments.

4. SWQB's use of single sample exceedences of numeric criteria is overly-protective and not an accurate assessment method or method to calculate a TMDL for pollutants such as phosphorus.

For pollutants such as phosphorus, it is the central tendency of the distribution of concentrations that usually drives the environmental response. In other words, single-sample exceedences of the numeric phosphorus criterion may not be well correlated with the productivity of the system (i.e., with algal growth and other nutrient-related impacts) compared to average or median concentrations.² Recognizing this, the Colorado Water Quality Control Commission, for example, has established default table values for phosphorus in cold- and warm-water streams based on using the median concentration measured in a stream. In contrast, the Draft TMDL focuses on single-sample exceedences of the arbitrary phosphorus criterion (i.e., no means or medians are assessed) and its proposed load allocations appear to be based on avoiding any single-sample exceedences of the criterion. This results in load estimates not correlated with attaining any designated use. This approach could result in unwarranted expenditures of public and private funds in an attempt to meet a TMDL that does not necessarily improve water quality.

SWQB Response:

SWQB's use of single sample exceedences of numeric criteria is in accordance with the New Mexico Water Quality Standards and thus is appropriate for use in impairment determinations and this TMDL. As discussed previously, collected water quality data are not used in the calculation of the TMDL or its allocations.

5. Until such time as the SWQB has additional data for *E. coli* sufficient to calculate 30-day, or at minimum two-month, geometric means for comparison with the multi-sample criterion to determine whether the multi-sample criterion is actually exceeded, it is meaningless and likely over-protective to calculate a TMDL using the flawed approach in the Draft TMDL, especially when an extensive study is already pending and no exigency exists to regulate *E. coli*.

E. coli is a fecal pathogen that is an indicator of the presence of fecal contamination and the potential for human infectious disease. Fecal pathogens are generally associated with untreated human and non-human (i.e., pets, livestock, and wildlife) excrement. The multi-sample *E. coli* criterion for recreation use, based on EPA guidance, is 126 cfu/100ml, which is derived from an anticipated risk level of 36 swimmer illnesses per 1,000 swimmers.³ The EPA-recommended criterion also requires assessing attainment not just using the magnitude of measurements, but also the duration and frequency of occurrence.⁴ The current EPA-recommended criterion is a 30-day geometric mean value selected because the designated use to be protected is primary contact recreation and a 30-day evaluation period "allows for the detection of transient fluctuations in water quality in a timely manner."⁵ Accordingly, collecting and analyzing a minimum sample size within a 30-day period for assessing attainment of that standard is the most technically defensible approach:

EPA now specifically recommends a duration period over which the GM [i.e., geometric mean] of samples should be calculated and over which the STV [i.e., single-sample threshold] should be compared against a recommended limit on the frequency of excursions. EPA is recommending that states use a duration for the GM and STV of 30 days. The duration and frequency of excursion should be explicitly included in the state's WQS as it is a component of the WQS. . . . EPA recommends that states consider the number of samples evaluated in order to minimize the possibility of incorrect use attainment decisions."⁶

For segments without sufficient data to evaluate that standard, requiring additional samples to be collected before making an assessment decision is warranted:

When identifying sampling frequency as part of a state's monitoring plan, a state may consider that, typically, a larger dataset will more accurately characterize the water quality in a waterbody, which may result in more meaningful attainment determinations. Therefore, EPA is recommending that states conduct at least weekly sampling to evaluate the GM and STV over a 30-day period and encourages more frequent sampling at more densely populated beaches.⁷

The SWQB's approach to assessing the *E. coli* single-sample criterion and proposed TMDL suffers from not accounting for the variability within and distribution of fecal pathogen

³ U.S. EPA, Office of Water, *Recreational Water Quality Criteria*, EPA-820-F-12-058 (November 26, 2012).

⁴ *Id.* at 41.

⁵ *Id.* at 40.

⁶ *Id.*

⁷ *Id.* at 42.

measurements and results in the SWQB improperly analyzing fecal pathogen risk, improperly assessing the *E. coli* criteria for attainment, and not calculating a meaningful TMDL for *E. coli*.⁸ Because any individual sample tested for *E. coli* can have widely variable results, states like Colorado have concluded that it is not reliable to assess attainment of the standard, and the risk of swimmer illnesses, from single sample results. As EPA states, supported by numerous citations to the literature, “[t]he distribution of [fecal indicator bacteria] in water is highly variable and can generally be represented as a log₁₀ normal distribution.”⁹ This variability, and lack of ability to characterize *E. coli* concentrations from single samples, is demonstrated by the widely ranging values over the length of the Animas River and over time evident in the single-sample data for *E. coli* in Appendix C of the Draft TMDL.

SWQB Response:

SWQB does not agree with your comments that data and analysis are meaningless or flawed. As discussed above, New Mexico has a single sample criterion for E. coli in the Water Quality Standards and relevant EPA guidance and state of New Mexico Assessment Protocols were followed during collection and analysis to make this impairment determination.

It also defies logic that the SWQB assessed impairment using the single-sample criterion, and then calculated loads required for attainment using the geometric mean criterion. As the Draft TMDL acknowledges, at p. 19, this approach is “fraught with challenge” and “will result in an over-estimations of the actual reduction necessary” (i.e., because the geometric mean criterion is substantially lower). Further, rather than using a geometric mean to calculate “measured loads,” the SWQB resorted to the arithmetic mean to calculate target and existing loads, which effectively over-estimates existing loads, is not consistent with the criterion and the epidemiological human health protection basis for it, and is not statistically valid given that *E. coli* data are log₁₀ normally distributed (i.e., this is why the criterion requires calculating a geometric mean). Finally, the SWQB will have the benefit of an intensive *E. coli* monitoring and source assessment study being overseen by the San Juan Watershed Group in the near future. Given the deficiencies in the data and assessment of *E. coli* attainment, the lack of data and a sound methodology for calculating meaningful *E. coli* loads and needed reductions, and that a rigorous assessment of this parameter in the Animas River will be available soon, the SWQB should not finalize the *E. coli* TMDL at this time and assign it a low priority.

SWQB Response:

Assessment of E. coli impairment using the single-sample criterion is consistent with SWQB’s Assessment Protocols, which are revised periodically and open to public review and comment during each revision. Use of the geometric mean criterion to develop the Animas River TMDLs for E. coli is consistent with previously-approved E. coli TMDLs in New Mexico and is considered a component of the Margin of Safety, as described in Section 4 of the TMDL document. For further discussion, please see below.

Sections 2 and 3 of the Procedures for Assessing Use Attainment for the State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Water Quality Monitoring and Assessment Report (May 2011) discusses the use of spatially and temporally independent samples; samples that are not spatially or temporally independent are averaged. Details of the assessments are available on the Assessment Summary Sheets, which were made available for public inspection as part of the 2012-2014 State of New Mexico CWA §303(d)/§305(b) Integrated List public record. SWQB generally does not have enough independent samples to calculate a monthly geometric mean for assessment purposes. Section 3.3 and

Table 3.8 of the Assessment Protocol addresses the procedure for assessing primary and secondary contact uses. Additionally, 20.6.4.14 NMAC reads:

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

Therefore, SWQB can only apply the single sample *E. coli* criterion to the available *E. coli* data for assessment purposes. Data collected during the 2010 stream survey indicate that the waterbody is impaired using the Assessment Protocols in place at the time of assessment. Additionally, details of the assessments are available on the Assessment Summary Sheets, which are made available for public inspection as part of the 2012-2014 State of New Mexico CWA §303(d)/ §305(b) Integrated List public record.

SWQB acknowledges the limitations and approximate nature of those loads and notes that the calculation of measured loads of contaminants is meant to offer an estimate of conditions and is for informational purposes only. As stated in this comment and the TMDL document, any comparison between exceedences of the single sample criterion and the monthly geometric mean standard are fraught with challenge and will result in an over-estimation of the actual reduction necessary and are therefore not included in the document.

6. References to estimated loads and decreases in loads needed at the Colorado stateline should be deleted.

The Draft TMDL purport to calculate existing loads and the load reductions needed at the Colorado stateline for both *E. coli* (at p. 24) and for phosphorus (at p. 48). For the reasons described above, and others, those estimates are unsupportable as a technical matter and should be deleted as a policy matter. To calculate the *E. coli* "load delivered at the stateline" the SWQB relies on only eight measurements from 2010 to calculate an arithmetic mean load per-day for *E. coli* at that station. Again, that is not sufficient data to characterize *E. coli* concentrations for either assessment or TMDL purposes, and it is not a statistically valid approach to use the arithmetic mean for that purpose. Similarly, the mean of only seven phosphorus measurements was used to estimate the load per-day "that enters New Mexico." No discussion is provided that might justify using such small sample sizes to calculate a mean daily loads, or to assert that those data are representative of water quality conditions in the Animas River such that pollutant loads can be reliably estimated.

Any discussion of *E. coli* loads from Colorado should await preparation of a watershed-based plan and include analysis of sufficient samples from which to draw any conclusion about *E. coli* loads. The SWQB should properly acknowledge on-going pollution control efforts in Colorado and it should not engender conflict or put a wrench in the ongoing cooperative efforts to reduce pollutant loads upstream of New Mexico.

SWQB Response:

SWQB has reworded a statement that discussed reduction of measured load at the stateline in Sections 4.5 and 6.5. During discussions with EPA Region 6 during TMDL development, EPA requested that SWQB include estimations of the load as it entered New Mexico in order to meet the needs of the TMDL to address sources of loading in the watershed. In order to calculate this loading, SWQB used the best

available data: data collected from the northern-most station located in New Mexico. New Mexico cannot assign a WLA to another state, but EPA requested that SWQB discuss the load from the upstream watershed using the approach outlined in the discussion in Section 3.1 of the TMDL document.

7. The discussion of the potential for impacts to water quality from the Animas-La Plata Project should be revised or deleted.

The SWCD holds the water rights for the Animas La Plata Project ("A-LP Project"), a federal reclamation project to divert and store water from the Animas River for municipal and industrial use by communities in Colorado and New Mexico, as well as the Southern Ute and Ute Mountain Ute Indian tribes. Accordingly, the SWCD has a vital interest in ensuring that the water quality of the Animas River is supportive of appropriate designated uses.

The potential for impacts to water quality from operation of the A-LP Project is discussed in a few sentences on pages 26 and 51 of the Draft TMDL. The SWQB speculates that A-LP Project operations are "expected to decrease flows to the Animas River in New Mexico" in the future, which "may increase the effective concentrations" of *E. coli* and phosphorus. In fact, the best available analysis of the potential water quality impacts of the A-LP Project, practical and legal constraints on Project operations, and the planned delivery of stored Project allocations in the Animas River to entities New Mexico do not support that conclusion.

Chapter 3.3 of the *Animas-La Plata Project Final Supplemental Environmental Impact Statement* ("FSEIS"), completed in July 2000, assessed the Project's potential impacts to the hydrology and water quality of the Animas River, including to segments in New Mexico. That analysis used very conservative assumptions regarding consumptive use and depletions of water to evaluate changes to the hydrology of the Animas River. For example, it was assumed that municipal and industrial ("M&I") uses of Project water would be 50% consumptive (FSEIS at 3-5; Table 3.2-2). Typically such uses are 15% consumptive (i.e., 85% of water diverted to M&I use is returned to the stream).

The FSEIS modeled water quality impacts using a dataset of 74,000 measurements of various regulated parameters and pollutants. That analysis found that, under full Project operation and using the conservative hydrological assumptions noted above, only nominal changes in concentrations of only some pollutants, primarily metals, in the New Mexico portion of the Animas River (see FSEIS at 3-46 and at Table 3.3-3). The FSEIS concluded that average concentrations of regulated parameters would increase less than 10 percent and most by no more than five percent, "which would not be measureable." FSEIS at 3-46. It also concluded that there would be only one additional exceedance of the numerical criterion for phosphorus over a 45-year period. *Id.* No increase in fecal coliform, another fecal pathogen indicator commonly used before the *E. coli* standard was recommended by EPA, was predicted. Accordingly, a large dataset and intensive modeling using conservative assumptions indicate that the A-LP Project is not expected to cause meaningful increases in the concentrations of phosphorus or *E. coli*.

The ultimate uses, timing, and location of use of the Project remain to be determined, and full use of Project allocations, as assumed in the FSEIS, likely remains years away. However, given that the minimum bypass flow requirements for the Project will require that Project allocations will generally only be pumped into storage only during periods of relatively high flows (see FSEIS at 3-12) and that releases of stored water from Lake Nighthorse to the Animas River will likely occur during the portions of the year when flows are lowest (see FSEIS at 3-12 discussing direct diversion of Project water versus releases from storage), it is not at all certain the A-LP Project will actually reduce flows in the Animas River in New Mexico substantially or even impact water quality to the minimal degree the FSEIS modeling predicted. In fact, current plans indicate that it is likely that future Project releases from Lake Nighthorse will actually increase flows in the Animas River during the most water-short periods, given that the San Juan Water Commission, the La Plata Conservancy District, and the Navajo Nation are each expected to receive Project deliveries of water stored in Lake Nighthorse via the Animas River in New Mexico. In sum, the potential effects to the water quality of the Animas River from the operation of the Animas-La Plata Project are speculative at best, are likely years away, and even under conservative assumptions are likely to be insignificant. Therefore, discussion of the potential impacts of the Project would not appear to be relevant to this Draft TMDL.

SWQB Response:

The sections referenced in the comment have been updated with more detailed and accurate information. . SWQB appreciates clarification of the impacts to be expected from the full operation of the Animas-La Plata Project. A requirement of the TMDL document is to discuss potential future use in the watershed. While full operation is expected to be some distance in the future, it is a foreseeable use and is therefore relevant to the TMDL. EPA requires that TMDLs include potential future use and growth, and this is indeed a potential future use.

8. Any forthcoming watershed-based plan for the Animas River should include a pollutant trading framework between point and/or non-point sources in New Mexico and Colorado.

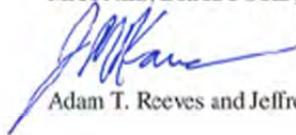
The Draft TMDL indicates that a watershed-based plan will be drafted to provide a strategy for reducing pollutant loads to the Animas River. That effort should include crafting a pollutant trading framework that would allow New Mexico dischargers to contribute to pollutant load reducing projects in Colorado where such efforts would be effective at improving water quality and more cost-efficient. Colorado has ongoing nonpoint source pollution reduction projects in the Animas River watershed, and additional nonpoint source management projects could be implemented that would reduce pollutant loads in the Animas River in New Mexico. A trading framework could reduce loading immediately above New Mexico, benefitting the environment of both Colorado and New Mexico.

SWQB Response:

The upcoming WBP will identify ways that water quality standards can be achieved in the watershed. SWQB looks forward to receiving the SWCD's input on the WBP once development is underway.

Thank you for the opportunity to submit these comments. Please let us know if we can provide copies of any of the references cited herein. The SWCD looks forward to the continued cooperative efforts to protect and improve water quality in the Animas River.

Sincerely,
MAYNES, BRADFORD, SHIPPS & SHEFTEL, LLP



Adam T. Reeves and Jeffrey M. Kane