FINAL-APPROVED

TOTAL MAXIMUM DAILY LOAD (TMDL)

FOR THE

SAN JUAN RIVER WATERSHED

(PART TWO)

NAVAJO NATION BOUNDARY AT THE HOGBACK TO NAVAJO DAM

JANUARY 17, 2006

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4Q3	4-day, 3-year low-flow frequency
AU	Assessment Unit
AZ	Arizona
BL	Background load
BLM	Bureau of Land Management
BMP	Best management practices
CBOD	Carbonaceous biological oxygen demand
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CGP	Construction general storm water permit
CWA	Clean Water Act
DO	Dissolved oxygen
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information Systems
$H_2PO_4^-$	Dihydrogen phosphate ion
HPO_4^{2-}	Phosphoric acid
HUC	Hydrologic unit code
IOWDM	Input and Output for Watershed Data Management
kg/ha/yr	Kilogram per hectare per year
LA	Load allocation
lbs/day	Pounds per Day
m	Meters
m^2	Square meters
mg/cm^2	Milligram per centimeter squared
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square mile
mL	Milliliters
MOS	Margin of safety
MOU	Memoranda of Understanding
MS4	Municipal Separate Storm Sewer System
MSGP	Multi Sector General Storm Water Permit
N_2	Nitrogen gas
NBOD	Nitrogenous biological oxygen demand
NH_3	Ammonia
NH_4^+	Ammonium ion
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NO_3^-	Nitrate
NO_2^-	Nitrite
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
^oC	Degrees Celsius

^oF	Degrees Fahrenheit
%	Percent
PO_4^{3-}	Phosphate ion
QAPP	Quality Assurance Project Plan
Q2K	Qual2K
RFP	Request for proposal
SOD	Sediment oxygen demand
STORET	Storage and Retrieval Database
SWPPP	Storm Water Pollution Prevention Plan
SWQB	Surface Water Quality Bureau
SWSTAT	Surface Water Statistics
TBODu	Total ultimate biological oxygen demand
TKN	Total Kjehahl Nitrogen
TMDL	Total maximum daily load
TN	Total nitrogen
TP	Total phosphorus
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through October 11, 2002)
WRAS	Watershed Restoration Action Strategy
WWTP	Waste water treatment plant

EXECUTIVE SUMMARY

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

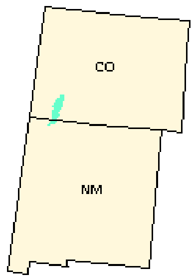
The San Juan River watershed is located in northwestern New Mexico. The Surface Water Quality Bureau (SWQB) conducted an intensive surface water quality survey of the San Juan River basin in 2002. Stations were located throughout the San Juan River basin during an intensive watershed survey to evaluate the impact of tributary streams. As a result of assessing data generated during this monitoring effort, combined with data from outside sources that met SWQB quality assurance requirements, impairment determinations of New Mexico water quality standards for low dissolved oxygen in the La Plata River (McDermott Arroyo to CO border), excessive temperature in Animas River (Estes Arroyo to CO border), and impairment of the narrative plant nutrient standard in the Animas River (San Juan River to Estes Arroyo). The upper Animas River assessment unit designated use of coldwater fishery is not existing or attainable in this stream reach. Accordingly, a change to the water quality standards will be proposed in future triennial reviews and a temperature TMDL will not been prepared. This total maximum daily load document addresses the above noted impairments as summarized in the tables below.

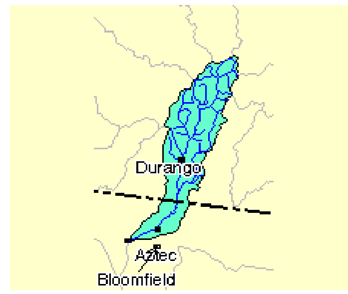
The following additional impairments were noted during the survey, but were previously addressed in the *Final Total Maximum Daily Load (TMDL) for the San Juan River Watershed (Part 1)* (NMED/SWQB 2005): fecal coliform were documented for the La Plata River (San Juan River to McDermott Arroyo), La Plata River (McDermott Arroyo to CO border), San Juan River (Navajo Nation boundary at the Hogback to Animas River), San Juan River (Animas River to Cañon Largo), and Animas River (San Juan River to Estes Arroyo). Impairment due to selenium exceedences was determined for Gallegos Canyon (San Juan River to Navajo bnd). In 2003, SWQB performed a special study with the U.S. Department of Agriculture National Sedimentation Lab to determine potential sedimentation impairment in the San Juan River and Animas River. As a result of the study, the San Juan River (Animas River to Cañon Largo) remained listed for sedimentation/siltation (stream bottom deposits). The La Plata River (San Juan River to McDermott Arroyo) was also determined to be impaired for sedimentation/siltation based on existing assessment protocols and data collected during the survey. Additional impairments based on benthic macroinvertebrate bioassessments and ambient water and sediment toxicity were documented on stream reaches based on 2002 and 2003 data, but additional data is needed to determine the exact cause of these impairments. Portions of the San Juan River and Navajo Reservoir are also listed for mercury in fish tissue because they are on the New Mexico Fish Consumption Guidelines due to mercury contamination (NMDOH *et al.* 2001).

Additional water quality data will be collected by New Mexico Environment Department during the standard rotational period for intensive stream surveys. As a result, targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate attainment category on the Clean Water Act Integrated §303(d)/§305(b) list of waters (NMED/SWQB 2004a).

The SWQB's Watershed Protection Section has and will continue to work with the San Juan Watershed Group to finalize the Watershed Restoration Action Strategies (WRAS) in order to develop and implement strategies to attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in WRAS will be done with participation of all interested and affected parties.

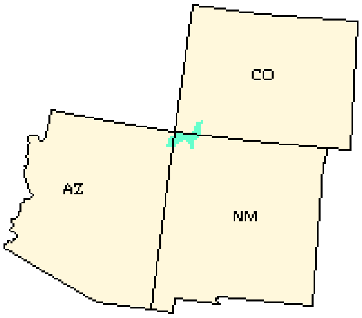
TOTAL MAXIMUM DAILY LOAD FOR NUTRIENTS
ANIMAS RIVER (SAN JUAN RIVER TO ESTES ARROYO)

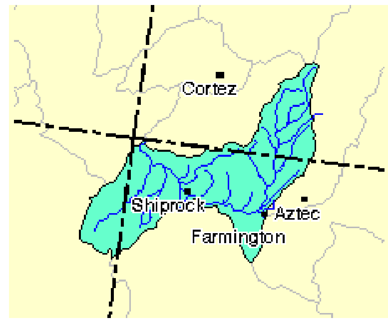




New Mexico Standards Segment	San Juan Basin 20.6.4.403
Assessment Unit Identifier	Animas River (San Juan River to Estes Arroyo), NM-2403.A_00 (formerly SJR4-10000)
Assessment Unit Length	16.9 miles
Parameters of Concern	Nutrients
Designated Uses Affected	Marginal Coldwater Fishery
Geographic Location	Animas USGS Hydrologic Unit Code 14080104
Scope/size of Watershed	1,357 mi^2 (277 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (56%), Agriculture (8%), Rangeland (29%), Built-up (5%), Barren (<1%), Water (1%), Wetlands (<1%)
Identified Sources	Drought-related Impacts, Flow Alterations from Water Diversions, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Source Unknown, Streambank Modifications/destabilization
Land Management (NM only)	Private (34%), BLM (60%), State (6%)
Priority Ranking	High
TMDL for: Nutrients	
Total Phosphorus	**WLA (9.32) + LA (12.6) + Background (8.18) + MOS (3.35) = 33.5 lbs P/day**
Total Nitrogen	**WLA (25.3) + LA (40.6) + Background (115) + MOS (20.1) = 201 lbs N/day**

TOTAL MAXIMUM DAILY LOAD FOR DISSOLVED OXYGEN
LA PLATA RIVER (MCDERMOTT ARROYO TO COLORADO BORDER)





New Mexico Standards Segment	San Juan Basin 20.6.4.402
Assessment Unit Identifier	La Plata River (McDermott Arroyo to Colorado border), NM-2402.A_01, (formerly SJR5-20100 split)
Assessment Unit Length	7.1 miles
Parameters of Concern	Dissolved Oxygen
Designated Uses Affected	Marginal Coldwater Fishery
Geographic Location	Middle San Juan USGS Hydrologic Unit Code 14080105
Scope/size of Watershed	435 mi^2 (30 mi^2 in NM)
Land Type	Arizona/New Mexico Plateau Ecoregion (22)
Land Use/Cover (NM only)	Forest (42%), Agriculture (20%), Rangeland (37%), Built-up (1%), Barren (<1%), Water (<1%)
Identified Sources	Animal Feeding Operations (NPS), Drought-related Impacts, Flow Alterations from Water Diversions, Loss of Riparian Habitat, On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Rangeland Grazing, Streambank Modifications/Destabilization
Land Management (NM only)	Private (47%), Native Lands (15%), BLM (32%), State (6%)
Priority Ranking	High
TMDL for: **Dissolved Oxygen**	**WLA (0.0) + LA (0.258) + MOS (0.0646) = 0.323 lbs TBODu/day**

NOTE: TBODu = Total ultimate biological oxygen demand.

1.0 INTRODUCTION

Under Section 303 of the Clean Water Act (CWA), states establish water quality standards, which are submitted and subject to approval of the U.S. Environmental Protection Agency (USEPA). Under Section 303(d)(1) of the CWA, states are required to develop a list of waters within a state that are impaired and establish a total maximum daily load (TMDL) for each pollutant. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality 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 (NPSs) at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for NPSs and natural background conditions, and includes a margin of safety (MOS). This document provides TMDLs for assessment units 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 and numeric translators for narrative standards.

This document is divided into several sections. Section 2.0 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, and briefly discusses the intensive water quality survey conducted in the San Juan River basin in 2002. Section 3.0 provides detailed descriptions of the individual watersheds for which TMDLs were developed. Section 4.0 presents the TMDL developed for total phosphorus and total nitrogen in the Animas River basin. Section 5.0 presents the TMDLs developed for dissolved oxygen in the La Plata River basin. Pursuant to Section 106(e)(1) of the Federal CWA, Section 6.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 7.0 discusses implementation of TMDLs (phase two) and the relationship between TMDLs and Watershed Restoration Action Strategies (WRAS). Section 8.0 discusses assurance, Section 9.0 public participation in the TMDL process, and Section 10.0 provides references.

2.0 SAN JUAN RIVER BASIN BACKGROUND

2.1 Description and Land Ownership

The entire San Juan River basin encompasses portions of New Mexico, Colorado, Utah, and Arizona. The New Mexico portion extends into portions of McKinley, San Juan, and Rio Arriba counties in the northwestern portion of the state. The geographic area of the 2002 Surface Water Quality Bureau (SWQB) study was from the Navajo Nation boundary at the Hogback to Navajo Dam, as well as tributaries that enter the San Juan River in this area. Land ownership/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, and Jicarilla Apache), State, and Private (Figure 2.1).

2.2 Geology

The San Juan Basin lies on the Colorado Plateau. Several formations of Tertiary and Cretaceous age compose the consolidated geology in the New Mexico portion of the San Juan River basin (Table 2.1, Figures 3.1 - 3.2). The predominant geologic formation is the Nacimiento Formation of Tertiary age which underlies the soils and crops out along nearly all 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 layers underlie the soils and crop out west of the Hogback. These two formations underlie tile soils and compose the outcrop in most of the upland area south of the San Juan River. Near Farmington, Cretaceous rocks rise sharply in some areas, forming hogback ridges (Chronic 1987). All of the shales of Cretaceous age consist at least in part of gray arid black shale. The San Juan River valley is composed in part of Quaternary unconsolidated sand, gravel, silt, clay, and terrace gravel and boulder deposits. Valley soils typically are derived from sandstone, shale, siltstone, and mudstone and range in permeability from moderately rapid to moderately slow (Blanchard et al. 1993).

Table 2.1 Geologic Unit Definitions for the San Juan River Basin (see Figures 3.1 – 3.2)

Geologic Unit Code	Definition
K_{ch}	Cliff House sandstone; transgressive marine sandstone
K_{kf}	Kirtland and Fruitland Formations; coal-bearing, coal primarily in the Fruitland; Campanian to Maastrichtian
K_{l}	Lower Cretaceous, undivided
K_{m}	Mancos Shale; divided into Upper and Lower parts by Gallup Sandstone
K_{mf}	Menefee Formation; mudstone, shale, and sandstone; coal-bearing
K_{mv}	Mesaverde Group; cretaceous sandstones that cap the mesas; includes $K_{mf,}$ $K_{ch,}$ K_{pl}
K_{pc}	Pictured cliff sandstone; prominent cliff forming marine sandstone
K_{pl}	Point Lookout sandstone; regressive marine sanstone
QT_{p}	Older Piedmont alluvial deposit and shallow basin fill
QT_{s}	Upper Santa Fe Group
Q_{al}	Alluvium, Q_{a}
TK_{a}	Combination of Tertiary and Cretaceous (age) rock units
TK_{i}	Paleogene and Upper Cretaceous intrusive rocks
TK_{oa}	Ojo Alamo Formation; fine- to medium-grained sedimentary sandstone; $T_{oa;}$ named after a New Mexico trading post where it was first found. The trading post in turn was named after a large cottonwood tree (called alamo in Spanish) that grew next to the spring nearby (http://www.palaeos.com/Vertebrates/Units/Unit330/330.600.html)
T_{n}	Nacimiento Formation; discontinuous fluvial sandstone
T_{sj}	San Jose Formation; stacked alluvial and fluvial sandstones with lateral discontinuities; recognized by rounded-ledge outcrops

2.3 Water Quality Standards

Water quality standards (WQS) for all assessment units in this document are set forth in the following various sections of *New Mexico Standards for Interstate and Intrastate Surface Waters* (NM Administrative Code [NMAC] 20.6.4) (NMAC 2002):

20.6.4.402 SAN JUAN RIVER BASIN - La Plata river from its confluence with the San Juan river upstream to the New Mexico-Colorado line.

A. Designated Uses: irrigation, limited warmwater fishery, marginal coldwater fishery, livestock watering, wildlife habitat, and secondary contact.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0 and temperature shall not exceed 32.2°C (90°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

20.6.4.403 SAN JUAN RIVER BASIN - The Animas river from its confluence with the San Juan upstream to U.S. highway 550 at Aztec.

A. Designated Uses: municipal and industrial water supply, irrigation, livestock watering, wildlife habitat, marginal coldwater fishery, secondary contact, and warmwater fishery.

B. Standards:

(1) In any single sample: pH shall be within the range of 6.6 to 9.0, and temperature shall not exceed 27°C (80.6°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.
(2) The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 mL; no single sample shall exceed 400/100 mL (see Subsection B of 20.6.4.13 NMAC).

NMAC 20.6.4.900 provides standards applicable to attainable or designated uses unless otherwise specified in 20.6.4.101 through 20.6.4.899. NMAC 20.6.4.12 lists general standards that apply to all surface waters of the state at all times, unless a specified standard is provided elsewhere in NMAC.

The New Mexico Environment Department (NMED) proposed a variety of modifications to San Juan River basin water quality standard segments during the February 2004 triennial review hearings. Most notable,

- The description of segment 20.6.4.401 will be changed to "The main stem of the San Juan river from the Navajo Nation at the Hogback upstream to its confluence with the Animas River" to acknowledge that New Mexico does not have jurisdiction over surface water quality standards in the San Juan River downstream of the Hogback. New Mexico and the Navajo Nation share jurisdiction on the main stem of the San Juan river from the Navajo Nation at the Hogback upstream to its confluence with the La Plata River. A new water quality standard segment (20.6.4.408) will cover the San Juan River from the Animas River to Cañon Largo. This split will not impact any current or proposed water quality criteria.

- Animas River 20.6.4.403 designated contact use of "secondary contact" was changed to "primary contact." The change was made to recognize that swimming has been observed as an existing use in this portion of the Animas River.

Proposed changes to the standards are still under review and have not been approved by USEPA at the time of this writing. Accordingly, this TMDL document was prepared using the existing water quality standards (NMAC 2002).

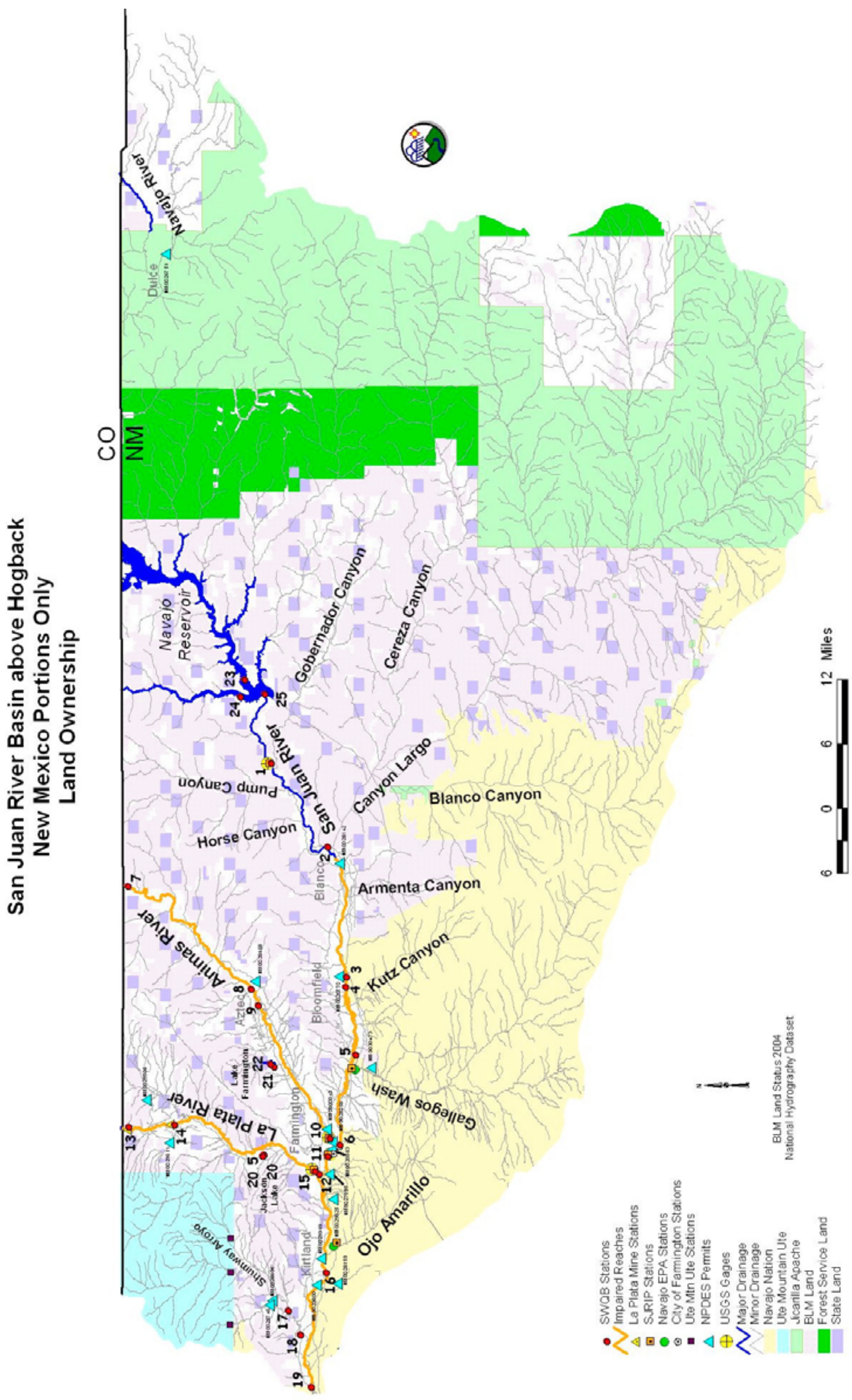


Figure 2.1 San Juan River Basin Land Ownership

2.4 Intensive Water Quality Sampling

The San Juan River basin was intensively sampled by the SWQB in 2002, with additional study during 2003. A brief summary of the survey and the hydrologic conditions during the intensive sample period is provided in the following subsections.

2.4.1 Survey Design

Surface water quality samples were collected monthly between March and October for the 2002 intensive SWQB study. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches and reservoirs) throughout the basin (Table 2.2, Figures 2.2 and 2.3). Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. Surface water grab samples stations were analyzed for a variety of chemical/physical parameters. Data results from grab sampling are housed in the SWQB provisional water quality database and will be uploaded to USEPA's Storage and Retrieval (STORET) database.

Table 2.2 SWQB 2002 San Juan River Sampling Stations

Station	Station Location
1	SAN JUAN RIVER BLW GAGE STATION
2	SAN JUAN RIVER AT BRIDGE NEAR BLANCO
3	SAN JUAN RIVER AT BLOOMFIELD BRIDGE
4	SAN JUAN RIVER BELOW BLOOMFIELD WWTP
5	SAN JUAN R AT HAMMOND BRIDGE
6	SAN JUAN R ABV THE ANIMAS RIVER IN FARMINGTON
7	ANIMAS RIVER @ COLORADO STATE LINE
8	ANIMAS R @ AZTEC @ HWY 550 BRIDGE
9	ANIMAS RIVER 300M BELOW AZTEC WWTP OUTFALL
10	ANIMAS R AT FARMINGTON
11	SAN JUAN RIVER AT BISTI BRIDGE
12	SAN JUAN R ABV LA PLATA R CONFL
13	LA PLATA RIVER @ NM-COLORDO STATE LINE
14	LaPlata at LaPlata
15	LA PLATA RIVER NR FARMINGTON, NM
16	SAN JUAN RIVER NEAR KIRTLAND
17	Shumway ab Creek 6800
18	Shumway at Hwy 550
19	SAN JUAN R AT HOGBACK
20	Jackson Lake at Dam
20.5	Jackson Lake Shallow
21	Lake Farmington Deep
22	Lake Farmington Shallow
23	Navajo Reservoir at Sims
24	Navajo Reservoir at Gooseneck
25	Navajo Reservoir towards dam

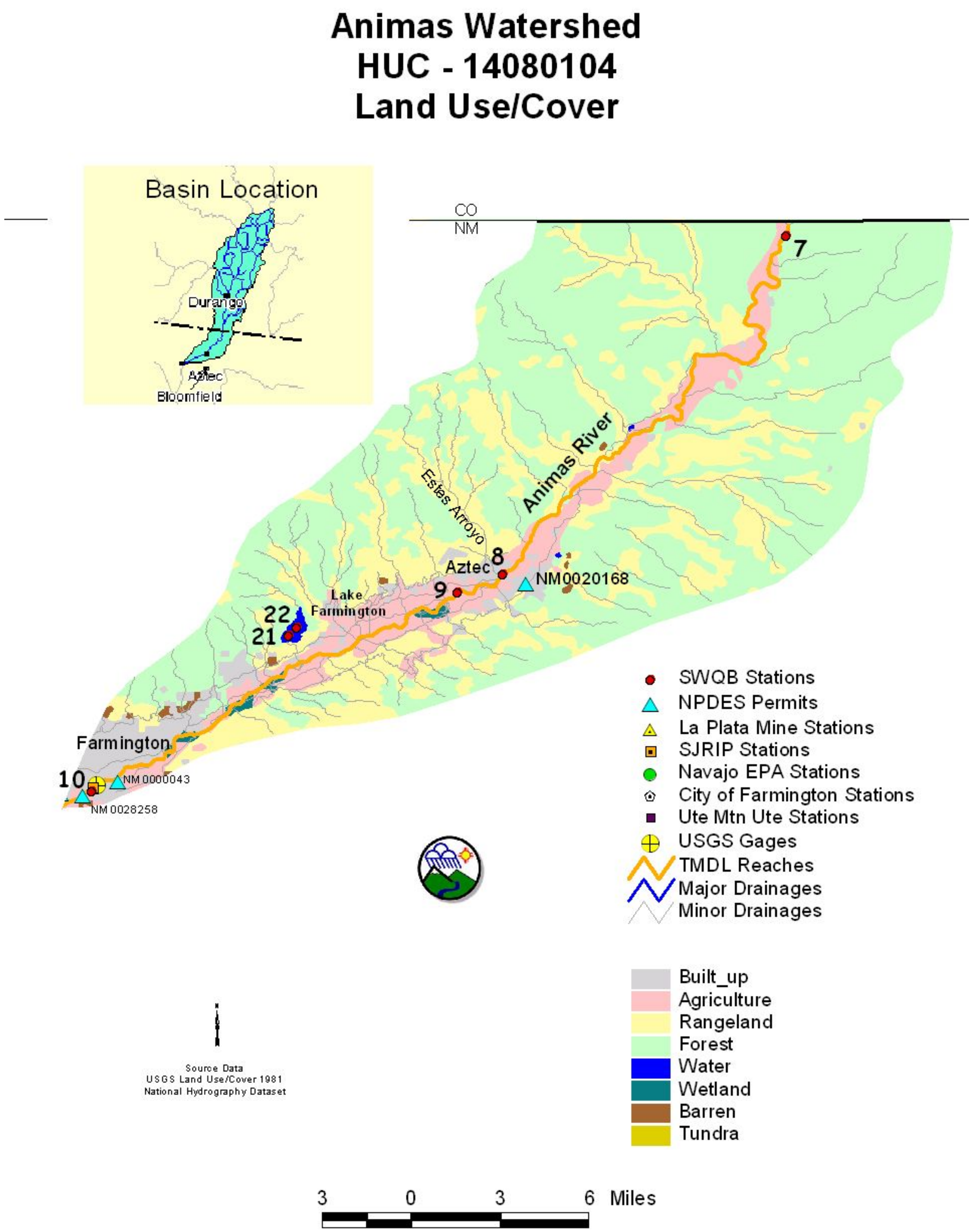


Figure 2.2 Animas River Land Use/Cover and Sampling Stations

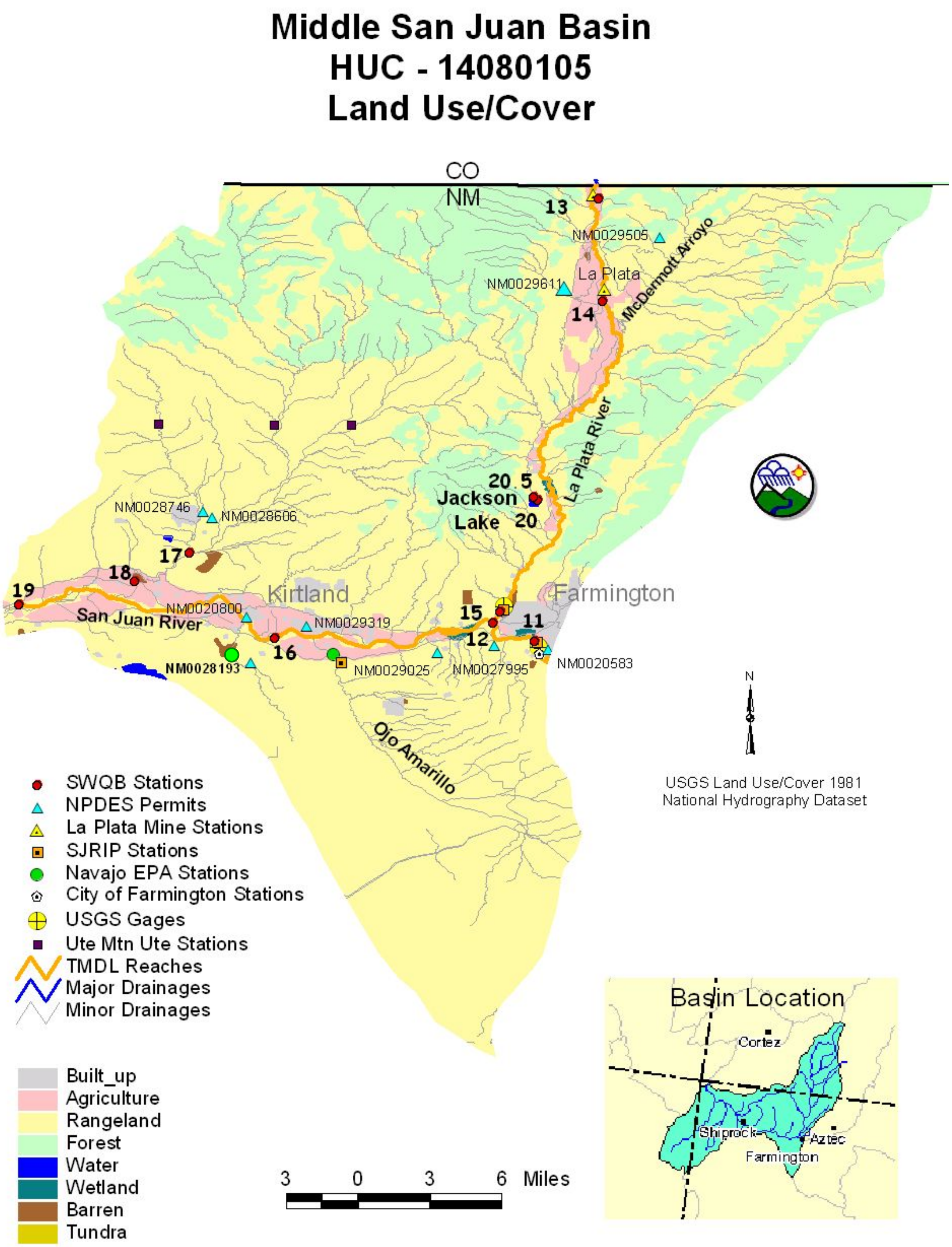


Figure 2.3 Middle San Juan River Land Use/Cover and Sampling Stations

In 2003, additional nutrient assessment data was collected in the Animas River as part of the Animas River Nutrient Work Group efforts. In 2002, SWQB applied for and received a CWA Section 104(b)(3) grant to develop a protocol for determination of sedimentation/siltation impairment in large southwest rivers. The San Juan and Animas Rivers were chosen as case studies for this protocol. Data collection occurred fall of 2003. Section 4.0 addresses the supplementary nutrient assessment efforts. Additional information on sedimentation/siltation was previously addressed in the *Final Total Maximum Daily Load (TMDL) for the San Juan River Watershed (Part 1)* (NMED/SWQB 2005).

All sampling and assessment techniques used during the 2002-2003 intensive SWQB survey are detailed in the *Quality Assurance Project Plan* (QAPP) (NMED/SWQB 2001), assessment protocols (NMED/SWQB 2004b), and U.S. Department of Agriculture (USDA) National Sedimentation Lab (NSL) study (Heins *et al.*, 2004). As a result of the 2002 and 2003 monitoring efforts, several surface water impairments were determined. Accordingly, these impairments were added to New Mexico's 2004-2006 CWA Integrated §303 (d)/305(b) list (NMED/SWQB 2004a).

2.4.2 Hydrologic Conditions

There are three active, real-time U.S. Geological Survey (USGS) gaging stations in the San Juan River basin associated with the reaches presented in this document. USGS gage locations are presented in Figures 2.2 and 2.3. Daily stream flow for these USGS gages are presented graphically in Figures 2.4 through 2.6 for the 2002 calendar year.

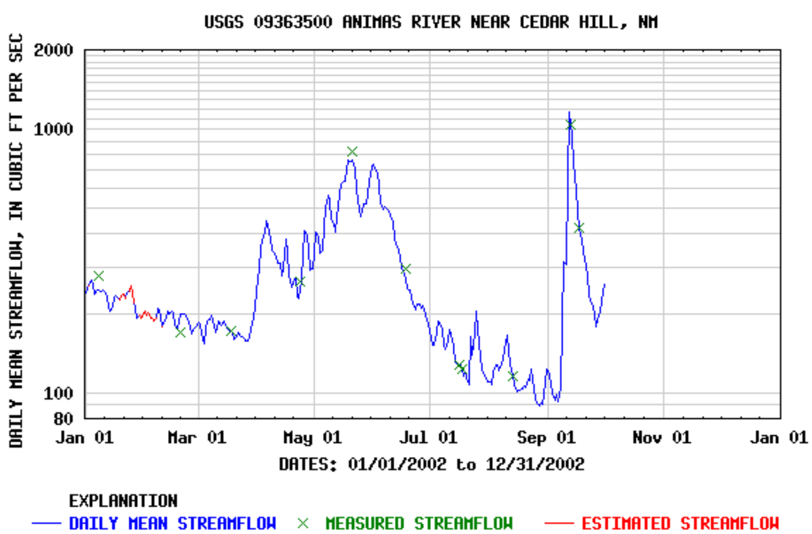


Figure 2.4 2002 USGS Average Daily Flow, Animas River near Cedar Hill, NM

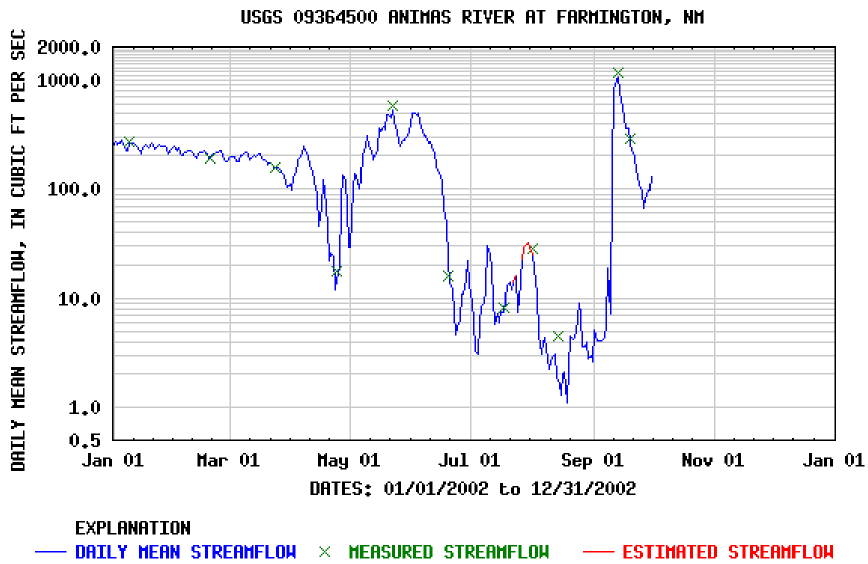


Figure 2.5 2002 USGS Average Daily Streamflow, Animas River at Farmington, NM

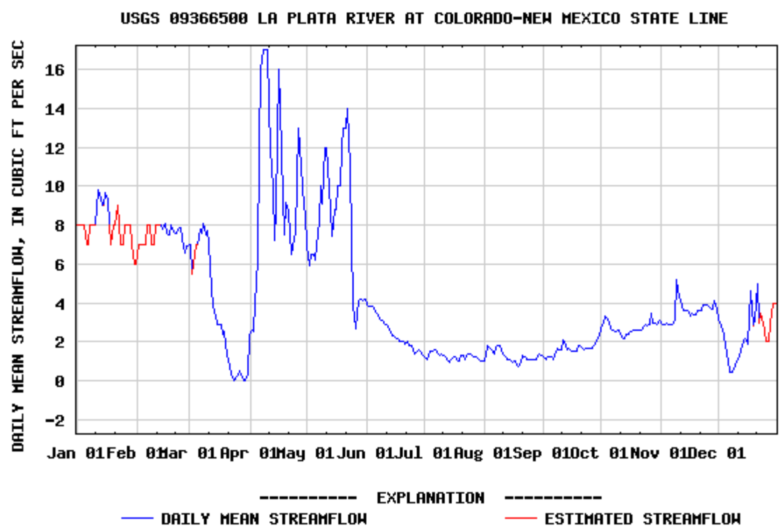


Figure 2.6 2002 USGS Average Daily Streamflow, La Plata River at Colorado-New Mexico State Line

Flows during the 2002 survey year were below average based on the period of record. Flows were among the lowest on record. As stated in the Assessment Protocol (NMED/SWQB 2004b), data collected during all flow conditions, including low flow conditions (i.e., flows below the 4-day, 3-year low flow frequency [4Q3]), will be used to determine 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.

3.0 INDIVIDUAL WATERSHED DESCRIPTIONS & IMPAIRMENTS

TMDLs were developed for assessment units for which constituent (or pollutant) concentrations measured during the 2002 water quality survey, as combined with quality outside data, indicated 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. In addition, the 2004-2006 Integrated §303(d)/§305(b) listings within the San Juan River basin are discussed (NMED/SWQB 2004a).

3.1 Animas River Watershed (HUC 14080104)

The headwaters of the 1,357 square mile (mi^2) Animas River watershed originate in Colorado. According to available Geographic Information System (GIS) coverages, the New Mexico portion of the Animas River watershed (Photo 3.1) is approximately 277 mi^2 and includes several ephemeral tributaries. As presented in Figure 2.1, land ownership is 34% private, 60% BLM, and 6% State. Land use includes 56% forest, 8% agriculture, 29% rangeland, 5% built-up land, 1% water, and less than 1% wetlands and barren land (Figure 2.2). The geology of the Animas watershed is predominantly comprised of the Tertiary Nacimiento Formation with limited areas of the San Jose Formation near the northeast section of the New Mexico portion of the watershed (Figure 3.1).

Photo 3.1 Animas River at Boyd Park, September 2003.

The New Mexico portion of the Animas River was divided into two assessment units (AUs). SWQB established two stations in each AU. Data from these stations were combined with readily available data from other sources that met quality control objectives, and assessed using established assessment protocols to determine whether or not designated uses were being met. As a result, the Animas River (San Juan River to Estes Arroyo) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for nutrients and fecal coliform, and the Animas River (Estes Arroyo to Colorado border) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for temperature (NMED/SWQB 2004a). The upper Animas River AU designated use of coldwater fishery is not existing or attainable in this stream reach. Accordingly, a change to the water quality standards for will be proposed in future triennial reviews and a temperature TMDL will not been prepared.

A fecal coliform TMDL was previously established for the Animas River (San Juan River to Estes Arroyo) and was included in the *Final Total Maximum Daily Load (TMDL) for the San Juan River Watershed (Part 1)* (NMED/SWQB 2005):

A TMDL for nutrient impairment in the Animas River between the San Juan River and Estes Arroyo has not previously been development and therefore is included in this document.

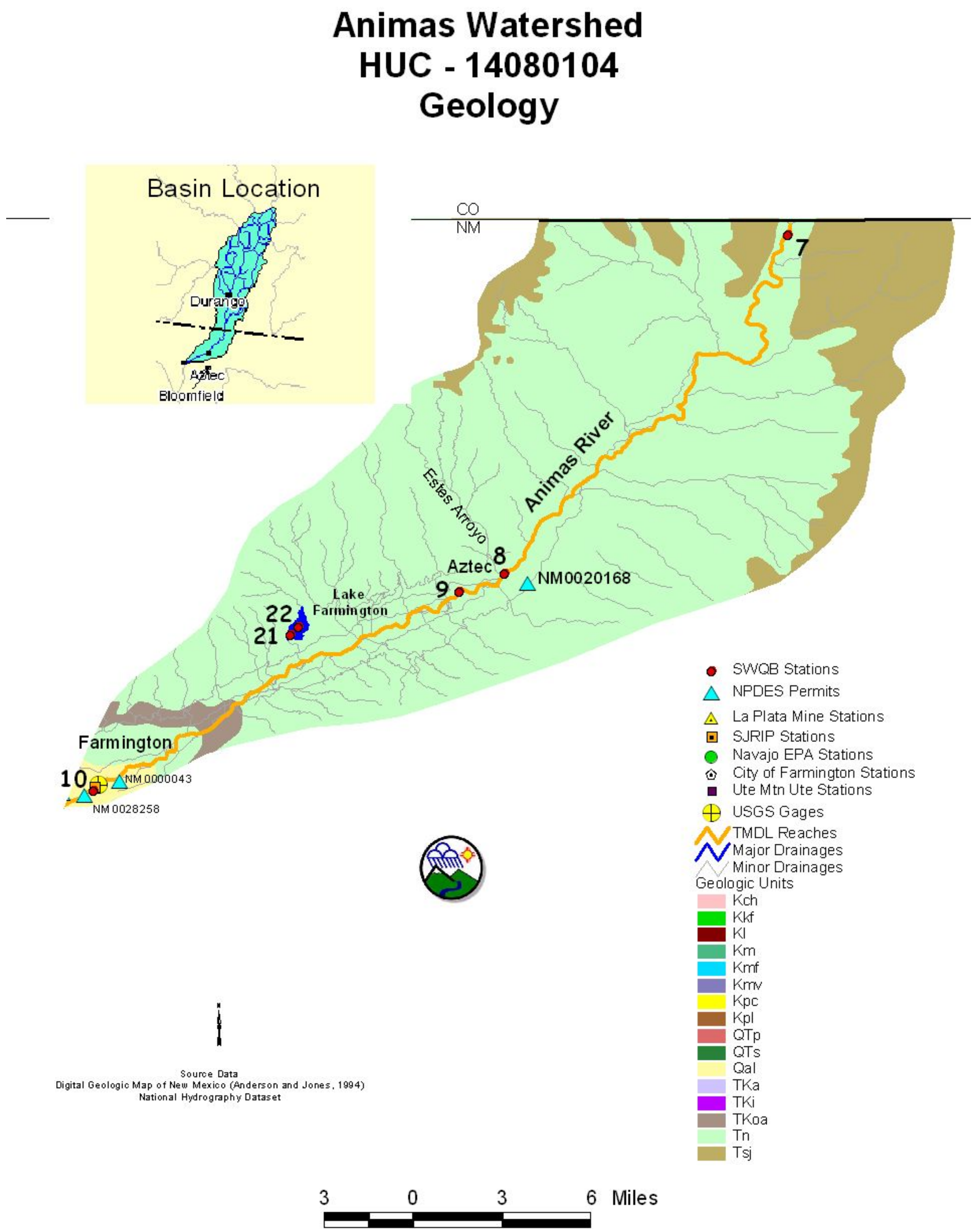


Figure 3.1 Animas River Basin Geology (see Table 2.1 for definitions)

3.2 Middle San Juan River Watershed (HUC 14080105)

The Middle San Juan River watershed includes the La Plata River and San Juan River between the Navajo Nation boundary at the Hogback and the Animas River. The headwaters of the 583 mi^2 La Plata River watershed originate in Colorado. According to available GIS coverages, the New Mexico portion of the La Plata River watershed is approximately 162 mi^2 and includes several ephemeral tributaries. As presented in Figure 2.1, land ownership is 29% private, 45% BLM, 20% Native Lands (Ute Mountain Ute) and 6% State. Land use includes 48% forest, 6% agriculture, 45% rangeland, <1% built-up land, <1% water, < 1% wetlands and, <1% barren (Figure 2.3). The geology of the Middle San Juan River watershed consists of a complex distribution of Tertiary and Cretaceous formations, with Nacimiento Formation as the most predominant layer (Figure 3.2). The Navajo Nation at the Hogback forms the western border of the study area. The hogback is formed by steeply tilted Cliffhouse sandstone, which is part of the Mesaverde group (Chronic 1987).

The New Mexico portion of the La Plata River was divided into two AUs (Photo 3.2). SWQB established one station in the lower AU and two stations in the upper AU. Data from these stations were combined with readily available data from other sources that met quality control objectives and assessed using established assessment protocols to determine whether or not designated uses were being met. As a result, the La Plata River (McDermott Arroyo to Colorado border) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for fecal coliform and dissolved oxygen. La Plata River (San Juan River to McDermott Arroyo) was included on the Integrated 2004-2006 CWA §303(d)/§305(b) list for fecal coliform and sedimentation/siltation (NMED/SWQB 2004a). This lower La Plata River AU was also listed for dissolved oxygen, but the designated use marginal coldwater fishery is not existing or attainable in this stream reach. Accordingly, a change to the water quality standards will be proposed in future triennial reviews.

Photo 3.2 La Plata River near La Plata, NM, November 2003

The following TMDLs were previously established for the La Plata River and were included in the *Final Total Maximum Daily Load (TMDL) for the San Juan River Watershed (Part 1)* (NMED/SWQB 2005):

- ***Fecal coliform***: La Plata River (San Juan River to McDermott Arroyo), La Plata River (McDermott Arroyo to Colorado border)
- ***Sedimentation/siltation***: La Plata River (San Juan River to McDermott Arroyo)

A TMDL for dissolved oxygen impairment in the La Plata River between McDermott Arroyo and the Colorado border has not previously been development and therefore is included in this document.

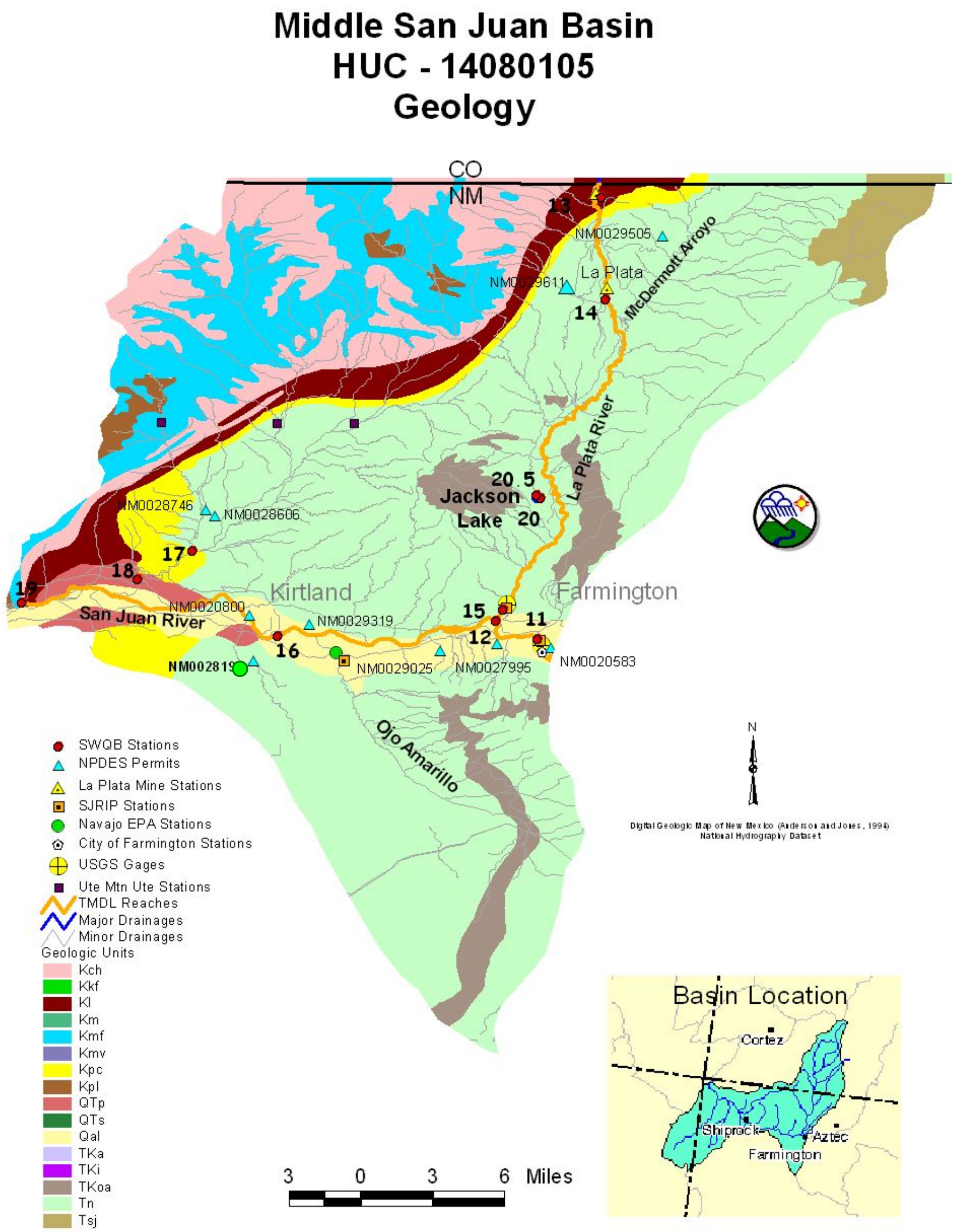


Figure 3.2 Middle San Juan River Basin Geology (see Table 2.1 for definitions)

4.0 NUTRIENTS

The potential for excessive nutrients in the lower Animas were noted through visual observation during the 2002 study. To address this concern, a workgroup was formed comprised of state and tribal environmental specialists, as well as concerned citizens.

The nutrient assessment protocol was performed on 8/25/03 at the site approximately one mile above the San Juan River at Boyd Park (Station 10; Figure 2.2). Total nitrogen values were above the ecoregion criteria of 0.42 milligram per liter (mg/L) in greater than 15% of the samples, the percent dissolved oxygen (DO) saturation was greater than 120%, and the ash free dry mass of algal sampling was greater than 5 milligrams per square centimeter (mg/cm^2). The nutrient assessment protocol was also performed on 8/25/03 at the Flora Vista site (Station 9; Figure 2.2). The chlorophyll a concentration was greater than 0.010 mg/cm^2, the percent DO saturation was greater than 120%, and the ash free dry mass of algal sampling was greater than 5 mg/cm^2. Since three or more indicators were present at both sites, nutrients will be added as a cause of non support.

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

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

Rain, overland runoff, groundwater, drainage networks, and industrial and residential waste effluents transport nutrients to receiving waterbodies. Once nutrients have been transported into a waterbody 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 (Figure 4.1).

As noted above, phosphorus and nitrogen are essential for proper functioning of ecosystems. However, excess nutrients cause conditions unfavorable for the 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 (Figure 4.1). The relationship between nuisance algal growth and nutrient enrichment in stream systems has been well documented in the literature (Welch 1992; Van Nieuwenhuyse and Jones 1996; Dodds et al. 1997; Chetelat et al. 1999). Unfortunately, the magnitude of nutrient concentration that constitutes an “excess” is difficult to determine and varies by ecoregion.

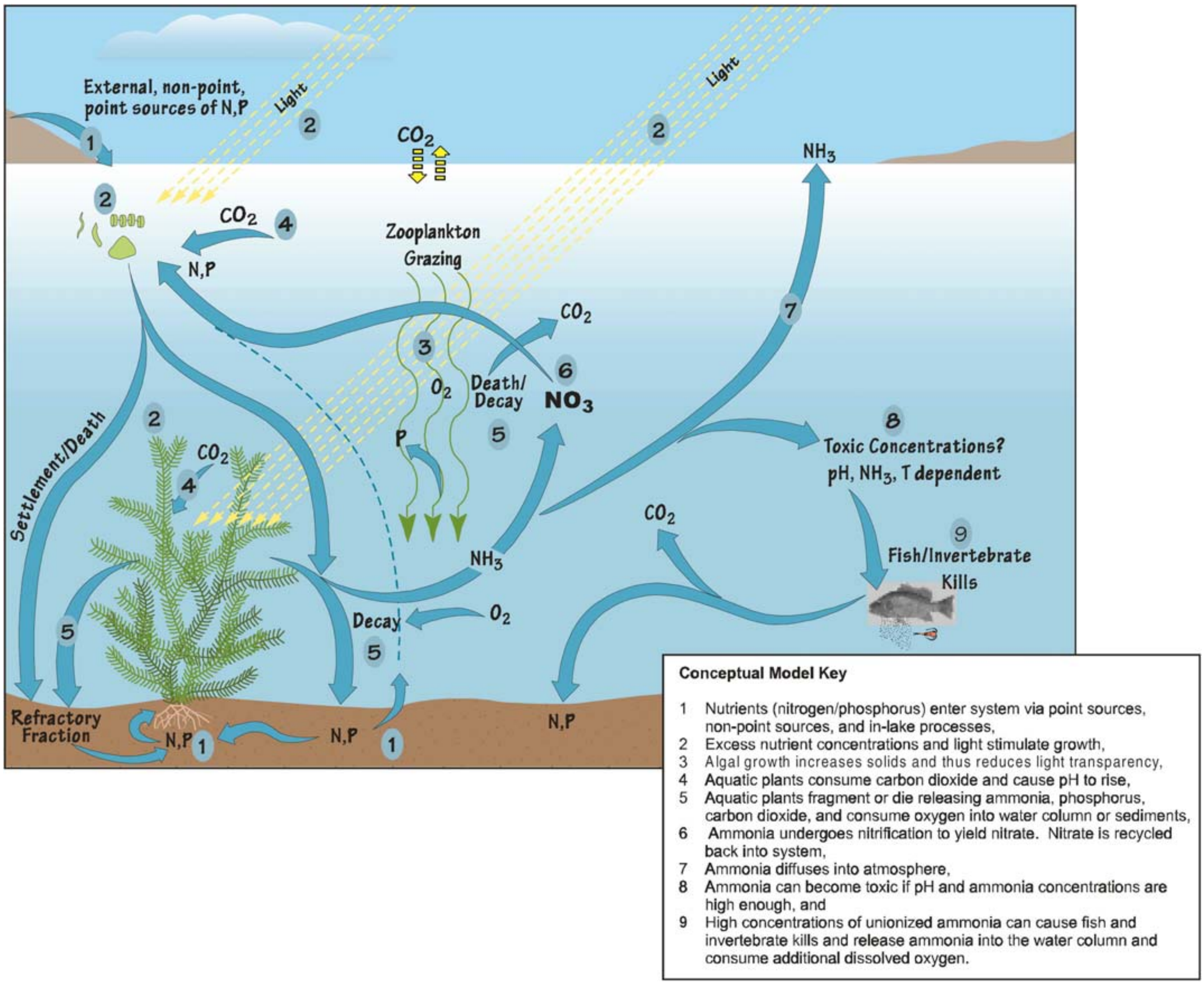


Figure 4.1 Nutrient Conceptual Model (USEPA 1999a)

4.1 Target Loading Capacity

Target values for this Nutrient TMDL will be determined based on 1) the presence of numeric criteria or appropriate numeric translator to a narrative standard, 2) the degree of experience in applying the indicator, and 3) the ability to easily monitor and produce quantifiable and reproducible results. This TMDL is also consistent with New Mexico's antidegradation policy.

The New Mexico Water Quality Control Commission (WQCC) has adopted narrative water quality standards for plant nutrients to sustain and protect existing or attainable uses of the surface waters of the state. This general standard applies to surface waters of the state at all times unless a specified standard is provided elsewhere. These water quality standards have been set at a level to protect cold-water aquatic life.

The marginal coldwater aquatic life use designation requires that a stream have water quality, streambed characteristics, and other attributes of habitat sufficient to protect and maintain marginal coldwater aquatic life. The plant nutrient standard leading to an assessment of use impairment is as follows (NMAC 20.6.4.12.E):

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

There are two potential contributors to nutrient enrichment in a given stream: excessive nitrogen and/or phosphorus. The reason for controlling plant growth is to preserve aesthetic and ecologic characteristics along the waterway. The intent of numeric standards for nitrogen and phosphorus is to control the excessive growth of attached algae and higher aquatic plants that can result from the introduction of these plant nutrients into streams. Algal bioassays and laboratory analysis of waters sampled along this assessment unit showed a range of results (Appendix A). In water collected at Flora Vista, phosphorus addition did not increase algal growth by itself but did increase growth when added along with nitrogen addition. Similarly, in water sampled at Aztec, growth was stimulated when both nitrogen and phosphorus were added. These results indicate that both sites are limited for both nitrogen and phosphorus and both nutrients are driving the productivity of algae and macrophytes in the stream. Therefore, to ensure that the narrative water quality standards are met, management procedures should avoid any increase in both nitrogen and phosphorus inputs.

Currently, there are no numeric standards applicable to this assessment unit for total phosphorus (TP) and total nitrogen (TN). Numeric standards are 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 control plans, and to support designated uses within the Animas River.

The USEPA has published recommended nutrient criteria for causal (TN and TP) and response (chlorophyll a and turbidity) variables associated with the prevention and assessment of eutrophic conditions (USEPA 2000). The criteria are empirically derived from data in USEPA's STORET to represent conditions of surface waters that are minimally impacted by human activities and protective of aquatic life and recreational uses. Ideally, USEPA wanted to base these criteria on actual reference conditions. The criteria would have been based on the 75th percentile of reference condition data. However, much of USEPA's data could not be considered to be reference conditions. Consequently, USEPA performed a statistical analysis of the entire body of non-reference data. The 25th percentile of each season (winter, spring, summer, fall) was calculated, and then the median of these four values was calculated. This approach assumes that the lower 25th percentile of all data overlaps with the 75th percentile of reference condition data, so therefore the 25th percentile data can be used to represent reference conditions.

The Animas River watershed is located in Level III Ecoregion 22 (the Arizona/New Mexico [AZ/NM] Plateau) contained within Aggregate Ecoregion III (the Xeric West). The USEPA's recommended criteria for total phosphorus and total nitrogen in streams associated with these ecoregions are presented in Table 4.1 below.

Table 4.1 USEPA's Recommended Nutrient Criteria for Ecoregion III (Xeric West), Subecoregion 22 (AZ/NM Plateau)

Nutrient Parameter	USEPA's Recommended Criteria	
	Xeric West	AZ/NM Plateau
Total Phosphorus	0.02 mg P/L	0.015 mg P/L
Total Nitrogen	0.38 mg N/L	0.23 mg N/L

The USEPA developed these criteria with the intention that they serve as a starting point for states to develop more refined nutrient criteria, as appropriate. There is a great deal of variability in nutrient levels and nutrient responses throughout the country due to differences in geology, climate and waterbody type. Rather than promulgate the proposed criteria, USEPA has allowed states and tribes to submit nutrient criteria development plans to document how nutrient criteria will be developed. SWQB has submitted a plan to USEPA that uses a weight-of-evidence approach, which includes a number of indicators of nutrient enrichment:

- Total Nitrogen concentration (TN)
- Total Phosphorus concentration (TP)
- Dissolved Oxygen Concentration
- Dissolved Oxygen Saturation
- pH
- Algal Productivity (from algal bioassays)
- Chlorophyll a concentration
- Hilsenhoff Biotic Index
- Benthic Macroinvertebrate IBI Score

USEPA Region 6 contracted with USGS-Austin, TX to provide technical support to states in the development of site-specific ecoregional nutrient criteria that fully reflect localized conditions and protect specific designated uses. As part of this assistance, the USGS modified the proposed USEPA ecoregional numeric criteria for TP and TN based on further stratification and analysis of the available TP and TN data. The aggregate ecoregions used in the proposed criteria were stratified to Level III Ecoregions (Omernik 1987) and site medians were used for sites with multiple data points. The USGS's proposed Ecoregion 22 criteria for TP and TN are 0.07 mg/L and 0.42 mg/L, respectively. The criteria for the other indicators are from USEPA guidance documents, peer reviewed literature, and NMED WQSs.

This TMDL document is adopting the philosophy and numeric targets suggested by the USGS-Austin, TX because the suggested numeric targets are site-specific ecoregional criteria that reflect the localized conditions of the AZ/NM Plateau and protect the designated uses along this assessment unit. The USGS suggests an instream TP concentration of less than 0.07 mg/L and an instream TN concentration of less than 0.42 mg/L (Table 4.2).

Table 4.2 Numeric Nutrient Targets

Constituent or Factor	TMDL Target Concentrations
Total Phosphorus	0.07 mg P/L
Total Nitrogen	0.42 mg N/L

4.2 Flow

The presence of plant nutrients 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 plant nutrients to increase. Thus, a TMDL is calculated for each assessment unit at a specific flow.

The *critical condition* can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. The critical flow is used in calculation of point source (National Pollutant Discharge Elimination System [NPDES]) permit WLA and in the development of TMDLs.

The critical flow conditions for this TMDL occur when the ratio of effluent to stream flow is the greatest and was obtained using a 4Q3 regression model (Appendix B). The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. It is assumed that 4Q3 flows will be the critical periods for aquatic life.

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning 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.

4.3 Calculations

This section describes the relationship between the numeric target and the allowable pollutant-level by determining the waterbody's total assimilative capacity, or loading capacity, for the pollutant. The loading capacity is the maximum amount of pollutant loading that a waterbody can receive while meeting its water quality objectives. The Linkage Analysis therefore represents the critical quantitative link between the TMDL and attainment of the water quality standards.

As the Animas River flows past Aztec, Flora Vista, and Farmington it has a specific carrying capacity for nutrients. This carrying capacity, or TMDL, is defined as the mass of pollutant that can be carried under critical low-flow conditions without violating the target concentration for that constituent. These TMDLs were developed based on simple dilution calculations using 4Q3 flow, the numeric target proposed by the USGS in Austin, TX, and a conversion factor. The specific carrying capacity of a receiving water for a given pollutant, may be estimated as:

Combined Flow (in million gallons per day [mgd]) x Numeric Target (in mg/L) x 8.34 = TMDL (pounds per day [lbs/day]). **(Eq. 1)**

USGS gage data were used to determine the 4Q3 for this calculation (Figure 2.5 and Appendix B). The 4Q3 was estimated through application of USGS gage data to a log Pearson Type III distribution using "*Input and Output for Watershed Data Management*" (IOWDM) software, Version 4.1 (USGS 2002a) and "*Surface-Water Statistics*" (SWSTAT) software, Version 4.1 (USGS 2002b). A unit-less conversion factor of 8.34 is used to convert units to pounds per day (Appendix C). By applying Equation 1 to total phosphorus, it is determined that the lower Animas River can transport approximately 33.5 lbs/day of total phosphorus and 201 lbs/day of total nitrogen during critical low-flow conditions and in-stream concentrations will not exceed 0.07 mg/L and 0.42 mg/L, respectively. The annual target loads for TP and TN are summarized in Table 4.3.

The measured loads for TP and TN were similarly calculated. In order to achieve comparability between the target and measured loads, the same flow value was used for both calculations. The geometric mean of the collected data that *exceeded* the numeric criteria was substituted for the numeric target in Equation 1 (Table 4.4). The same conversion factor of 8.34 was used. The results are presented in Table 4.5.

Table 4.3 Estimates of Annual Target Loads for TP and TN: Animas River (San Juan River to Estes Arroyo)

Parameter	Combined Flow[1] (mgd)	Numeric Target (mg/L)	Conversion Factor	Estimate of Target Loading (lbs/day)
Total Phosphorus	57.4	0.07	8.34	33.5[2]
Total Nitrogen	57.4	0.42	8.34	201[2]

1. Combined Flow = 4Q3 low-flow + current WWTP design capacity (1.0 mgd).
2. Values rounded to three significant figures.

Table 4.4 SWQB data that *exceeded* the numeric criteria for TP and TN: Animas River (San Juan River to Estes Arroyo)

Location	Sampling Date	TP (mg/L)	TN (mg/L)
Animas River near Flora Vista			
	09-19-2002	0.118	0.517
	08-25-2003	0.399	1.250
	04-23-2004	0.071	0.591
Animas River @ Farmington			
	07-16-2002	---	0.656
	09-17-2002	0.147	0.476
	08-25-2003	0.181	0.654
GEOMETRIC MEAN		**0.155**	**0.654**

Table 4.5 Estimates of Annual Measured Loads for TP and TN: Animas River (San Juan River to Estes Arroyo)

Parameter	Combined Flow[1] (mgd)	Geometric Mean Conc.[2] (mg/L)	Conversion Factor	Measured Load Capacity (lbs/day)
Total Phosphorus	57.4	0.155	8.34	74.2[3]
Total Nitrogen	57.4	0.654	8.34	311[3]

1. Combined Flow = 4Q3 low-flow + current WWTP design capacity (1.0 mgd).
2. Geometric mean of TP and TN *exceedences* (See Table 4.4 for data).
3. Values rounded to three significant figures.

4.4 Waste Load Allocations and Load Allocations

4.4.1 Waste Load Allocation

The only existing point source along this assessment unit is the NPDES-permitted wastewater treatment plant (WWTP) owned and operated by the city of Aztec (NM0020168). There are no individually permitted Municipal Separate Storm Sewer System (MS4) storm water permits in this assessment unit.

Excess nutrient levels may be a component of some (primarily construction) storm water discharges so these discharges should be addressed. In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES construction general storm water permit (CGP) 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., total suspended solids, turbidity, siltation, stream bottom deposits, etc.) and flow velocity during and after construction compared to preconstruction 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 storm water facilities are generally covered under the current NPDES Multi Sector General Storm Water Permit (MSGP). This permit also requires preparation of an SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In 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.

Therefore, this TMDL does not include a specific WLA for storm water discharges for this assessment unit. However, because the city of Aztec owns and operates an NPDES-permitted wastewater treatment plant a WLA for the WWTP is included in this TMDL.

A simple mixing model was used to calculate the WLA for NM0020168. The effluent limitations for TP and TN were calculated using the Equation 2:

$$C_e = \frac{C_s(Q_a + Q_e) - C_a Q_a}{Q_e} \qquad \textbf{(Eq. 2)}$$

where C_e = allowable WWTP effluent concentration (mg/L)
C_s = numeric target (TP = 0.07 mg/L & TN = 0.42 mg/L)
C_a = average stream concentration upstream of assessment unit (mg/L)
Q_e = design capacity of WWTP (mgd)
Q_a = critical 4Q3 low-flow of stream (mgd)

The equation is based on a simple steady-state mass balance model. The numeric target and ambient upstream concentrations used to calculate the annual effluent limitation are 0.07 and 0.05 mg/L, respectively for TP and 0.42 and 0.37 mg/L, respectively for TN. The data that were used to calculate the average ambient upstream concentration are listed in Table 4.6. The results of this mixing calculation for TP are presented in Table 4.7 and in Table 4.8 for TN.

Table 4.6 Data used to calculate ambient upstream concentrations (C_a)

Location	Sampling Date	TP (mg/L)	TN (mg/L)
Animas River @ Hwy 550 Bridge @ Aztec	04-16-2002	0.015	0.282
	05-20-2002	0.069	0.329
	05-28-2002	0.046	0.248
	06-18-2002	0.015	0.226
	07-15-2002	0.036	0.407
	08-20-2002	0.015	0.282
	09-19-2002	0.177	0.515
	10-22-2002	0.015	0.100
	08-25-2003	0.208	0.689
	10-07-2003	0.015	0.233
	04-23-2004	0.076	0.640
	11-18-2004	0.006	0.230
Animas River @ Colorado State Line	04-17-2002	0.015	0.285
	05-21-2002	0.048	0.231
	05-28-2002	0.015	0.263
	06-18-2002	0.015	0.231
	07-15-2002	0.029	0.277
	08-21-2002	0.073	0.303
	09-16-2002	0.115	0.398
	10-21-2002	0.400	0.100
	08-26-2003	0.121	0.304
	10-06-2003	0.015	0.284
Aggregate Ecoregion III Level III Ecoregion 22 [(a)]			
Fall	n = 78 & 31	0.031	0.310
Spring	n = 83 & 33	0.080	0.460
Summer	n = 82 & 33	0.050	0.350
Winter	n = 58 & 13	0.033	0.470
AVERAGE AMBIENT CONCENTRATION		**0.051**[(b)]	**0.374**[(b)]

NOTE: TP = Total Phosphorus TN = Total Nitrogen mg/L = milligrams per liter
n = number of samples collected (1st number for TP; 2nd number for TN)
[(a)] Taken from USEPA's ecoregional nutrient criteria dataset. Median values for each season are shown. (USEPA 2000)
[(b)] Values rounded to three significant figures.

Table 4.7 Allowable TP effluent concentration and WLA to meet water quality standards in the Animas River (San Juan River to Estes Arroyo)

	Discharge		Total Phosphorus		
Time Scale	Q_a (mgd)	Q_e (mgd)	C_a (mg/L)	C_e (mg/L)	WLA (lbs/day)
Annual	56.4*	1.00	0.051*	1.12*	9.32*

NOTE: Q_a = critical 4Q3 low-flow of stream (mgd)
Q_e = design capacity of WWTP (mgd)
C_a = average stream concentration upstream of assessment unit (mg/L)
C_e = allowable WWTP effluent concentration (mg/L)
WLA = Waste Load Allocation (lbs/day)
* = Values rounded to three significant figures.

Table 4.8 Allowable TN effluent concentration and WLA to meet water quality standards in the Animas River (San Juan River to Estes Arroyo)

	Discharge		Total Nitrogen		
Time Scale	Q_a (mgd)	Q_e (mgd)	C_a (mg/L)	C_e (mg/L)	WLA (lbs/day)
Annual	56.4*	1.00	0.374*	3.04*	25.3*

NOTE: Q_a = critical 4Q3 low-flow of stream (mgd)
Q_e = design capacity of WWTP (mgd)
C_a = average stream concentration upstream of assessment unit (mg/L)
C_e = allowable WWTP effluent concentration (mg/L)
WLA = Waste Load Allocation (lbs/day)
* = Values rounded to three significant figures.

Current loading from the WWTP was estimated from a grab sample collected on June 13, 2005 by SWQB staff. The TP and TN concentrations measured at the WWTP outfall pipe were 0.833 and 2.56 mg/L, respectively. Assuming that discharge was at plant capacity (1.0 mgd), the current phosphorus loading from the plant into the Animas River is 6.95 lbs/day and the current nitrogen loading from the plant into the Animas River is 21.3 lbs/day. Therefore, a TP WLA of 9.30 lbs/day and TN WLA of 25.2 lbs/day are justifiable given that the current load is based on one data point and the WWTP only accounts for approximately 2% of the flow in the Animas River.

4.4.2 Background Load

Soil erosion, leaf litter decay, and wild animal waste supply background phosphorus and nitrogen loads from undeveloped land to the Animas River. Background concentrations were determined from USEPA/USGS ecoregional reference criteria and SWQB nutrient data from the Colorado/New Mexico border.

Reference sites are relatively undisturbed by human influences. The definition of a reference condition ranges from a pristine, undisturbed state of a stream, to merely the "best available" or "best attainable" conditions. In the case of the New Mexican streams used in this study, the seasonal concentrations from Level III Ecoregion 22 were used to help determine background water quality. SWQB nutrient data from upstream sampling sites and the USEPA seasonal concentrations from Level III Ecoregion 22 reference sites were averaged to calculate an annual background concentration.

The background load to the Animas River is calculated by multiplying the combined flow volume (in mgd) by the background concentration (in mg/L). A unit-less conversion factor of 8.34 is used to convert units to lbs/day (Appendix C). The TP background load for the assessment unit is summarized in Table 4.9 and the TN background load is summarized in Table 4.10.

Table 4.9 Calculated Total Phosphorus Background Load to the Animas River

Time Interval	Combined Flow[1] (mgd)	Background Concentration (mg P/L)	Unit-less Conversion Factor	Estimated TP Background Load (lbs/day)
Annual	57.4	0.017	8.34	8.18

1. Combined Flow = 4Q3 low-flow + current WWTP design capacity (1.0 mgd).

Table 4.10 Calculated Total Nitrogen Background Load to the Animas River

Time Interval	Combined Flow (mgd)	Background Concentration (mg N/L)	Unit-less Conversion Factor	Estimated TN Background Load (lbs/day)
Annual	57.4	0.24	8.34	115

4.4.3 Load Allocation

In order to calculate the LAs for phosphorus and nitrogen , the WLAs, Background Loads (BL), and MOSs were subtracted from the target capacity (TMDL) using the following equation:

$$WLA + LA + BL + MOS = TMDL \qquad \textbf{(Eq.3)}$$

The results are presented in Table 4.11 and Figures 4.2 and 4.3.

Table 4.11 Calculation of Annual TMDL for TP and TN

Parameter	WLA (lbs/day)	LA (lbs/day)	BL (lbs/day)	MOS (10%) (lbs/day)	TMDL (lbs/day)
Total Phosphorus	9.32	12.6	8.18	3.35	33.5
Total Nitrogen	25.3	40.6	115	20.1	201

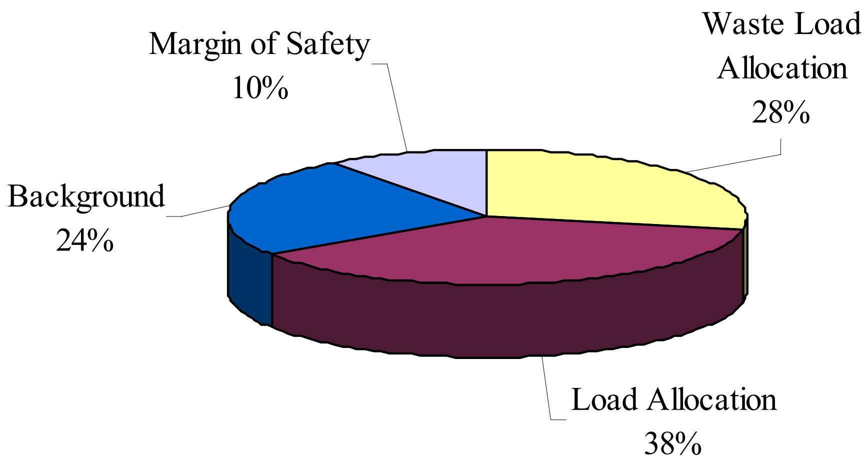


Figure 4.2 Annual TMDL for Total Phosphorus

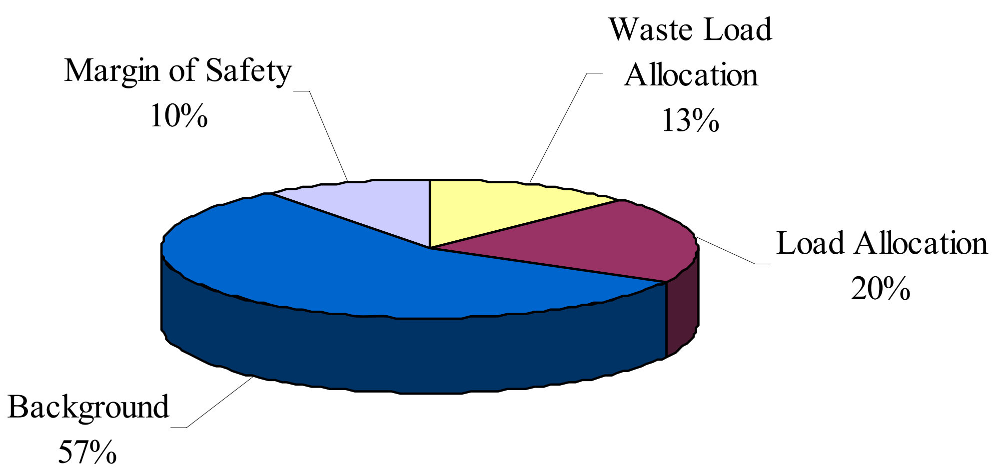


Figure 4.3 Annual TMDL for Total Nitrogen

The load reductions that would be necessary to meet the target loads were calculated to be the difference between the calculated target load allocation (Table 4.3) and the measured load (Table 4.5), and are shown in Table 4.12.

Table 4.12 Calculation of Load Reduction for TP and TN

Parameter	Target Load[(a)] (lbs/day)	Measured Load (lbs/day)	Load Reduction (lb/day)
Total Phosphorus	30.1	74.2	44.1
Total Nitrogen	181	311	130

NOTE: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.
(a) Target Load = LA + WLA +BL

4.5 Identification and Description of Pollutant Source(s)

Potential pollutant sources of total phosphorus that could contribute to this assessment unit are listed in Table 4.13. Potential sources of total nitrogen are listed in Table 4.14.

Table 4.13 Pollutant Source Summary for Total Phosphorus

Pollutant Sources	**Magnitude** (Measured Load [lbs/day])	**Location**	**Potential Sources** (% from each)
Point: NM0020168	6.95[a]	Aztec WWTP	9%
Nonpoint:	67.3[b]	Animas River (San Juan River to Estes Arroyo)	91% Drought-related Impacts Flow Alterations from Water Diversions Municipal (Urbanized High Density Area) Municipal Point Source Discharges On-site Treatment Systems (septic systems and similar decentralized systems) Range Grazing - Riparian or Upland Natural Sources

[a] Measured load for the Aztec WWTP (NM0020168) was calculated based on one SWQB grab sample from 06/23/05. *Refer to Section 4.4.1 for details.*

[b] Measured load for nonpoint sources was estimated to be the difference between the measured load (74.2 lbs/day) calculated in Section 4.3 (Table 4.5) and the current load from the Aztec WWTP (6.95 lbs/day; Section 4.4.1).

Table 4.14 Pollutant Source Summary for Total Nitrogen

Pollutant Sources	Magnitude (Measured Load [lbs/day])	Location	Potential Sources (% from each)
Point: NM0020168	21.3[a]	Aztec WWTP	7%
Nonpoint:	290[b]	Animas River (San Juan River to Estes Arroyo)	93% Drought-related Impacts Flow Alterations from Water Diversions Municipal (Urbanized High Density Area) Municipal Point Source Discharges On-site Treatment Systems (septic systems and similar decentralized systems) Range Grazing - Riparian or Upland Natural Sources

[a] Measured load for the Aztec WWTP (NM0020168) was calculated based on one SWQB grab sample from 06/23/05. *Refer to Section 4.4.1 for details*.

[b] Measured load for nonpoint sources was estimated to be the difference between the measured load (311 lbs/day) calculated in Section 4.3 (Table 4.5) and the current load from the Aztec WWTP (21.3 lbs/day; Section 4.4.1).

4.6 Linkage of 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.

SWQB fieldwork includes an assessment of the potential sources of impairment (NMED/SWQB 1999). The completed Pollutant Source(s) Documentation Protocol forms in Appendix D provide documentation of a visual analysis of probable sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Staff completing these forms identify and quantify potential sources of NPS impairments along each reach as determined by field reconnaissance and assessment. It is important to consider not only the land directly adjacent to the stream, which is predominantly privately held, but also to consider upland and upstream areas in a more holistic watershed approach to implementing this TMDL. This nutrient TMDL was calculated using the best available methods that were known at the time of calculation and may be revised in the future.

The Animas River has six main land uses that were identified as potential sources of phosphorus and nitrogen (Figure 4.4). They include residential, industrial, mixed agriculture, forest, shrubland, and grasslands. As described in Section 4.2, the presence of plant nutrients 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 plant nutrients to increase. Nutrients generally reach the Animas River 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 to 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 nutrients from septic tank disposal systems, landscape maintenance, as well as backyard livestock (e.g. cattle, horses) and pet wastes. Industrial areas and urban development contribute nutrients by disturbing the land and consequently increasing soil erosion, by increasing the impervious area within the watershed, and by directly applying nutrients to the landscape. Recreational activities such as hiking and biking can also contribute nutrients to the stream by reducing plant cover and increasing soil erosion (e.g. trail network, streambank destabilization), direct application of human waste, campfires and/or wildfires, and dumping trash near the riparian corridor.

Undeveloped, or natural, landscapes also can deliver nutrients to a waterbody through decaying plant material, soil erosion, air deposition, and wild animal waste. Another geographically occurring nutrient source is atmospheric deposition which adds nutrients directly to the waterbody through dryfall and rainfall. Atmospheric phosphorus and nitrogen can be found in both organic and inorganic particles, such as pollen and dust. The contributions from these natural sources are generally considered to represent background levels. Background loads were estimated using SWQB water quality data and USEPA data from regional reference streams (Section 4.4.2).

Nutrients from anthropogenic and natural sources reach the Animas River primarily by two routes: directly in overland flow (stormwater runoff and irrigation return flow) and indirectly in ground water. Nutrients applied directly to land (e.g. fertilizers, pet wastes) can be carried overland in storm water runoff and agricultural return flow or can dissolve and percolate through the soil to reach ground water. Septic tank disposal systems contribute nutrients primarily into ground water, which may eventually discharge into the stream. There are a total of 131 houses located within 100 meters of the Animas River in New Mexico (Figure 4.5). It was assumed that all 131 houses have on-site wastewater systems (i.e. septic tanks) because they are located outside of the city limits of Farmington and Aztec and do not have access to a wastewater treatment facility. Some of the phosphorus and nitrogen loads will be removed through plant uptake, but site-specific uptake rates are not known, therefore accurate groundwater loads could not be calculated.

This source-specific analysis accounts for the differences in magnitudes between sources and provides a basis for allocating loads. Analyses presented in these TMDLs demonstrate that defined loading capacities will ensure attainment of New Mexico water quality standards.

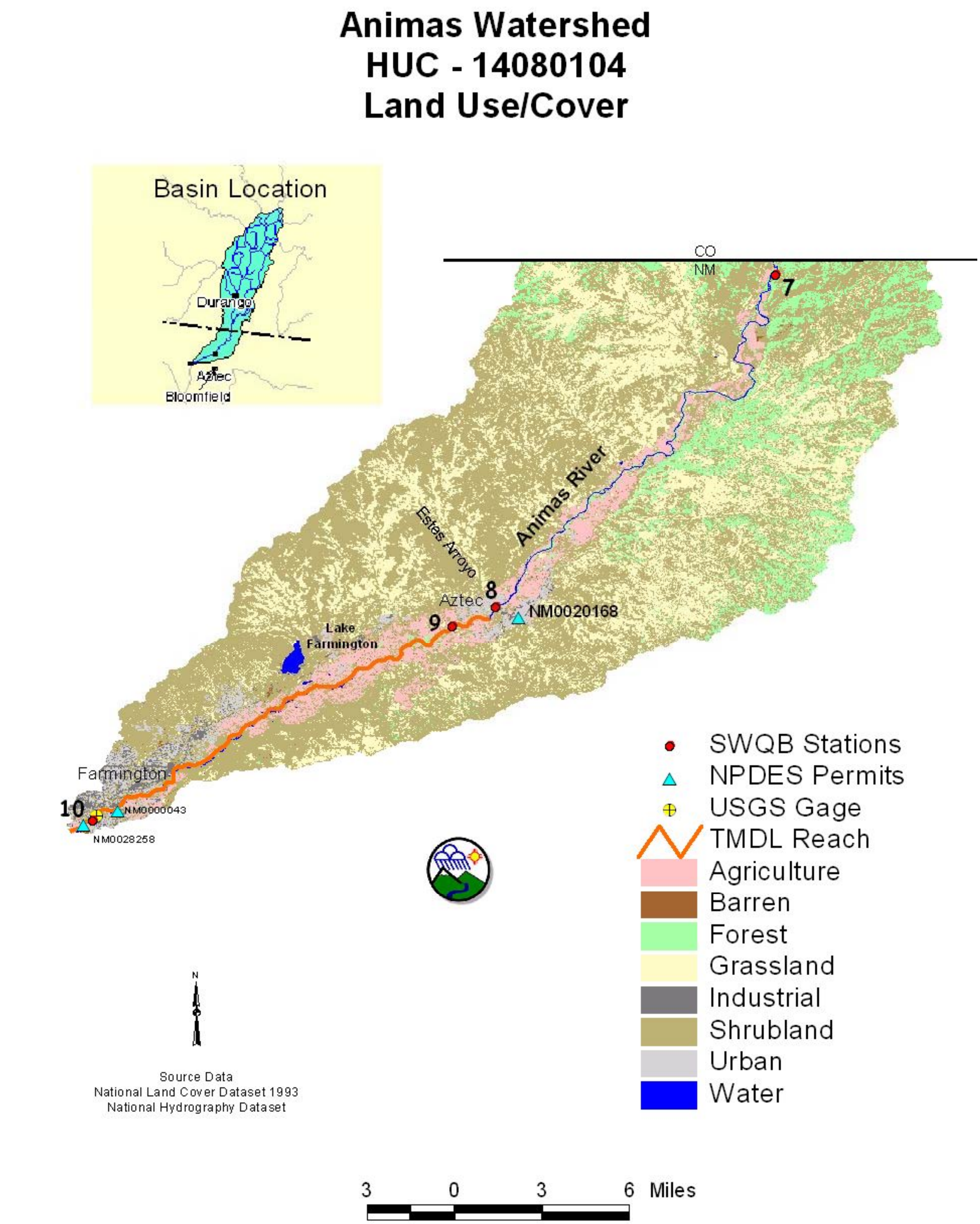


Figure 4.4 Land Use/Land Cover in the New Mexican portion of the Animas Watershed

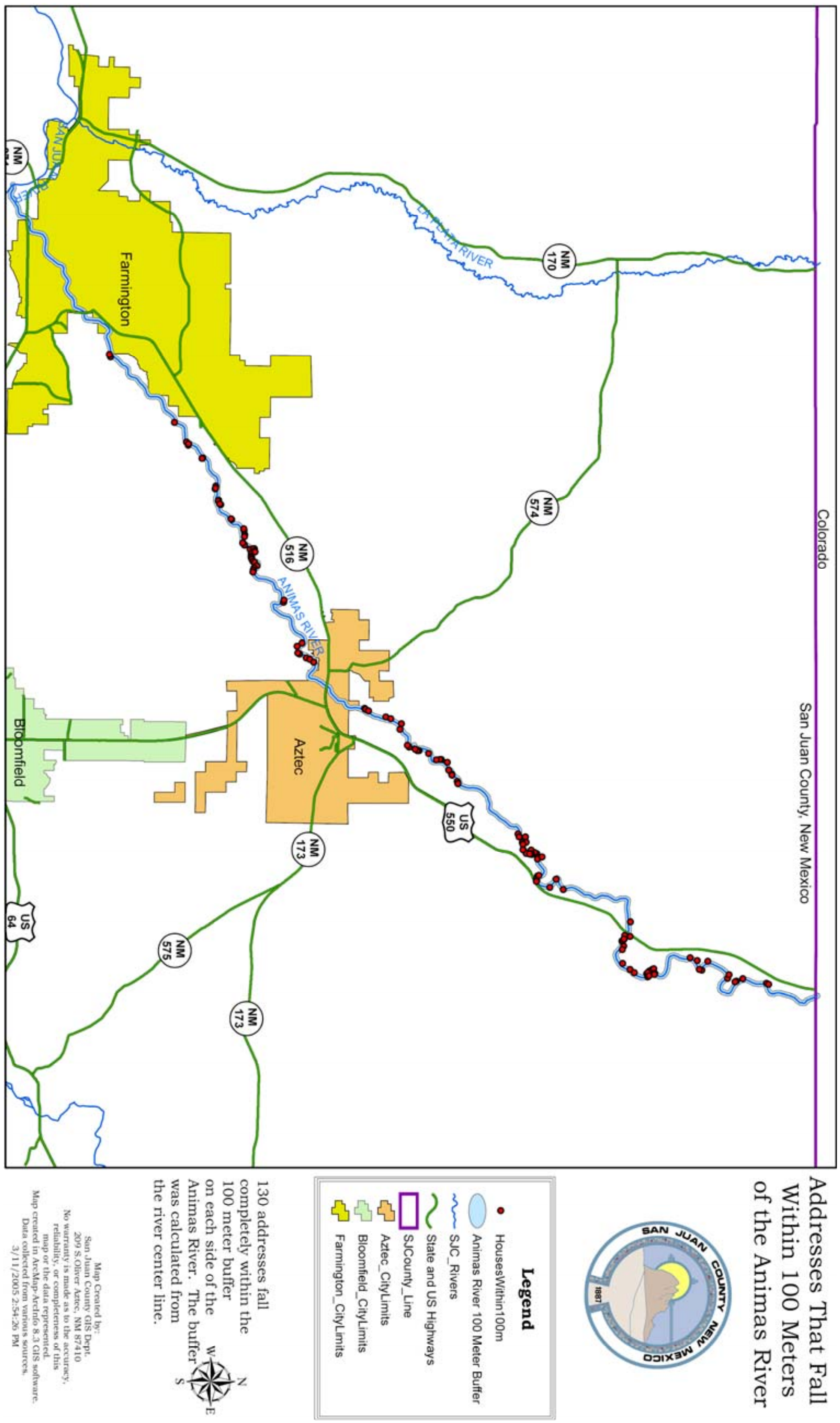


Figure 4.5 Residences that fall within 100 meters of the Animas River, NM

4.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and NPS load estimates, and the modeling analysis. For these nutrient TMDLs, the MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors in flow calculations. Therefore, this margin of safety is the sum of the following two elements:

- *Conservative Assumptions*

    - Treating phosphorus and nitrogen as conservative pollutants, that is a pollutant that does not readily degrade in the environment, was used as a conservative assumption in developing these loading limits.
    - Using the 4-day, 3-year (4Q3) critical low flow to calculate the allowable load.
    - Using the USGS gage station #09364500 (Animas River at Farmington, NM) for historic records that provide confident datasets in order to determine flow.
    - Using the treatment plant design capacity for calculating the point source loading when, under most conditions, the treatment plant is not operating at full capacity.
    - A more conservative limit of the geometric mean value, rather than the current and proposed standards which allow for higher concentrations in individual grab samples, was used to calculate measured loading values.

- *Errors and uncertainty in data collection*

    - Data uncertainty and collection error in nutrient data collection. A conservative MOS for this element is **10 percent**.

4.8 Consideration of Seasonal Variation

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 all seasons, which captured flow alterations related to snowmelt, agricultural diversions, and summer monsoonal rains. Data that exceeded the target concentration for TP and TN were used to calculate the geometric mean concentrations and can be found in Tables 4.4 and 4.15. Subsequently, the geometric means were used to calculate the measured loads (Table 4.5). The critical condition used for calculating the TMDL was low flow. It was assumed that if critical conditions are met during this time, coverage of any potential seasonal variation will also be met.

Table 4.15 Nutrient Results from the 2002-2004 Sampling Efforts

Location	Sampling Date	TP (mg/L)	TN (mg/L)
Animas River near Flora Vista	04-16-2002	0.015	0.318
	05-21-2002	0.069	0.325
	05-28-2002	0.037	0.243
	06-19-2002	0.015	0.244
	07-17-2002	0.041	0.416
	08-20-2002	0.015	0.389
	09-19-2002	0.118*	0.517*
	10-22-2002	0.015	0.100
	08-25-2003	0.399*	1.250*
	10-07-2003	0.015	0.227
	04-23-2004	0.071*	0.591*
	11-17-2004	0.017	0.295
Animas River @ Farmington	04-16-2002	0.015	0.395
	05-21-2002	0.057	0.301
	05-28-2002	0.032	0.297
	06-19-2002	0.015	0.266
	07-16-2002	0.015	0.656*
	08-19-2002	0.032	0.409
	09-17-2002	0.147*	0.476*
	08-25-2003	0.181*	0.654*
	10-08-2003	0.015	0.303

NOTE:
* = Exceeds water quality criterion for given nutrient
mg/L = milligrams per liter
TP = Total Phosphorus
TN = Total Nitrogen

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 2030. Growth estimates for San Juan County project a 44% growth rate through 2030. According to the calculations, the overwhelming source of nutrient loading is from nonpoint sources. Estimates of future growth are not anticipated to lead to a significant increase in nutrient concentrations that cannot be controlled with BMP implementation in this watershed. However, it is imperative that BMPs continue to be utilized and improved upon in this watershed while continuing to improve road conditions and grazing allotments and adhering to SWPPP requirements related to construction and industrial activities covered under the general permit.

5.0 DISSOLVED OXYGEN

During the 2002 SWQB intensive water quality survey in the San Juan River Watershed, exceedences of the New Mexico water quality standard for dissolved oxygen were documented at the La Plata sampling station on the La Plata River (SWQB Station 14). Consequently, the La Plata River from McDermott Arroyo to Colorado Border was listed on the 2004-2006 Clean Water Act Integrated §303(d)/§305(b) list for dissolved oxygen.

Based on USEPA's TMDL guidance and requirements, development of the dissolved oxygen TMDL for the La Plata River was conducted for critical low-flow conditions using a modeling program called QUAL2K (Chapra and Pelletier 2003). QUAL2K (Q2K) is a river and stream water quality model that is intended to represent a modernized version of USEPA's QUAL2E model (Brown and Barnwell 1987). Q2K is similar to QUAL2E in the following respects:

- The channel is well-mixed vertically and laterally (i.e. one dimensional).
- Steady flow is simulated.
- The heat budget and temperature are simulated as a function of meteorology on a diurnal time scale.
- All water quality variables are simulated on a diurnal time scale.
- Point and non-point loads and abstractions are simulated.

Q2K differs from QUAL2E in several ways. Q2K is implemented within the Microsoft Windows environment and is programmed in the Windows macro language with Visual Basic for Applications. Microsoft Excel is used as the graphical user interface. The following are additional features of the Q2K model listed on the USEPA's Support Center Q2K webpage:

- Model segmentation. QUAL2E segments the system into river reaches comprised of equally spaced elements. In contrast, Q2K uses unequally spaced reaches. In addition, multiple loadings and abstractions can be input into any reach.
- Carbonaceous Biological Oxygen Demand (CBOD) speciation. Q2K uses two forms of CBOD to represent organic carbon. These forms are a slowly oxidizing form (slow CBOD) and a rapidly oxidizing form (fast CBOD). In addition, non-living particulate organic matter (detritus) is simulated. This detrital material is composed of particulate carbon, nitrogen and phosphorus in a fixed stoichiometry.
- Anoxia. Q2K accommodates anoxia by reducing oxidation reactions to zero at low oxygen levels. In addition, denitrification is modeled as a first-order reaction that becomes pronounced at low oxygen concentrations.
- Sediment-water interactions. Sediment-water fluxes of dissolved oxygen and nutrients are simulated internally rather than being prescribed. That is, oxygen, sediment oxygen demand (SOD) and nutrient fluxes are simulated as a function of settling particulate organic matter, reactions within the sediments, and the concentrations of soluble forms in the overlying waters.
- Bottom algae. The model explicitly simulates attached bottom algae.
- Light extinction. Light extinction is calculated as a function of algae, detritus and inorganic solids.

- pH. Both alkalinity and total inorganic carbon are simulated. The river's pH is then simulated based on these two quantities.
- Pathogens. A generic pathogen is simulated. Pathogen removal is determined as a function of temperature, light, and settling.

Additional information on the Q2K program including model parameters and specific input values can be found in Appendix E.

5.1 Target Loading Capacity

Target values for this dissolved oxygen TMDL will be determined based on 1) the presence of numeric criteria, 2) the degree of experience in applying the indicator, and 3) the ability to easily monitor and produce quantifiable and reproducible results. For this TMDL document, target loads that translate New Mexico's numeric dissolved oxygen criterion are based on total ultimate biological oxygen demand (TBODu). This TMDL is also consistent with New Mexico's antidegradation policy.

According to the New Mexico water quality standards (20.6.4.900.M NMAC) for a marginal coldwater fishery (MCWF), the dissolved oxygen shall not be less than 6.0 mg/L.

Grab sample data for the La Plata River (McDermott Arroyo to Colorado border) were collected from the La Plata station (SWQB station 14) six times between April 16 and July 16, 2002 and eight times at the NM-Colorado State Line station (SWQB station 13) between April 17 and October 22, 2002. Samples were not collected at Station 14 after July 16, 2002 because river levels were too low to allow for sample collection. Only one dissolved oxygen reading from the grab sample events at Station 14 was below the 6.0 mg/L criteria. No grab samples collected from Station 13 at the NM-Colorado State Line were below the dissolved oxygen criteria. Data were also collected June 19 – 21, 2002 at Station 14 using a data sonde. Approximately 63% of the dissolved oxygen measurements were below the 6.0 mg/L criteria at the La Plata Station 14 during the June 2002 sonde deployment sampling.

The pollutant of concern, based on the QK2 modeling, is biochemical oxygen demand, both carbonaceous (CBODu) and nitrogenous (NBODu), which is expressed in terms of TBODu. The equations below show this relationship. The TMDL will be expressed in terms of TBODu, based on the waterbody's assimilative capacity for oxygen-demanding substances.

$$\text{TBODu} = \text{CBOD} + \text{NBOD} \qquad \textbf{(Eq. 4)}$$

Where:

$$\text{NBODu} = \text{Total Kjedahl Nitrogen (TKN)} * 4.57 \qquad \textbf{(Eq. 5)}$$

Over the time scale of years, stream bottom sediments act as sinks for oxygen (Chapra 1997, Thomann and Mueller 1987). Oxygen is consumed by the oxidation of organic carbon (CBOD) and by the nitrification of ammonia (NBOD) in the bottom sediment. This process is known as SOD. The role of sediments in the system-wide nutrient budget is especially important during the summer when seasonal low flows diminish tributary nutrient loads. During the summer, warm temperatures enhance biological processes in the sediments, increasing SOD (USEPA 1993a).

There have been numerous studies for establishing a SOD/TBODu relationship. According to the Streeter-Phelps SOD model, SOD is approximately 130 percent of the downward flux of TBODu (Chapra 1997) and the TMDL will employ the following relationship to link TBODu and SOD.

$$SOD = 1.3 * TBODu \qquad \textbf{(Eq. 6)}$$

5.2 Flow

TMDLs are calculated for the La Plata River at a specific flow. Dissolved oxygen concentrations in a stream vary as a function of flow. As flow decreases, the concentration of dissolved oxygen can decrease. Therefore the critical flow for this TMDL is low-flow which corresponds to June 2002 when the lowest dissolved oxygen measurements were collected. When available, USGS gages are used to estimate flow. Where gages are absent, geomorphologic cross section field data are collected at each site and flows are modeled or actual flow measurements are taken. In this case, flow was measured in the field at both SWQB stations 13 and 14. The flow measurement at SWQB station 14 for June 2002 (0.005 cubic feet per second [cfs]) was determined to be the critical flow for this TMDL based on dissolved oxygen measurements at this site, therefore this flow was used in the Q2K model (see Appendix E for more detail).

This flow value was converted for cfs to units of mgd as follows:

$$0.005\,\frac{ft^3}{\sec} \times 7.48\frac{gal}{ft^3} \times 86{,}400\,\frac{\sec}{day} \times 10^{-6} = 0.0032\,mgd \qquad \textbf{(Eq. 7)}$$

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning 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.

5.3 Calculations

The determination of the TMDL value was performed using the Q2K model (see Appendix E for a detailed description of this model and the process involved in determining the TMDL). The calibration or baseline model run for dissolved oxygen is shown in Figure 5.1. This dissolved oxygen curve, calculated by Q2K, corresponds to a CBODu input value of 18.28 mg/L . TBODu can then be calculated based on the following:

$$NBODu = TKN * 4.57 \quad \textbf{(Eq. 5)}$$

Where: TKN at Station 14 for 6/17/02 = 0.276 mg/L
Therefore NBODu = 0.276 mg/L * 4.57 = 1.26 mg/L

$$TBODu = NBOD + CBOD \quad \textbf{(Eq. 4)}$$

Therefore TBODu = 1.26 mg/L + 18.28 mg/L = 19.54 mg/L

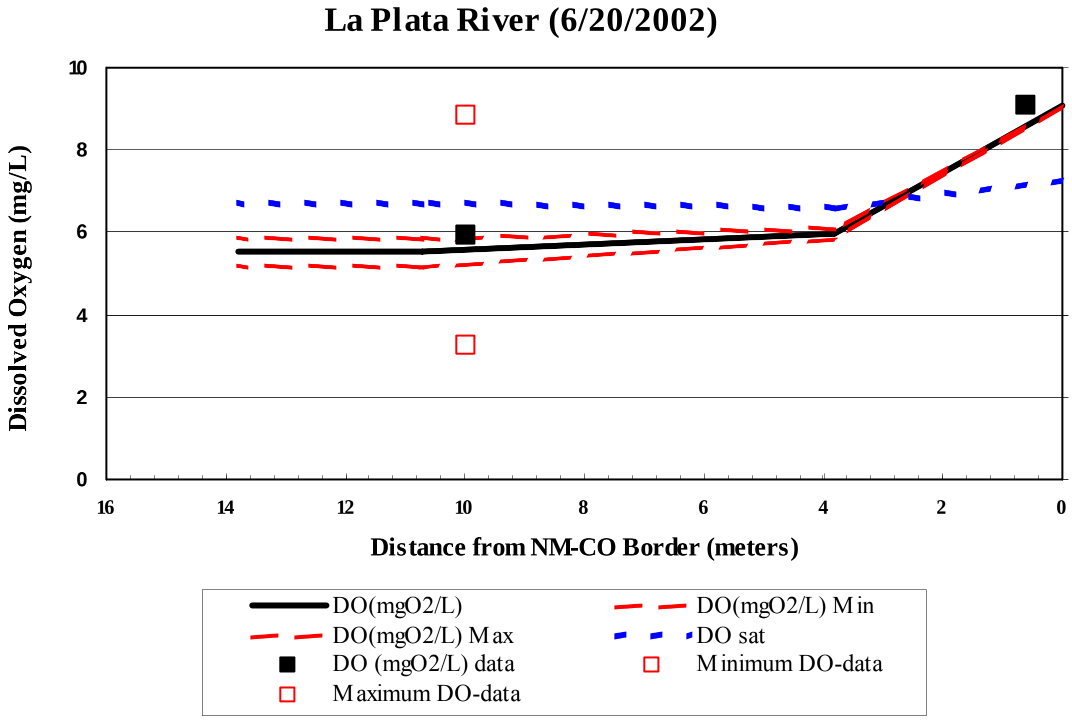


Figure 5.1 Model-Predicted Dissolved Oxygen Based on Existing Conditions for the La Plata River

The baseline condition model was then run adjusting the CBOD (while keeping the rest of the calibrated parameters the same), to bring the modeled in-stream dissolved oxygen concentration at or above 6.0 mg/L (representing the state criterion). This involved an iterative process to determine the CBODu value that would not violate water quality standards for dissolved oxygen (Figure 5.2). This value was determined to be 10.83 mg/L CBODu or 12.09 mg/L of TBODu.

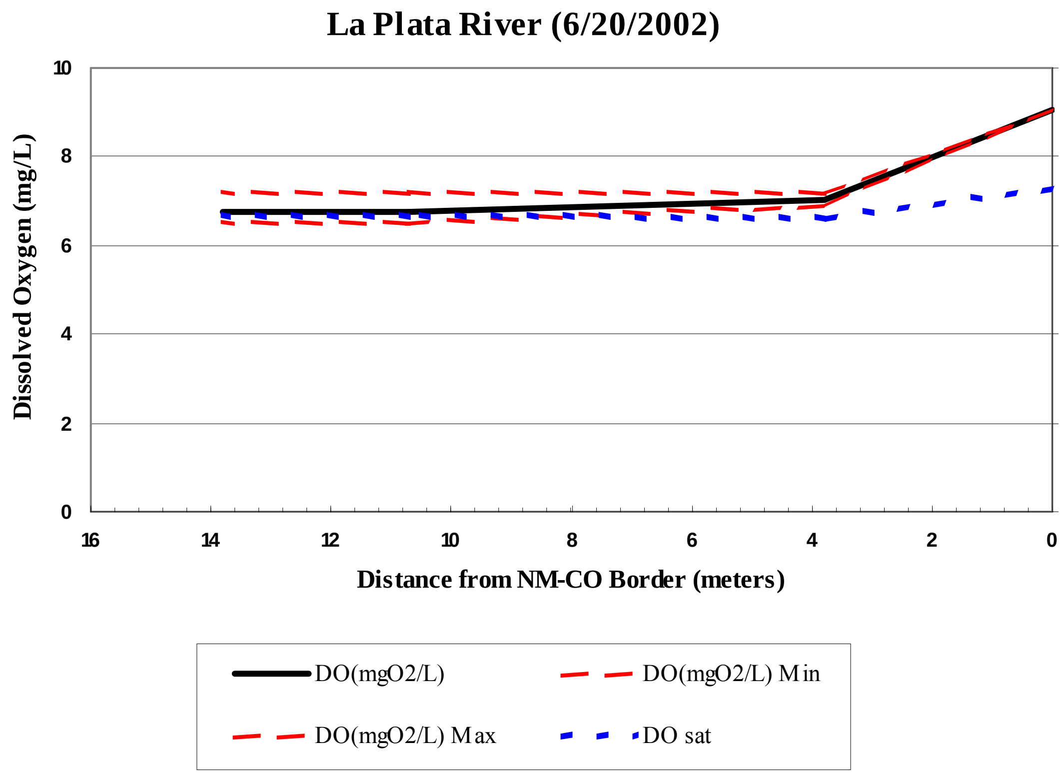


Figure 5.2 Model-predicted Dissolved Oxygen Concentrations in the La Plata River for the TMDL Scenario

A target load for TBODu is calculated based on a flow, the TBODu concentration at which the dissolved oxygen standard will be meet, and a conversion factor (8.34) that is a used to convert mg/L units to lbs/day (see Appendix C for Conversion Factor Derivation). The target loading capacity is calculated using **Equation 1**. The results are shown in Table 5.1.

Critical Flow (mgd) x Standard (mg/L) x 8.34 = Target Loading Capacity **(Eq. 1)**

Table 5.1 Calculation of Target Loads for TBODu

Location	**Flow[(a)] (mgd)**	**TBODu (mg/L)**	**Conversion Factor**	**Target Load Capacity (lbs/day)**
La Plata River (McDermott Arroyo to Colorado Border)	0.0032	12.09	8.34	0.323

NOTES: (a) Flow is based on field measurements at SWQB station 14 on 6/19/02.

The measured loads for TBODu were similarly calculated using the model-calculated load of 19.54 mg/L. The same conversion factor of 8.34 was used. Results are presented in Table 5.2.

Table 5.2 Calculation of Measured Loads for TBODu

Pollutant sources	**Flow[(a)] (mgd)**	**TBODu (mg/L)**	**Conversion Factor**	**Measured Load Capacity (lbs/day)**
La Plata River (McDermott Arroyo to Colorado Border)	0.0032	19.54	8.34	0.521

NOTES: (a) Flow is based on field measurements at SWQB station 14 on 6/19/02.

5.4 Waste Load Allocations and Load Allocations

5.4.1 Waste Load Allocation

There are no point source contributions associated with this TMDL. Therefore, the WLA is zero.

5.4.2 Load Allocation

In order to calculate the LA, the WLA and MOS were subtracted from the target capacity (TMDL) following **Equation 6**.

$$WLA + LA + MOS = TMDL \qquad \textbf{(Eq. 3)}$$

The MOS is estimated to be 20% of the target load calculated in Table 5.2. Results are presented in Table 5.3. Additional details on the MOS chosen are presented in Section 5.7 below.

Table 5.3 Calculation of TMDL for TBODu

Location	WLA (lbs/day)	LA (lbs/day)	MOS (20%) (lbs/day)	TMDL (lbs/day)
La Plata River (McDermott Arroyo to Colorado Border)	0	0.258	0.0646	0.323

The extensive data collection and analyses necessary to determine background TBODu loads for the La Plata River watershed was beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

The NPS and background load reductions that would be necessary to meet the target loads were calculated to be the difference between the calculated target load allocation (Table 5.2) and the measured load (Table 5.3) shown in Table 5.4.

Table 5.4 Calculation of Load Reduction for TBODu

Location	Target Load[(a)] (lbs/day)	Measured Load (lbs/day)	Load Reduction (lb/day)
La Plata River (McDermott Arroyo to Colorado Border)	0.258	0.521	0.263

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.
(a) Target Load = LA + WLA

5.5 Identification and Description of Pollutant Sources

Pollutant sources that could contribute to this assessment unit are listed in Table 5.5.

Table 5.5 Pollutant Source Summary for TBODu

Pollutant Sources	**Magnitude** (Measured Load [lbs/day])	**Location**	**Potential Sources** (% from each)
Point: None	0	--------	0%
Nonpoint:	0.521	La Plata River (McDermott Arroyo to Colorado Border)	100% Drought-related Impacts Flow Alterations from Water Diversions Loss of Riparian Vegetation On-site Treatment Systems (septic systems and similar decentralized systems) Range Grazing - Riparian or Upland

5.6 Linkage Between Water Quality and Pollutant Sources

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.

SWQB fieldwork includes an assessment of the potential sources of impairment (NMED/SWQB 1999). The completed *Pollutant Source(s) Documentation Protocol* forms in Appendix D provide documentation of a visual analysis of probable sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Staff completing these forms identify and quantify potential sources of NPS impairments along each reach as determined by field reconnaissance and assessment. It is important to consider not only the land directly adjacent to the stream, which is predominantly privately held, but also to consider upland and upstream areas in a more holistic watershed approach to implementing this TMDL.

The primary sources of dissolved oxygen impairment in the La Plata River are drought-related impacts, flow alterations from water diversions, loss of riparian vegetation, on-site treatment systems (septic systems and similar decentralized systems), and range grazing (riparian or upland). Field notes indicate that this river went dry in places during the 2002 survey year. Upstream activities, such as grazing, water diversions for agricultural use, residential runoff and wastewater systems, clearing of vegetation from streambanks may be contributing to the dissolved oxygen impairment.

Oxygen-consuming constituents from NPS pollution are delivered to the stream during storm events. Sources can include runoff from agricultural fields and leaf litter or plant material from riparian zones. These constituents settle out of the stormwater and become a part of the stream bottom. In slow flowing streams with a high bed-to-channel-volume ratio, large portions of the organic material will settle to the sediment surface and thus increase the TBODu and SOD. A stream impacted by heavy loads of oxygen-consuming pollutants, either natural or man-made, will exhibit low dissolved oxygen concentrations during warm low flow periods (Wood 2001; Thomann et al. 1994; Thomann and Mueller 1987; Congalton 1998; Chapra 1997).

The above-mentioned watershed activities increase nutrient rich and organic enriched substances in the stream. It results in high TBODu and SOD and low dissolved oxygen. Reduction/control of watershed activities associated with nutrient rich and organic enriched substances will result in lower TBODu and SOD and higher dissolved oxygen. The lack of riparian vegetation along many areas of the streambank can lead to increasing water temperatures which will also cause a decrease in the dissolved oxygen saturation potential of the water.

The U.S. Department of Interior Bureau of Reclamation is presently constructing the Animas-La Plata Project, which includes the building of the Ridges Basin Reservoir in the Animas River drainage near Durango, Colorado. The Project pumping station will divert high flows of the Animas River to Ridges Basin Reservoir, an off-stream impoundment, where the stored water may be diverted directly for use or released back to the Animas River during low-flow periods for delivery of use. This Project will potentially affect water quality in the La Plata River in

Colorado and New Mexico downstream of the confluence of the La Plata with Long Hollow, depending on whether any water is eventually diverted from Ridges Basin Reservoir into the La Plata River drainage for use. If so, the La Plata River channel could be used to convey the imported water or to collect return flow from the use of imported water. Importation of Project water thus may potentially increase base flows in the La Plata River during summer months.

5.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and NPS load estimates, and the modeling analysis. For this TMDL, there will be no MOS for point sources since there are none. For NPS loads, the MOS is estimated to be an addition of **20%** for dissolved oxygen in this case, excluding background. This MOS incorporates several factors:

- Errors in calculating NPS loads

  A level of uncertainty exists in sampling NPSs of pollution. Techniques used for measuring dissolved oxygen concentrations in stream water can lead to inaccuracies in the data and several assumptions had to be made in running the Q2K model. Therefore, a conservative MOS for dissolved oxygen increases the TMDL by **10%.**

- Errors in calculating flow

  Some flow estimates used in the Q2K model were based on a visual measurement at SWQB station 14 during the June sampling run because of the extremely low flow in the river. Instrument and operator error can also lead to inaccuracy in flow measurements. Accordingly, a conservative MOS increases the TMDL by an additional **10%.**

5.8 Consideration of Seasonal Variability

Data was collected during spring, summer, and fall on the La Plata River in order to ensure coverage of any potential seasonal variation in the system. Data used in the calculation/modeling of this TMDL were collected mainly during the summer of 2002. The critical condition for dissolved oxygen is set to low flow during summer months because the lowest dissolved oxygen values were recorded during June 2002 at low flows. This flow condition was determined to have the most severe impacts on the aquatic life use. The low flow period has a reduced nutrient assimilative capability due to less stream flow available for dilution. Increases in stream temperatures resulting in lower dissolved oxygen levels are also common during summer month at low flow conditions coupled with increased air temperatures. If this stream segment is protected during this critical period, then other flow conditions under seasonal variations (e.g. under higher flow with stormwater or spring runoff) are protected as well.

5.9 Future Growth

Estimations of future growth are not anticipated to lead to a significant increase for dissolved oxygen that cannot be controlled with BMP implementation in this watershed. The majority of the land area along the La Plata River (McDermott Arroyo to Colorado Border) is agricultural or rangeland with a low population density and large growth is not anticipated for the area. Therefore, a growth allocation was not included in the load allocation for this TMDL. The Animas-La Plata Reservoir Project discussed in Section 5.6 has the potential to change the water quality of the La Plata River, but exact changes to the condition of the river is unknown at this time. The SWQB is scheduled to perform intensive monitoring of the San Juan Watershed in 2010 and effects of the reservoir will be included in this monitoring.

6.0 MONITORING PLAN

Pursuant to Section 106(e)(1) of the Federal CWA, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of NM. In accordance with the NM 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 River watershed is 2010. The SWQB maintains current quality assurance and quality control plans for the respective sample year to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6 (NMED/SWQB 2001). 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 will be directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997).

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 assessment protocols (NMED/SWQB 2004b).

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 Section 303(d) listing and 305(b) report assessments and to support the need for developing TMDLs. The approach provides:

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

SWQB recently developed a 10-year monitoring strategy submitted to USEPA on September 30, 2004. Once the 10-year monitoring plan is reviewed and approved by the USEPA, it will be available at the SWQB website: http://www.nmenv.state.nm.us/swqb/swqb.html. The strategy will detail both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. According to the draft proposed 8-year rotational cycle, which assumes the existing level of resources, the next time SWQB will intensively sample the San Juan River watershed is during 2010.

It should be noted that a watershed would not be ignored during the years in between intensive sampling. The rotating basin program will be supplemented with other data collection efforts such as the funding of long-term USGS water quality gaging stations for long-term trend data. 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.

7.0 IMPLEMENTATION OF TMDLS

7.1 Coordination

In this watershed public awareness and involvement will be crucial to the successful implementation of these plans and improved water quality. Staff from SWQB and the Meridian Institute have worked with stakeholders to develop a draft WRAS for the San Juan River Basin (SJWG 2005). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It details opportunities for private landowners and public agencies to reduce and prevent impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving constituent levels consistent with New Mexico's WQS, and will be used to prevent water quality impacts in the watershed. The WRAS is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WRAS leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

SWQB staff will continue to assist with any technical assistance such as selection and application of BMPs needed to meet WRAS goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholders in this process will include SWQB, and other members of the San Juan Watershed Group.

Implementation of BMPs within the watershed to reduce pollutant loading from NPSs will be encouraged. Reductions from point sources will be addressed in revisions to NPDES discharge permits.

7.2 Time Line

The San Juan Basin is atypical in that a watershed group was formed in 2002 during the planning stage for the 2002 intensive survey, and thus prior to any impairment determinations/verifications or TMDL development. As a result, the WRAS and TMDLs will be final at essentially the same time. The modified general implementation timeline is detailed below (Table 7.1).

7.3 Clean Water Act §319(h) Funding Opportunities

The Watershed Protection Section of the SWQB provides 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 two times a year through a Request for Proposal (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is available for both watershed group formation (which includes WRAS development) 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: http://www.nmenv.state.nm.us/swqb/.

Table 7.1 Proposed Implementation Timeline

Implementation Actions	Year 1 (2002)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Public Outreach and Involvement	X	X	X	X	X	X	X
Form watershed groups	X	X					
TMDL Development			X				
WRAS Development		X	X	X			
Revise any NPDES permits as necessary (currently USEPA Region 6)			X				
Establish Performance Targets				X			
Secure Funding			X	X			
Implement Management Measures (BMPs)			X	X	X		
Monitor BMPs			X	X	X		
Determine BMP Effectiveness					X	X	
Re-evaluate Performance Targets						X	X

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

Several other sources of funding existing to address impairments discussed in this TMDL document. NMED's Construction Programs Bureau assists communities in need of funding for WWTP upgrades and improvements to septic tank configurations (such as the design of cluster systems). 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 Colorado River Basin Salinity Control Program may provide matching funds to address selenium issues in Gallegos Canyon (contact NM Interstate Stream Commission 827-6165). The BLM has several programs in place to provide assistance to improve unpaved roads and grazing allotments (see section 4.6).

8.0 ASSURANCES

New Mexico's Water Quality Act (Act) does authorize 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 NMAC 20.6.4.10.C) (NMAC 2002) states:

> *These water quality standards do not grant the Commission or any other entity the power to create, take away or modify property rights in water.*

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

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

New Mexico's 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. The San Juan Watershed

Group applied for and was awarded a §319 grant in 2005 to begin development of projects to addressing bacteria impairments noted in this TMDL document.

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 USFS and the BLM. MOUs have also been developed with other State agencies, such as the New Mexico State Highway and Transportation Department. These MOUs provide for coordination and consistency in dealing with 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 members of the WRAS. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

9.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL (see Appendix F). The draft TMDL was made available for a 30-day comment period on September 23, 2005. Response to comments are attached as an Appendix to this final draft document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers.

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APPENDIX A
ALGAL GROWTH POTENTIAL (AGP) ASSAYS

Algal Growth Potential (AGP) Assays

on

Water from the Animas River

to

State Of New Mexico
Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, New Mexico 87502

submitted to
Seva Joseph

June 10, 2004

by

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Background:

The water was collected on April 23, 2004 and transported on ice to our laboratory. Water from each site was autoclaved and filtered, and used immediately. The initial tests for growth potential were initiated two days later and were terminated after 7 days of incubation under continuous illumination.

The procedures used for determining limiting nutrients and toxicity to algae was as established in the EPA-600/9-78-018 publication entitled "The *Selenastrum Capricornutum* Prinz Algal Assay Bottle Test" and EPA-660/3-75-034 publication entitled "Proceedings: Biostimulation/and/ Nutrient Assessment Workshop". The design is as follows:

Water from the creeks/rivers was autoclaved and passed through filters that had a pore diameter of 0.4 micrometers. The filtered water, 25 ml, was placed in 125 ml Erlenmeyer flasks which were covered with aluminum foil. Each assay was conducted in triplicate.

The design of the test for algal growth potential is as listed below:

1. Control (filtered river water with no additions)
2. Control + 0.05 mg P/liter
3. Control + 1.00 mg N/liter
4. Control + 1.00 mg N + 0.05 mg P /liter
5. Control + 1.00 mg Fe- EDTA/liter
6. Control + 1.00 mg Fe- EDTA + 0.05 mg P/liter
7. Control + 1.00 mg Fe- EDTA + 1.00 mg N/liter
8. Control + 1.00 mg Fe- EDTA + 1.00 mg N + 0.05 mg P/liter
9. Control + 0.0125 mg P/L
10. Control + 0.025 mg P/L
11. Control + 0.0375 mg P/L
12. Control + 0.100 mg P/L
13. Control + 0.25 mg N/L
14. Control + 0.50 mg N/L
15. Control + 0.75 mg N/L
16. Control + 2.00 mg N/L

At the end of 7 days of incubation, the amount of chlorophyll was determined using fluorescence measurement. The fluorescence values were converted to dry weight values using a standard that we had constructed under these conditions of growth. The results are given in dry weight measurements as is accordance with the EPA procedure.

The site of collection of the water samples was as designated below:

Site	Designation
Animas River @ Flora Vista	I
Animas River @ Aztec	II

Results:

The values for algal growth potential are given below as mg dry weight of algae/L.

Algal assays	Site of water collection I	Site of water collection II
1. Control (filtered river water without additions)	0.589	0.618
2. Control + 0.05 mg P/liter	0.601	0.624
3. Control + 1.00 mg N/liter	0.899	0.501
4. Control + 1.00 mg N + 0.05 mg P /liter	0.779	0.820
5. Control + 1.00 mg Fe. EDTA/liter	0.616	0.386
6. Control + 1.00 mg Fe- EDTA + 0.05 mg P/liter	0.491	0.286
7. Control + 1.00 mg Fe- EDTA + 1.00 mg N/liter	1.098	0.341
8. Control + 1.00 mg Fe- EDTA + 1.00 mg N + 0.05 mg P/liter	1.470	1.313
9. Control + 0.0125 mgP/L	0.433	0.525
10. Control + 0.025 mg P/L	0.433	0.439
11. Control + 0.0375 mg P/L	0.493	0.374
12. Control + 0.10 mg P/L	0.552	0.348
13. Control + 0.25 mg N/L	0.622	0.431
14. Control + 0.50 mg N/L	0.855	0.462
15. Control + 0.75 mg N/L	0.748	0.438
16. Control + 2.00 mg N/L	0.779	0.476

A study concerning the effect of N and P additions on algal growth was conducted on appropriate creek/river waters. The growth values are presented below and as graphs for various additions of P and N alone. Nutrients were added to the sterilized water and the amount of algal mass was determined after 7 days of incubation.

Productivity of algae as influenced by Nitrogen addition. Growth as mg dry weight/L.

Nitrogen added (mg N/L)	Site of water collection: I	II
0	0.589	0.617
0.25	0.622	0.431
0.5	0.855	0.462
0.75	0.748	0.438
1.0	0.899	0.501
2.0	0.779	0.476

Productivity of algae as influenced by Phosphorus addition. Growth as mg dry weight/L.

Phosphorus added (mg P/L)	Site of water collection: I	II
0	0.589	0.617
0.0125	0.433	0.525
0.025	0.433	0.439
0.0375	0.493	0.374
0.05	0.601	0.624
0.10	0.552	0.348

NOTE: Graphs of the N and P additions are in the attachment entitled graphs.

The following summary statements can be made concerning the water:

Animas River @ Flora Vista (Site I) has moderate algal productivity. Growth is increased slightly by nitrogen addition indicating that nitrogen is one of the limiting nutrients. Phosphorus addition does not increase algal growth by itself but does increase growth when added along with nitrogen addition. It should be noted that the addition of iron along with both N and P accounts for greatest stimulation of growth indicating that iron is also a limiting nutrient in this river water.

Animas River @ Aztec (Site II) has moderate algal productivity. Growth is not increased by the addition of either nitrogen or phosphorus when added alone. When both N and P are added, growth is stimulated indicating that both are limiting for algal growth. It should be noted that the addition of iron along with both N and P accounts for greatest stimulation of growth indicating that iron is also a limiting nutrient in this river water.

Productivity

The basis for productivity classification of river water are standards established for lakes using the laboratory assay technique to assess biomass. (Reference: EPA-600/9-78-018 publication entitled "The *Selenastrum Capricornutum* Prinz Algal Assay Bottle Test" and EPA-660/3-75-034 publication entitled "Proceedings: Biostimulation/and/ Nutrient Assessment Workshop")

Classification	Algal cell density (algal dry weight)
Low productivity	0.00 - 0.10 mg/L
Moderate productivity	0.11 - 0.80 mg/L
Moderately high productivity	0.81 - 6.00 mg/L
High Productivity	6.10 - 20.00 mg/L

1. Status of water in Animas River water at the site tested equivalent to trophic status of lakes.

Site I - Moderate productivity

Site II - Moderate productivity

2. Effect of N addition to Site I:

Water from this site is nitrogen and phosphorous limited. Addition of nitrogen (1 mg/L) or phosphorous (0.1 mg/L) did not increase growth when added individually. However, when added together productivity increased to the lower level of MODERATELY HIGH PRODUCTIVITY range. Even with maximum stimulation of growth by the addition of N, P and Fe as Fe-EDTA, growth was at the lower level of MODERATELY HIGH PRODUCTIVITY.

N addition to Site II:

Water at this site is both nitrogen and phosphorus limited. The addition of nitrogen to 1 mg or 2 mg/L and phosphorous t 0.05 or 0.1 mg/L, the productivity increased only to the lower level of MODERATELY HIGH PRODUCTIVITY. Even with the addition of Fe along with P and N additions, algal growth remained at the lower portion of the MODERATELY HIGH PRODUCTIVITY.

3. Effect of P addition to Site I:

This site is nitrogen limited and the singular addition of phosphorous does not increase the cell yield. When N addition was 1.0 mg/L and phosphorus was 0.05 mg/L the cell yield was increased; however, this was attributed to the addition of N and not due to P. Addition of P from 0.0125 mg/L to 0.1 mg/L without the addition of N did not increase growth but, in fact, growth was slightly inhibited. . Even with the addition of Fe along with P and N additions, algal growth remained at the lower portion of the MODERATELY HIGH PRODUCTIVITY.

P addition to Site II:

This site is both N and P limited. The singular addition of phosphorous from 0.0125 mg/L to 0.1 mg/L did not increase growth yield but growth was slightly inhibited. . Even with the addition of Fe along with P and N additions, algal growth remained at the lower portion of the MODERATELY HIGH PRODUCTIVITY.

4. General comments:

- Without nutrient additions, the Animas River has MODERATE PRODUCTIVITY. With nitrogen and phosphorus additions, productivity increases but never exceeds the lower range of MODERATELY HIGH PRODUCTIVITY. Singular additions of P or N to the level tested would not increase algal productivity. However, **management procedures should prevent the addition of both P and N to the Animas River**.

- Both sites of the Animas River were limited by iron for algal growth. This may be a pH effect and with runoff into the river becoming more acidic, growth of algae will increase. However, even with the addition of iron salts, **both sites are limited for both N and P**.

5. No samples were taken for chlorophyll a or ash free dry mass.

APPENDIX B
4Q3 CALCULATIONS

Log-Pearson Type III Statistics
SWSTAT 4.1
(based on USGS Program A193)

Notice -- Use of Log-Pearson Type III or Pearson-Type III distributions are for preliminary computations. User is responsible for assessment and interpretation.

09364500 Animas River at Farmington, NM
April 1 - start of season
March 31 - end of season
1967 - 2002 - time period
4-day low - parameter
35 - non-zero values
1 - zero values
0 - negative values (ignored)

111.500	111.250	95.000	156.500	190.250
92.750	6.000	201.250	7.850	189.000
94.000	10.900	20.750	132.750	162.500
147.000	303.250	272.750	258.500	231.500
379.250	226.000	261.250	99.250	82.500
169.750	187.250	241.250	122.000	142.250
211.250	225.500	202.250	14.375	84.750

The following 7 statistics are based on non-zero values:

Mean (logs)	2.050
Variance (logs)	0.209
Standard Deviation (logs)	0.457
Skewness (logs)	-1.675
Standard Error of Skewness (logs)	0.398
Serial Correlation Coefficient (logs)	0.153
Coefficient of Variation (logs)	0.223

Non-Exceedance Probability	Recurrence Interval	Parameter Value	Adjusted Non-Exceedance Probability	Adjusted Parameter Value
0.0100	100.00	3.030	0.0375	0.000
0.0200	50.00	5.846	0.0472	0.000
0.0500	20.00	14.101	0.0764	6.603
0.1000	10.00	27.798	0.1250	19.607
0.2000	5.00	55.783	0.2222	47.573
0.3333	3.00	94.163	0.3518	88.790
0.5000	2.00	148.212	0.5139	143.054
0.8000	1.25	263.334	0.8056	260.709
0.9000	1.11	313.387	0.9028	311.832
0.9600	1.04	351.634	0.9611	350.803
0.9800	1.02	368.074	0.9806	367.562
0.9900	1.01	378.225	0.9903	377.931

Calculated 4Q3 **(cfs)**

Note -- Adjusted parameter values include zero values and correspond with non-exceedance probabilities in column 1 and recurrence interval in column 2. Parameter values in column 3 are based on non-zero values.

APPENDIX C
CONVERSION FACTOR DERIVATION

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

TMDL Calculation:

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

Conversion Factor Derivation:

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

APPENDIX D
SOURCE DOCUMENTATION SHEET AND SOURCES SUMMARY TABLE

Source Documentation Sheet

CODES FOR USES NOT FULLY SUPPORTED

- ☐ HQCWF = HIGH QUALITY COLDWATER FISHERY
- ☐ CWF = COLDWATER FISHERY
- ☐ MCWF = MARGINAL COLDWATER FISHERY
- ☐ WWF = WARMWATER FISHERY
- ☐ LWWF = LIMITED WARMWATER FISHERY
- ☐ DWS = DOMESTIC WATER SUPPLY
- ☐ PC = PRIMARY CONTACT
- ☐ IRR = IRRIGATION
- ☐ LW = LIVESTOCK WATERING
- ☐ WH = WILDLIFE HABITAT

Fish culture, secondary contact and municipal and industrial water supply and storage are also designated in particular stream reaches where these uses are actually being realized. However, no numeric standards apply uniquely to these uses.

REACH NAME:

SEGMENT NUMBER:
BASIN:
PARAMETER:

STAFF MAKING ASSESSMENT:
DATE:

CODES FOR SOURCES OF NONSUPPORT (CHECK ALL THAT APPLY)

- ☐ <u>0100</u> <u>INDUSTRIAL POINT SOURCES</u>
- ☐ <u>0200</u> <u>MUNICIPAL POINT SOURCES</u>
- ☐ 0201 DOMESTIC POINT SOURCES
- ☐ <u>0400</u> <u>COMBINED SEWER OVERFLOWS</u>
- ☐ <u>1000</u> AGRICULTURE
- ☐ 1100 NONIRRIGATED CROP PRODUCTION
- ☐ 1200 IRRIGATED CROP PRODUCTION
- ☐ 1201 IRRIGATED RETURN FLOWS
- ☐ 1300 SPECIALTY CROP PRODUCTION (e.g., truck farming and orchards)
- ☐ 1400 PASTURELAND
- ☐ 1500 RANGELAND
- ☐ 1600 FEEDLOTS - ALL TYPES
- ☐ 1700 AQUACULTURE
- ☐ 1800 ANIMAL HOLDING/MANAGEMENT AREAS
- ☐ 1900 MANURE LAGOONS
- ☐ <u>2000</u> <u>SILVICULTURE</u>
- ☐ 2100 HARVESTING, RESTORATION, RESIDUE MANAGEMENT
- ☐ 2200 FOREST MANAGEMENT
- ☐ 2300 ROAD CONSTRUCTION or MAINTENANCE
- ☐ <u>3000</u> <u>CONSTRUCTION</u>
- ☐ 3100 HIGHWAY/ROAD/BRIDGE
- ☐ 3200 LAND DEVELOPMENT
- ☐ 3201 RESORT DEVELOPMENT
- ☐ 3300 HYDROELECTRIC

- ☐ <u>4000</u> <u>URBAN RUNOFF/STORM SEWERS</u>
- ☐ 5000 <u>RESOURCES EXTRACTION</u>
- ☐ 5100 SURFACE MINING
- ☐ 5200 SUBSURFACE MINING
- ☐ 5300 PLACER MINING
- ☐ 5400 DREDGE MINING
- ☐ 5500 PETROLEUM ACTIVITIES
- ☐ 5501 PIPELINES
- ☐ 5600 MILL TAILINGS
- ☐ 5700 MINE TAILINGS
- ☐ 5800 ROAD CONSTRUCTION/MAINTENANCE 8400
- ☐ 5900 SPILLS
- ☐ <u>6000</u> <u>LAND DISPOSAL</u>
- ☐ 6100 SLUDGE
- ☐ 6200 WASTEWATER
- ☐ 6300 LANDFILLS
- ☐ 6400 INDUSTRIAL LAND TREATMENT
- ☐ 6500 ONSITE WASTEWATER SYSTEMS (septic tanks, etc.)
- ☐ 6600 HAZARDOUS WASTE
- ☐ 6700 SEPTAGE DISPOSAL
- ☐ 6800 UST LEAKS
- ☐ <u>7000</u> <u>HYDROMODIFICATION</u>
- ☐ 7100 CHANNELIZATION
- ☐ 7200 DREDGING
- ☐ 7300 DAM CONSTRUCTION/REPAIR

- ☐ 7400 FLOW REGULATION/MODIFICATION
- ☐ 7500 BRIDGE CONSTRUCTION
- ☐ 7600 REMOVAL OF RIPARIAN VEGETATION
- ☐ 7700 STREAMBANK MODIFICATION OR DESTABILIZATION
- ☐ 7800 DRAINING/FILLING OF WETLANDS
- ☐ <u>8000</u> <u>OTHER</u>
- ☐ 8010 VECTOR CONTROL ACTIVITIES
- ☐ 8100 ATMOSPHERIC DEPOSITION
- ☐ 8200 WASTE STORAGE/STORAGE TANK LEAKS
- ☐ 8300 ROAD MAINTENANCE or RUNOFF
- ☐ 8400 SPILLS
- ☐ 8500 IN-PLACE CONTAMINANTS
- ☐ 8600 NATURAL
- ☐ 8700 RECREATIONAL ACTIVITIES
- ☐ 8701 ROAD/PARKING LOT RUNOFF
- ☐ 8702 OFF-ROAD VEHICLES
- ☐ 8703 REFUSE DISPOSAL
- ☐ 8704 WILDLIFE IMPACTS
- ☐ 8705 SKI SLOPE RUNOFF
- ☐ 8800 UPSTREAM IMPOUNDMENT
- ☐ 8900 SALT STORAGE SITES
- ☐ <u>9000</u> <u>SOURCE UNKNOWN</u>

San Juan River (Part Two) TMDL Probable Sources Summary

Reach	Parameter	Probable Sources (ADB v.2 terminology)
Animas River (San Juan River to Estes Arroyo)	Nutrients	Channelization Drought-related Impacts Flow Alterations from Water Diversions Loss of Riparian Habitat Municipal (Urbanized High Density Area) Municipal Point Source Discharges On-site Treatment Systems (Septic Systems and Similar Decentralized Systems) Streambank Modifications/destabilization
La Plata River (McDermott Arroyo to Colorado Border)	Dissolved Oxygen	Animal Feeding Operations (NPS) Drought-related Impacts Flow Alterations from Water Diversions Loss of Riparian Habitat On-site Treatment Systems (Septic Systems and Similar Decentralized Systems) Rangeland Grazing Streambank Modifications/destabilization

APPENDIX E
QUAL2K INPUT, DATA PREPARATION, AND MODEL ASSUMPTIONS FOR THE LA PLATA DISSOLVED OXYGEN TMDL

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Dissolved Oxygen TMDL Development

This section provides a description of the technical approach used to develop the dissolved oxygen TMDL for the La Plata River (McDermott Arroyo to Colorado border). The methodology is developed based on project objectives, data availability, model applicability, and consideration of critical condition and seasonal variation.

In order to ensure that the dissolved oxygen standards for the La Plata River are met under the critical environmental conditions, the QUAL2K (Q2K) model runs concentrated on dissolved oxygen simulations. Excessive algal growth impacts diurnal dissolved oxygen fluctuations, with higher dissolved oxygen in stream during the daylight hours due to algal photosynthesis process and lower dissolved oxygen concentrations during the nighttime due to plant respiration. These diurnal swings in dissolved oxygen could cause the in-stream dissolved oxygen to fall below the minimum dissolved oxygen allowed by the water quality standards (i.e. 6.0 mg/L). The magnitude of the diurnal swing could have a stressing effect on aquatic life if it is too large. Q2K links plant respiration and photosynthesis as well as other oxygen demanding substances such as carbonaceous biological oxygen demand (CBOD), the nitrification process (which uses oxygen to reduce organic nitrogen to ammonia and then to nitrite/nitrate) and sediment demands of organic substances to in-stream oxygen levels.

During the 2002 water quality survey of the La Plata River, diurnal data was collected at Surface Water Quality Bureau (SWQB) station 14 (Figure 1). This data showed diurnal swings of dissolved oxygen and these daily swings ranged from about 3.27 mg/L dissolved oxygen to as much as 8.91 mg/L.

Data collection efforts for the Q2K model should include measurements and observations to collect local data necessary to modify the model to local conditions. The measurements required for Q2K include meteorological data, flow data, field water quality measurements (temperature, dissolved oxygen, pH, etc.) as well as eutrophication impairment-related parameters such as nutrients, oxygen-demanding substances, and Total Suspended Solids (TSS). Biological data, such as local periphyton algae biomass distribution and density, are also important inputs for the model.

The Q2K model configuration involves setting up model reaches and setting initial conditions, boundary conditions, and hydraulic and kinetic parameters for the hydrodynamic and water quality simulations. The model was run for the assessment unit La Plata River (McDermott Arroyo to Colorado Border) and was divided into two reaches (i.e. above Cunningham Ditch to the Colorado Border and below Cunningham Ditch to McDermott Arroyo) (see Figure 1). Each reach had one sampling station and two irrigation ditches that were active during the modeling period. Ideally the assessment unit would have been further divided into smaller reaches approximately 1 kilometer (km) long, but because only limited data at two stations was available additional splitting was not practical.

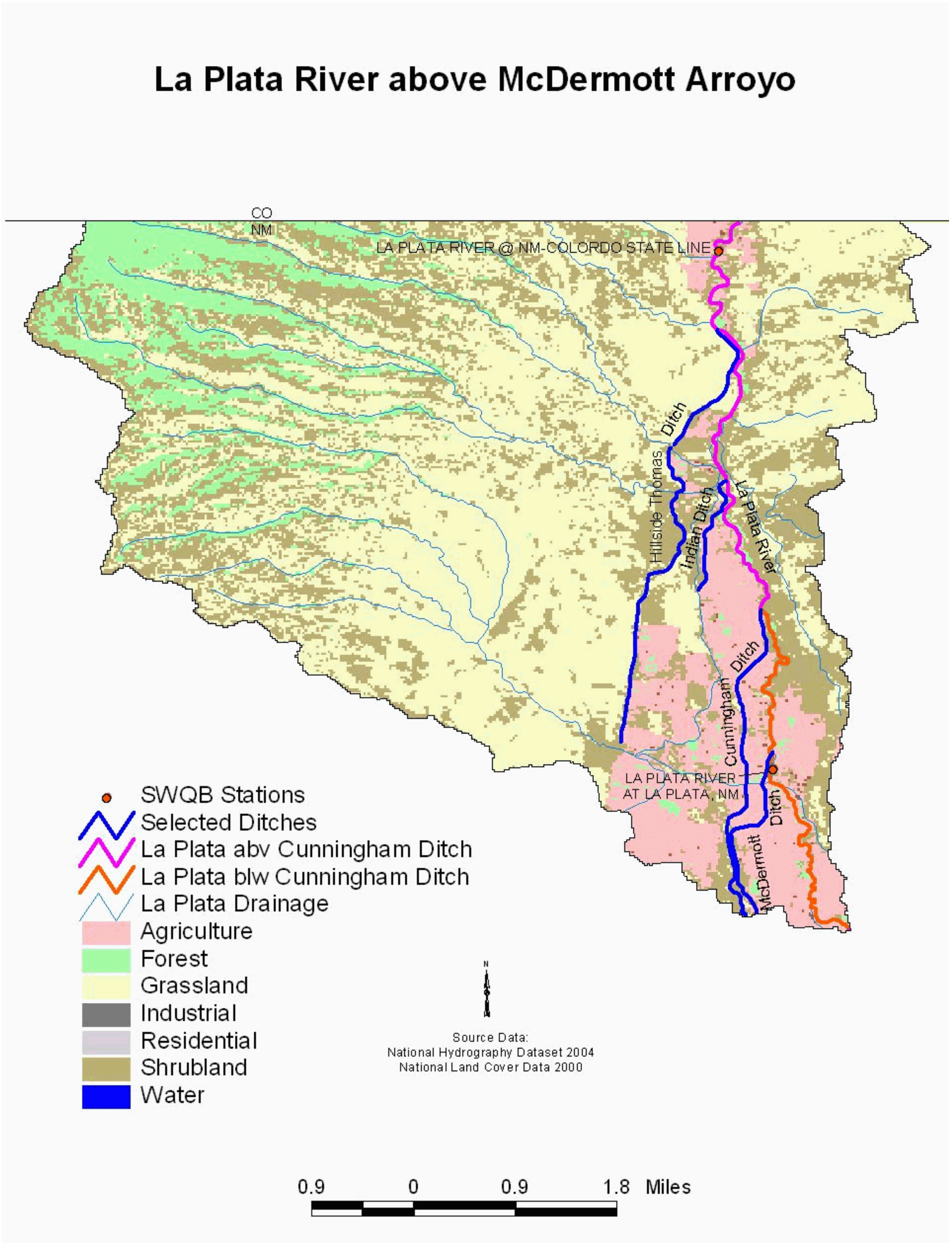


Figure 1: Q2K Model Segmentation for La Plata River Dissolved Oxygen TMDL Development

Data/Parameter Input

Whenever possible, input data for the Q2K model were based on field observed flow and water quality data, but the data collection performed on the La Plata River in 2002 was not specifically designed to meet the data requirements for Q2K. Therefore, additional data collected by the U.S. Geological Survey (USGS) had to be used to supplement the SWQB data. Additionally, some default values in the Q2K model were not modified because sufficient information was not available to determine the correct values for the La Plata River.

The following sections list the input parameters for Q2K based on the worksheets within the Q2K model.

Headwaters Worksheet

The USGS gage at the NM-Colorado border (09366500) was considered the headwaters of the La Plata River for the Q2K model. The model was run for June 20, 2002 because this date was within the critical period for dissolved oxygen and diurnal sonde data at SWQB station 14 was available for this date. Water quality grab sample data collected at SWQB station 13 located approximately 0.3 miles downstream from the USGS gage was used as the headwaters data. Table 1 lists the Q2K model headwaters worksheet input data and where this data was obtained. The headwaters worksheet asks for hourly water quality data, but this data was not available at SWQB station 13 therefore it was assumed for the model input that the data remained constant throughout the day.

Reach Worksheet

The majority of information used for the Reach worksheet was obtained using Geographic Information Systems (GIS) data. The depth and velocity information needed for the rating curves was obtained from the USGS for the NM-Colorado gage (09366500) and field measurements collected by SWQB staff were used for the La Plata gage (09367000). The equations for the rating curves are described in Section 3.2.2 of the Q2K Documentation and Users Manual (Chapra and Pelletier, 2003). The input parameters for the Reach worksheets are presented in Table 2.

Table 1. Headwaters Data Input

Headwater Parameters	Input Value	Data Obtained From
Headwater Flow	0.0569 m^3/s	USGS gage 09366500 for 6/20/02
Temperature	25.80^oC	SWQB sonde data from 6/17/02
Conductivity	964 umhos	SWQB sonde data from 6/17/02
Inorganic Solids	7.00 mg/L	No ISS data available, so SWQB TSS data from 6/17/02 was used
Dissolved Oxygen	9.07 mg/L	SWQB sonde data from 6/17/02
CBODslow	11.00 mg/L	Based on calibration of the model
CBODfast	11.00 mg/L	Based on calibration of the model
Dissolved Organic Nitrogen	218.00 ug/L	SWQB 6/17/02 data (Total Kjehldal Nitrogen - 1/2 Ammonia [detection limit])
NH4-Nitrogen	50.00 ug/L	SWQB 6/17/02 data (Reported as Nitrate + Nitrate, 1/2 detection limit was used)
NO3-Nitrogen	50.00 ug/L	SWQB 6/17/02 data (Reported as Nitrate + Nitrate = <100 ug/L, 1/2 detection limit was used)
Dissolved Organic Phosphorus	10.00 ug/L	SWQB 6/17/02 data (TP = <30 ug/L, Inorganic P was likely to be higher in this system)
Inorganic Phosphorus	20.00 ug/L	SWQB 6/17/02 data (TP = <30 ug/L, Inorganic P was likely to be higher in this system)
Phytoplankton	NA	No data available, left blank
Detritus	NA	No data available, left blank
Pathogen	18.5 cfu/100mL	SWQB 8/20/02 data
Alkalinity	178.67 mg/L	Average of SWQB 4/17/02, 8/20/02 and 9/16/02 data
pH	7.91 s.u.	SWQB sonde data from 6/17/02

NA = Not available.

Table 2. Reach Data Input

Reach Downstream end of Reach	Headwater	La Plata 1 Cunningham Ditch	La Plata 2 McDermott Arroyo	Data Obtained From
Downstream Location (km from CO-NM Border)	0	7.6	13.8	GIS coverage
Elevation				
Upstream (m)	NA	1823	1769	GIS coverage
Downstream (m)	1823	1769	1725	GIS coverage
Downstream				
Latitude	36°59'56"	36°56'58"	36°54'30"	GIS coverage
Longitude	108°11'21"	108°11'11"	108°10'30"	GIS coverage
Rating Curves				
Velocity				
Coefficient	1.276	1.276	19.16	Calculated[a]
Exponent	0.43	0.43	0.43	Q2K Manual (Typical Value)
Depth				
Coefficient	3.7196	3.7196	6.0196	Calculated[a]
Exponent	0.45	0.45	0.45	Q2K Manual (Typical Value)
Prescribed Dispersion (m2/s)	NA	NA	NA	No data available, left blank
Weir Height (m)	NA	NA	NA	No data available, left blank
Prescribed Reaeration (/d)	NA	0.10	0.10	Based on best professional judgment
Bottom Algae Coverage (%)	NA	10	75	SWQB Habitat assessment
Bottom SOD Coverage (%)	NA	3	25	SWQB field measurement (percent fines)
Prescribed SOD (gO2/m2/d)	NA	NA	NA	No data available, left blank
Prescribed CH4 flux (gO2/m2/d)	NA	NA	NA	No data available, left blank
Prescribed NH4 flux (mgN/m2/d)	NA	NA	NA	No data available, left blank
Prescribed Inorg P flux (mgP/m2/d)	NA	NA	NA	No data available, left blank

NA = Not available.
(a) Velocity and depth coefficients were calculated using the following equations from Section 3.2.2 (Chapra and Pelletier 2003):
$U = aQ^{b}$
$H = \alpha Q^{\beta}$
Where;
$b = 0.43$
$\beta = 0.45$
U = velocity (m/s)
H = depth (m)
Q = flow (m^3/s).

Meteorological Data Worksheets

The meteorological data needed for the air temperature, dew point temperature, wind speed, and cloud cover worksheets were collected at the Farmington, NM weather station. All of this information was available for June 20, 2002 at Weather Underground (www.wunderground.com). This website also provided all of the hourly information required for the Q2K model. Using data from the Farmington weather station was not ideal, but the required data was not available for the town of La Plata, NM. Farmington and La Plata are only about 16 miles apart and weather patterns for the two areas are very similar. The same meteorological data was used for both the La Plata 1 and La Plata 2 reaches in the model.

The cloud cover data was provided at Weather Underground as conditions (i.e. clear, smoke, partly cloudy, or mostly cloudy). Since the Q2K model requires percents for the input data percent values were assigned to each of these conditions (i.e. clear = 0%, smoke = 10%, partly cloudy = 25%, and mostly cloudy = 50%).

The shade data used for the shade worksheet was based on estimates obtained from aerial photography digitized on a topographic map of the La Plata watershed. Estimates were then compared to notes taken in the field and the resulting percents were discussed with the field crew that performed the sampling survey in 2002. The Q2K asks for hourly input of shade values but this information was not available so the same percents were used for daylight hours and 100% shade was used for the period from one hour before sundown to one hour after sunrise. The percent shade for each of the reaches (i.e. La Plata 1 and La Plata 2) is based on the average shade amounts for that particular reach.

Table 3 presents the meteorological data used for the air temperature, dew point temperature, wind speed, cloud cover, and shade worksheets.

Table 3. Meteorological Data Input

Time	Air Temp (°C)	Dew Point Temp (°C)	Wind Speed (m/s)	Cloud Cover (%)	Shade (%)	
					La Plata 1	La Plata 2
12:00 AM	15.60	11.70	4.11	0.0%	100.0%	100.0%
1:00 AM	15.60	11.70	2.06	0.0%	100.0%	100.0%
2:00 AM	13.90	12.80	2.58	0.0%	100.0%	100.0%
3:00 AM	13.30	12.80	2.58	0.0%	100.0%	100.0%
4:00 AM	11.70	11.10	2.58	0.0%	100.0%	100.0%
5:00 AM	13.90	8.90	4.64	0.0%	100.0%	100.0%
6:00 AM	14.00	7.00	5.67	0.0%	100.0%	100.0%
7:00 AM	13.90	7.20	4.64	0.0%	100.0%	100.0%
8:00 AM	16.70	6.10	4.64	0.0%	100.0%	100.0%
9:00 AM	18.30	3.30	3.61	0.0%	50.0%	25.0%
10:00 AM	22.20	1.10	2.06	0.0%	50.0%	25.0%
11:00 AM	26.70	0.60	3.08	0.0%	50.0%	25.0%
12:00 PM	28.90	1.70	2.58	10.0%	50.0%	25.0%
1:00 PM	31.10	3.30	1.56	10.0%	50.0%	25.0%
2:00 PM	32.20	5.00	7.20	10.0%	50.0%	25.0%
3:00 PM	35.00	6.70	6.17	10.0%	50.0%	25.0%
4:00 PM	36.70	6.10	6.69	0.0%	50.0%	25.0%
5:00 PM	36.10	6.10	8.75	0.0%	50.0%	25.0%
6:00 PM	36.10	6.70	6.69	0.0%	50.0%	25.0%
7:00 PM	34.40	5.60	10.28	0.0%	50.0%	25.0%
8:00 PM	30.60	3.30	2.06	0.0%	100.0%	100.0%
9:00 PM	30.00	2.20	1.56	25.0%	100.0%	100.0%
10:00 PM	28.90	1.70	1.56	25.0%	100.0%	100.0%
11:00 PM	26.00	7.00	14.42	50.0%	100.0%	100.0%

Rate/Light and Heat Worksheets

The default/recommended water column rates within the Q2K model were used for the La Plata River dissolved oxygen model. Table 4 lists the water column rate values. The default Q2K values were also used for the light and heat worksheet (Table 5).

Table 4. Water Column Rate Input

Parameter	Value	Units	Symbol
Stoichiometry:			
Carbon	40	mgC	gC
Nitrogen	7.2	mgN	gN
Phosphorus	1	mgP	gP
Dry weight	100	mgD	gD
Chlorophyll	1	mgA	gA
Inorganic suspended solids:			
Settling velocity	1	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
O2 for carbon oxidation	2.69	gO2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO2/gN	r_{on}
Oxygen inhib CBOD oxidation model	Exponential		
Oxygen inhib CBOD oxidation parameter	0.60	L/mgO2	K_{socf}
Oxygen inhib nitrification model	Exponential		
Oxygen inhib nitrification parameter	0.60	L/mgO2	K_{sona}
Oxygen enhance denitrification model	Exponential		
Oxygen enhance denitrification parameter	0.60	L/mgO2	K_{sodn}
Slow CBOD:			
Hydrolysis rate	2	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Fast CBOD:			
Oxidation rate	4	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.05	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Ammonium:			
Nitrification	4	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	1	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0	m/d	v_{di}
Temp correction	1.07		θ_{di}
Organic P:			
Hydrolysis	2	/d	k_{hp}
Temp correction	1.07		θ_{hp}

Phytoplankton:			
Max Growth	2.5	/d	k_{gp}
Temp correction	1.07		θ_{gp}
Respiration	0.1	/d	k_{rp}
Temp correction	1.07		θ_{rp}
Death	0	/d	k_{dp}
Temp correction	1		θ_{dp}
Nitrogen half sat constant	15	ugN/L	k_{sPp}
Phosphorus half sat constant	2	ugP/L	k_{sNp}
Light model	Half saturation		
Light constant	57.6	langleys/d	K_{Lp}
Ammonia preference	25	ugN/L	k_{hnxp}
Settling velocity	0.15	m/d	v_a
Bottom Algae:			
Max Growth	60	gD/m^2/d	C_{gb}
Temp correction	1.07		θ_{gb}
Respiration	1	/d	k_{rb}
Temp correction	1.07		θ_{rb}
Death	0.25	/d	k_{db}
Temp correction	1.07		θ_{db}
Nitrogen half sat constant	300	ugN/L	k_{sPb}
Phosphorus half sat constant	100	ugP/L	k_{sNb}
Light model	Half saturation		
Light constant	50	langleys/d	K_{Lb}
Ammonia preference	25	ugN/L	k_{hnxb}
Detritus (POM):			
Dissolution	5	/d	k_{dt}
Temp correction	1.07		θ_{dt}
Settling velocity	1	m/d	v_{dt}
Pathogens:			
Decay	0.8	/d	k_{dx}
Temp correction	1.07		θ_{dx}
Settling velocity	1	m/d	v_x
pH:			
Partial pressure of carbon dioxide	347	ppm	p_{CO2}

Table 5. Light and Heat Input

Parameter	Value	Unit	Symbol
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	*/m*	k_{eb}
Linear chlorophyll light extinction	0.0088	*1/m-(ugA/L)*	α_p
Nonlinear chlorophyll light extinction	0.054	*1/m-(ugA/L)2/3*	α_{pn}
ISS light extinction	0.052	*1/m-(mgD/L)*	α_i
Detritus light extinction	0.174	*1/m-(mgD/L)*	α_o
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	2		n_{fac}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Brunt		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Brady-Graves-Geyer		

Point Sources/Abstractions Worksheets

There are no permitted point source facilities located on the La Plata River (McDermott Arroyo to Colorado Border). There are several irrigation diversion and return flow ditches located along the La Plata River. Approximate with irrigation withdrawal values were determined based by contacting the NM Office of the State Engineer's Water Master for the La Plata, but no information was available for the amount of irrigation water being returned to the river through the return flow ditches. Therefore the values had to be modified in order to keep the river channel from going dry. The flow at the SWQB station 14 was subtracted from the flow at the NM-Colorado border to determine the net loss in the river channel for June 20, 2002. A percentage of this net loss was assigned to four of the irrigation diversion ditches based on water rights (Table 6).

Table 6. Point Abstractions Input

Name	*Location (km)*	*Point Abstraction (m^3/s)*
Hillside-Thomas Ditch	2.30	0.0035
Indian Ditch	5.00	0.0310
Cunningham Ditch	7.10	0.0155
McDermott Ditch	9.70	0.0057

Diffuse Sources Worksheets

No data for diffuse sources (i.e. Nonpoint sources) was collected; therefore this sheet was left blank.

Hydraulics, Temperature, Water Quality, Diel Data Worksheets
All hydraulics data for the headwaters/SWQB station 13 was obtained from the USGS NM-Colorado gage (09366500) and hydraulics data for SWQB station 14 was provided by SWQB field studies. Hydraulic, temperature, and water quality data are presented in Table 7.

Diel data was available for SWQB station 14, but only for the parameters collected using a YSI sonde (i.e. conductivity, pH, dissolved oxygen, and temperature (Table 8).

Table 7. Hydraulics, Temperature, and Water Quality Data Input

Parameter	(SWQB station 13)	(SWQB station 14)	Data Obtained From
Distance from Headwaters (km)	0.60	9.96	GIS Coverage
Flow (m^3/s)	0.057	0.00014	Field data/USGS
Depth (m)	1.024	0.111	Field data/USGS
Velocity (m/s)	0.372	0.422	Field data/USGS
Travel time (/d)	0.002	0.2090	Field data/USGS
Mean Temp (C)	25.80	19.00	SWQB sonde data from 6/17/02
Min Temp (C)	NA	13.91	SWQB sonde data from 6/17/02
Max Temp (C)	NA	26.38	SWQB sonde data from 6/17/02
Conductivity (umhos)	964	1349.59	SWQB sonde data from 6/17/02
ISS (mg/L)	7.00	3.00	Field data
DO (mg/L)	9.07	5.91	SWQB sonde data from 6/17/02
Norg (ug/L)	218.00	226.00	SWQB 6/17/02 data (Total Kjehldal Nitrogen - 1/2 Ammonia [detection limit])
NH4 (ug/L)	50.00	50.00	SWQB 6/17/02 data (Reported as Nitrate + Nitrate, 1/2 detection limit was used)
NO3 (ug/L)	50.00	50.00	SWQB 6/17/02 data (Reported as Nitrate + Nitrate = <100 ug/L, 1/2 detection limit was used)
Porg (ug/L)	10.00	10.00	SWQB 6/17/02 data (TP = <30 ug/L, Inorganic P was likely to be higher in this system)
Inorg P (ug/L)	20.00	20.00	SWQB 6/17/02 data (TP = <30 ug/L, Inorganic P was likely to be higher in this system)
Pathogens (cfu/100 mL)	18.50	461.10	SWQB 13 = 8/20/02 data and SWQB 14 = 6/17/02 data
Alkalinity ($mgCaCO_3/L$)	178.67	191.00	SWQB 13 = Average of SWQB 4/17/02, 8/20/02 and 9/16/02 data; SWQB 14 = 6/17/02 data
pH	7.91	7.97	SWQB sonde data from 6/17/02
TN (ug/L)	268.00	276.00	SWQB 6/17/02 data (Total Kjehldal Nitrogen)

TP (ug/L)	30.00	30.00	SWQB 6/17/02 (TP = <30 ug/L, used detection limit)
TSS (mg/L)	7.00	3.00	SWQB 6/17/02 data
TOC	3.22	3.60	SWQB 6/17/02 data

Table 8. Diel Data Input

Time (hr)	*Temp Water (^oC)*	*cond (umhos)*	*DO (mg/L)*	*pH*
1.00	19.00	1349.00	3.68	7.73
2.00	17.98	1354.00	3.77	7.73
3.00	17.23	1355.00	3.68	7.72
4.00	16.57	1358.00	3.70	7.71
5.00	15.80	1365.00	3.73	7.71
6.00	15.26	1365.00	3.80	7.70
7.00	14.67	1366.00	4.00	7.71
8.00	14.13	1365.00	4.23	7.72
9.00	14.00	1363.00	4.65	7.74
10.00	14.13	1360.00	5.59	7.83
11.00	15.28	1355.00	7.04*	8.01
12.00	17.75	1352.00	8.27*	8.19
13.00	20.33	1347.00	8.91*	8.30
14.00	22.96	1341.00	9.03*	8.33
15.00	25.06	1333.00	9.07*	8.33
16.00	26.04	1325.00	9.05*	8.33
17.00	26.05	1322.00	8.63*	8.30
18.00	24.64	1328.00	7.68*	8.24
19.00	23.50	1334.00	7.00*	8.19
20.00	22.44	1340.00	6.59*	8.08
21.00	21.23	1345.00	5.99	8.04
22.00	20.94	1349.00	5.34	7.95
23.00	20.48	1354.00	4.69	7.88
24.00	19.85	1361.00	4.19	7.80

* Values exceeded the dissolved oxygen criteria of 6.0 mg/L

Model Calibration and Validation

Calibration data for ambient water quality were based on the SWQB field sampling effort in 2002. Channel dimensions and cross sections are based on field physical measurement taken by USGS. Rating curve coefficients and exponents were developed using the equations in Chapra and Pelletier (2003). Air temperature, dew point temperature, and wind speed were based on meteorological data from the Farmington weather station (available at http://www.wunderground.com/).

For water quality calibration, the modeled concentrations for the following parameters were compared with observed data in order to provide guidance on parameter adjustment: Temperature, pH, alkalinity, dissolved oxygen, Total Nitrogen (TN), and Total Phosphorus (TP) (see Figures 2-7). Overall, the model is considered reasonably calibrated because the model simulated pollutants of interest within the range shown by the observed data and the model reproduced the general water quality trends reasonably well throughout the system.

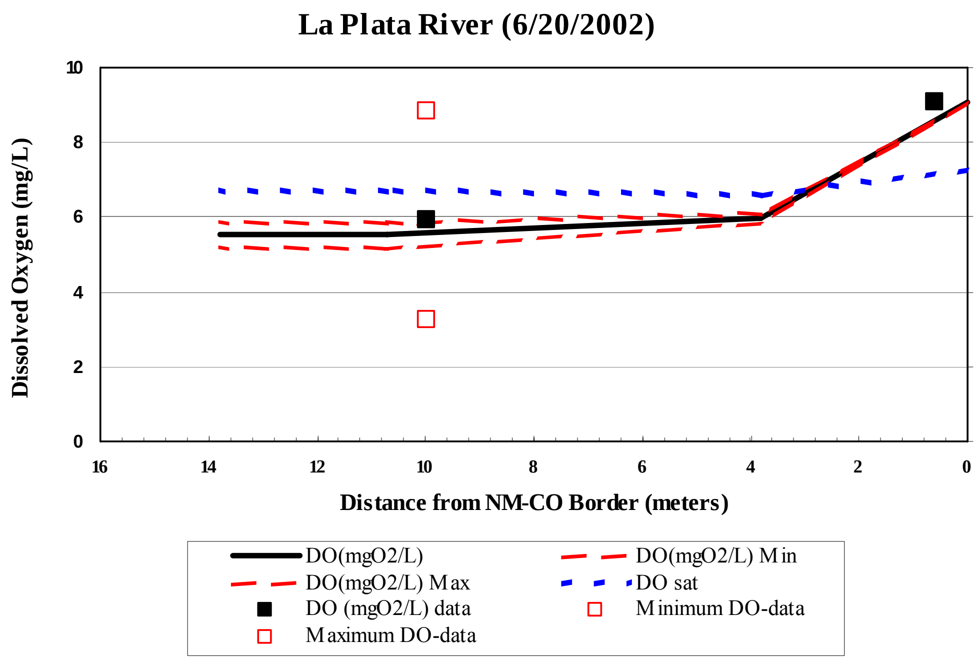


Figure 2. Model-Predicted Dissolved Oxygen Based on Existing Conditions for the La Plata River

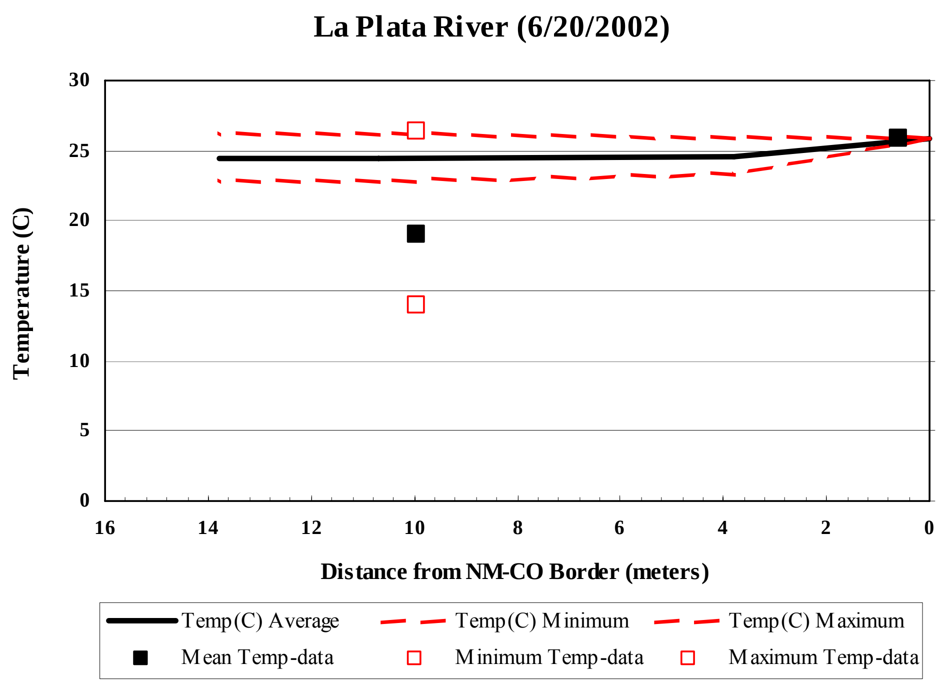


Figure 3. Model-Predicted Temperature Based on Existing Conditions for the La Plata River

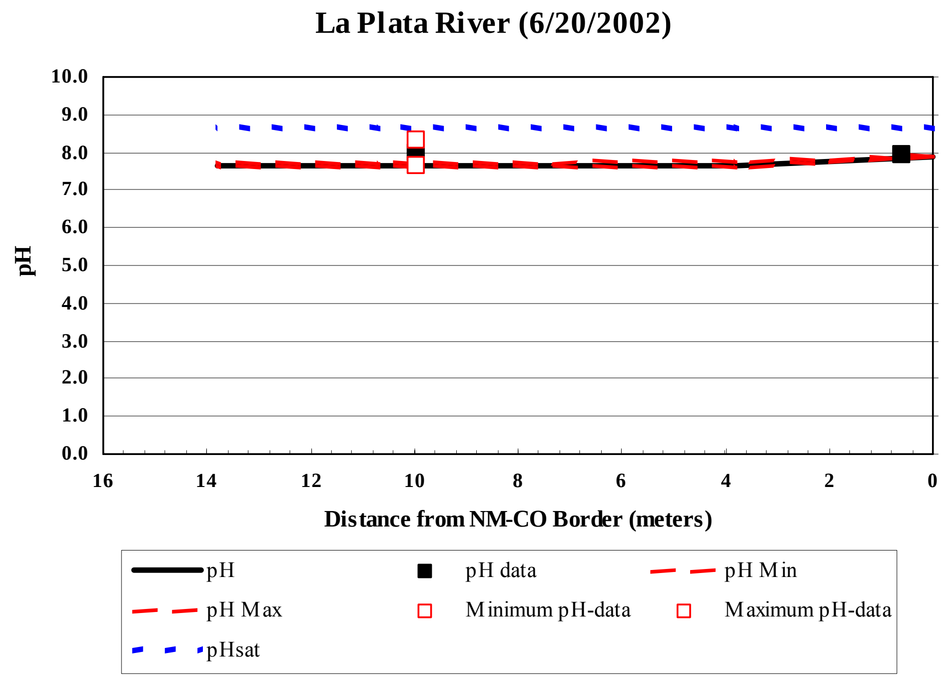


Figure 4. Model-Predicted pH Based on Existing Conditions for the La Plata River

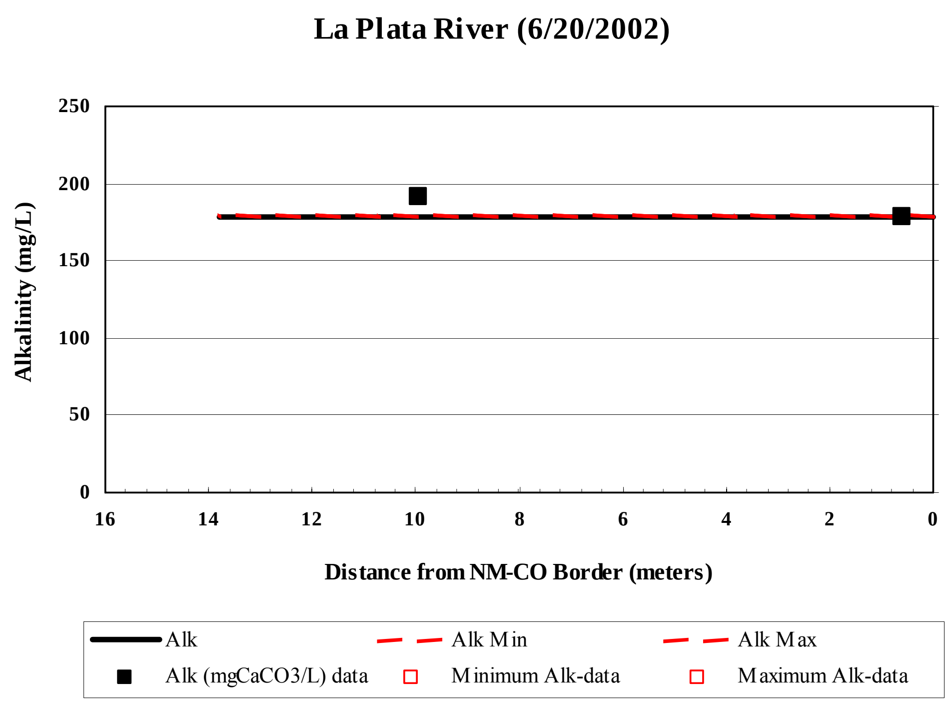


Figure 5. Model-Predicted Alkalinity Based on Existing Conditions for the La Plata River

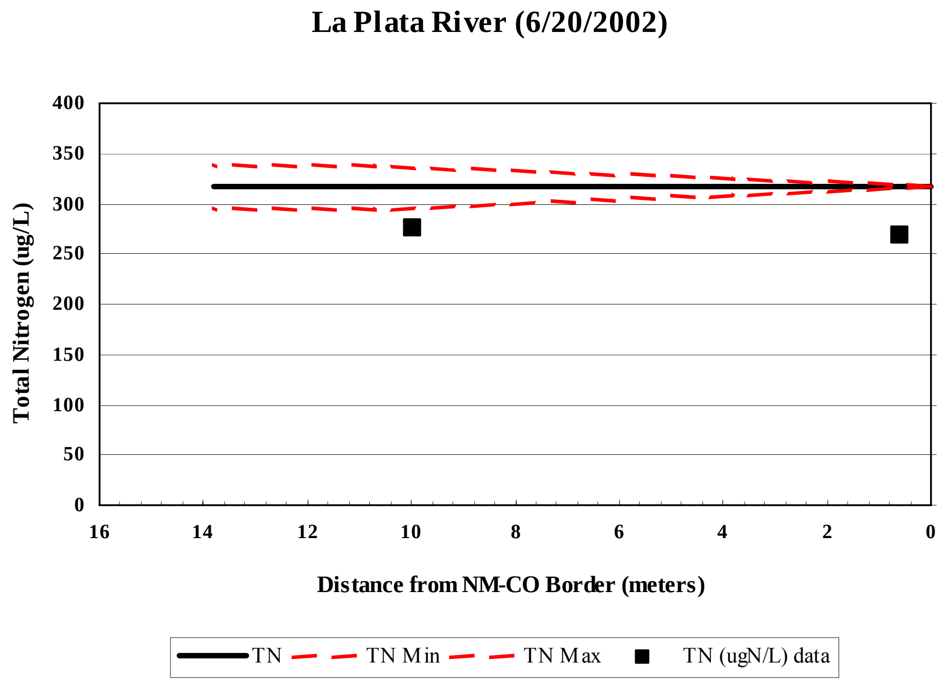


Figure 6. Model-Predicted Total Nitrogen Based on Existing Conditions for the La Plata

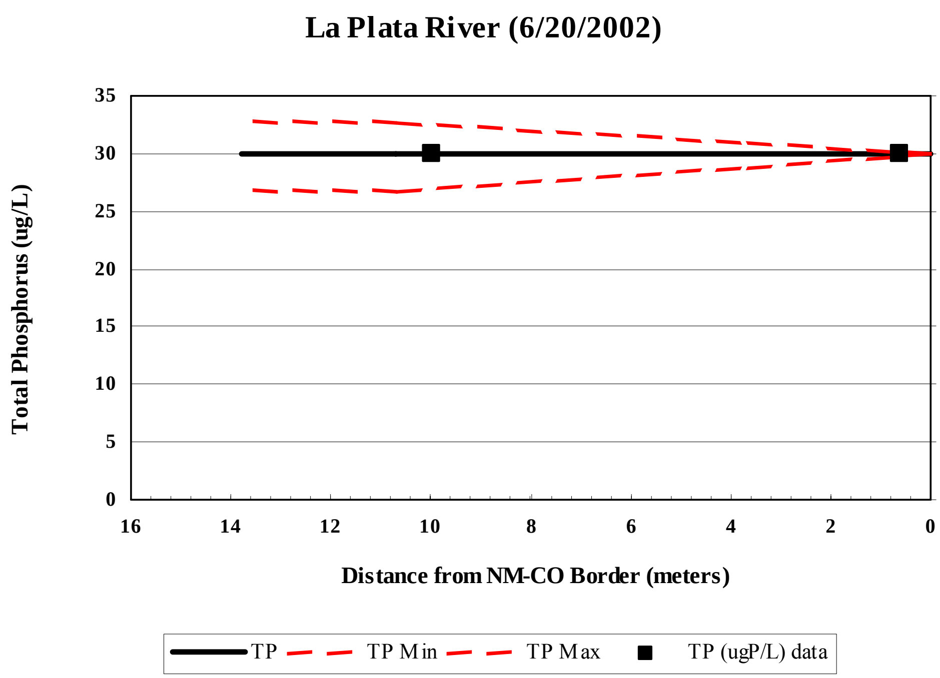


Figure 7. Model-Predicted Total Phosphorus Based on Existing Conditions for the La Plata River

TMDL Endpoint

The calibration or baseline model run for dissolved oxygen is shown in Figure 2. This corresponds to a CBODu value of 18.28 mg/L. The baseline condition model was then run adjusting the CBOD (while keeping the rest of the calibrated parameters the same), to bring the in-stream dissolved oxygen concentration up to or above 6.0 mg/L (representing the state water quality criterion). This involved an iterative process to determine the CBOD value that would not violate water quality standards for dissolved oxygen (Figure 8). This value was determined to be 10.83 mg/L CBODu or 12.09 mg/L of total ultimate biochemical oxygen demand (TBODu) (see TMDL calculations in Section 5.3 of the main document). Table 9 provides a summary of selected parameters related to dissolved oxygen concentrations from the output tables in Q2K.

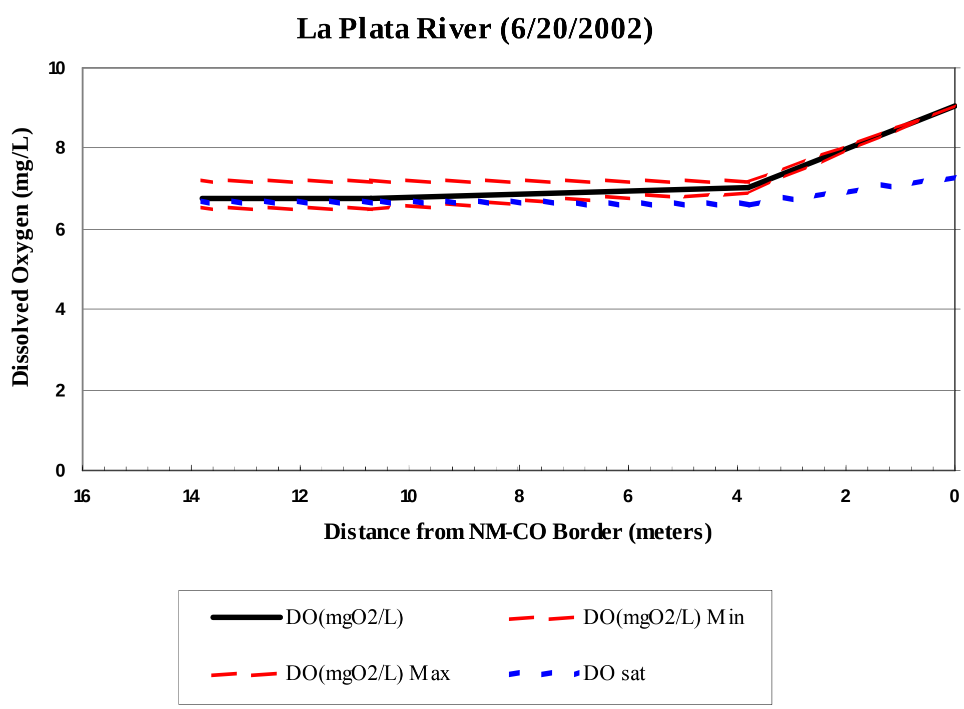


Figure 8. Model-predicted Dissolved Oxygen Concentrations in the La Plata River for the TMDL Scenario

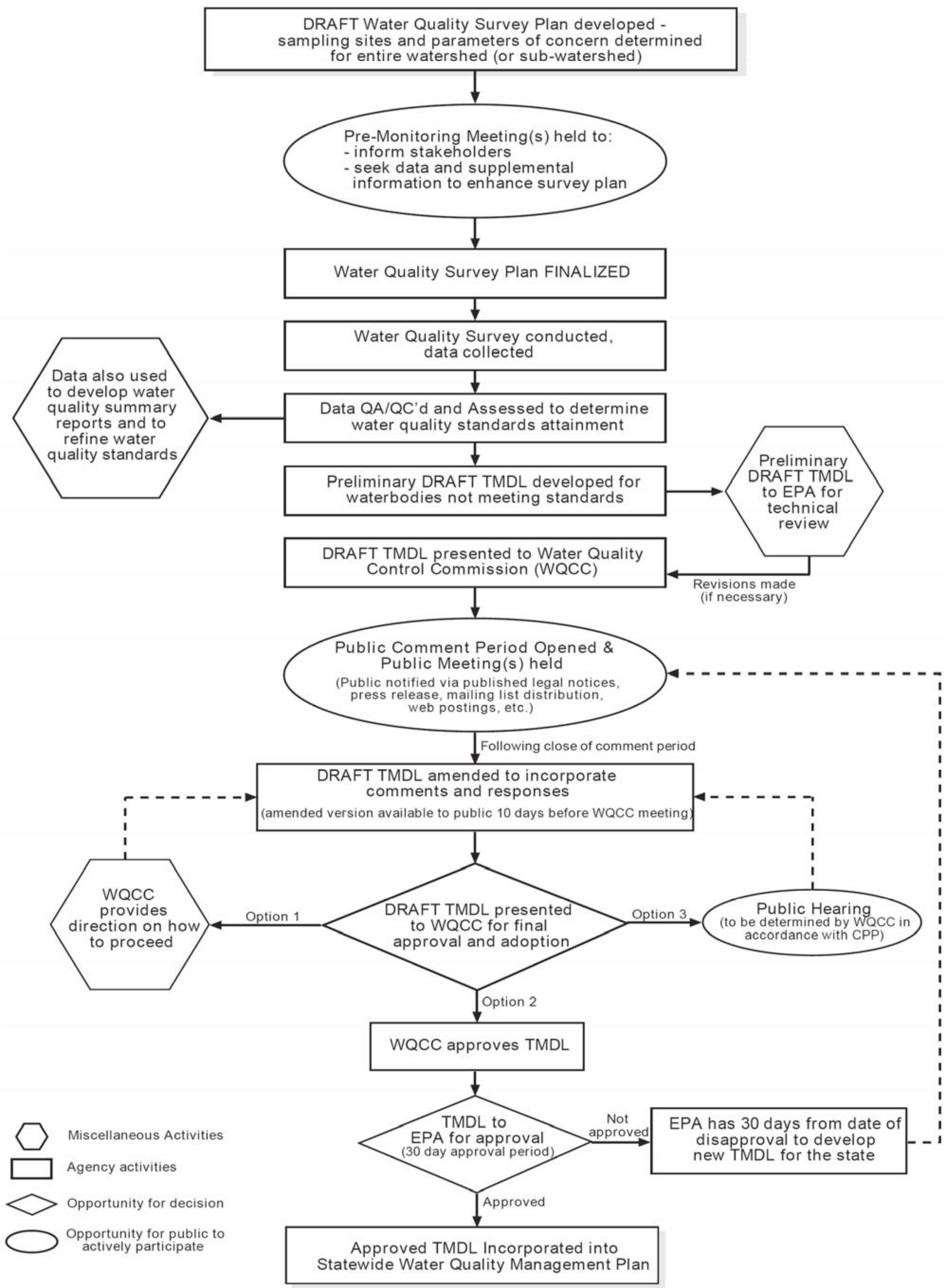
Table 9. Output values for Selected Parameters in the La Plata River for the TMDL Scenario

Reach Label	Headwater	La Plata 1	La Plata 2
Distance (km from the top of the reach)	0.00	3.80	10.70
Average Temp (C)	25.80	24.60	24.40
DO (mgO2/L)	9.07	7.03	6.77
Alkalinity	178.67	178.58	178.60
pH	7.91	7.76	7.74
Total Nitrogen	318.00	317.77	317.44
Total Phosphorus	30.00	29.98	29.94
TKN	268.00	256.53	259.56
CBODu	13.00	11.10	10.83
NH3	2.31	1.16	1.13
DO saturation	7.29	6.61	6.68
pH saturation	8.68	8.67	8.67

References

Chapra, Steve and Greg Pelletier. 2003. *QUAL2K: A Modeling Framework for Simulating River and Stream Water Quality. Documentation and Users Manual.* Civil and Environmental Engineering Dept., Tufts University, Medford, MA.

APPENDIX F
PUBLIC PARTICIPATION PROCESS FLOWCHART


DRAFT Water Quality Survey Plan developed - sampling sites and parameters of concern determined for entire watershed (or sub-watershed)
Pre-Monitoring Meeting(s) held to: - inform stakeholders - seek data and supplemental information to enhance survey plan
Water Quality Survey Plan FINALIZED
Water Quality Survey conducted, data collected
Data also used to develop water quality summary reports and to refine water quality standards
Data QA/QC'd and Assessed to determine water quality standards attainment
Preliminary DRAFT TMDL developed for waterbodies not meeting standards
Preliminary DRAFT TMDL to EPA for technical review
DRAFT TMDL presented to Water Quality Control Commission (WQCC)
Revisions made (if necessary)
Public Comment Period Opened & Public Meeting(s) held
(Public notified via published legal notices, press release, mailing list distribution, web postings, etc.)
Following close of comment period
DRAFT TMDL amended to incorporate comments and responses
(amended version available to public 10 days before WQCC meeting)
WQCC provides direction on how to proceed
Option 1
DRAFT TMDL presented to WQCC for final approval and adoption
Option 3
Public Hearing (to be determined by WQCC in accordance with CPP)
Option 2
WQCC approves TMDL
TMDL to EPA for approval (30 day approval period)
Not approved
EPA has 30 days from date of disapproval to develop new TMDL for the state
Approved
Approved TMDL Incorporated into Statewide Water Quality Management Plan
Miscellaneous Activities
Agency activities
Opportunity for decision
Opportunity for public to actively participate

APPENDIX G
RESPONSES TO COMMENTS

Comment Set A:
San Juan Water Commission

October 19, 2005

Ms. Jennifer Ickes
Surface Water Quality Bureau
New Mexico Environment Department
Room N2109
P.O. Box 26110
Santa Fe, NM 87502

Via e-mail (jennifer.ickes@state.nm.us)
and U.S. mail

Re: Comments of San Juan Water Commission on the Draft Total Maximum Daily Load ("TMDL") for the San Juan River Watershed (Part Two)

Dear Ms. Ickes:

Pursuant to the notice of a 30-day public comment period on the Surface Water Quality Bureau's ("SWQB") Draft Total Maximum Daily Load ("TMDL") for the San Juan River Watershed (Part Two) ("Draft TMDL Document"), I hereby submit the following comments to SWQB on behalf of the San Juan Water Commission ("SJWC").

General Considerations

On April 13, 2005, SJWC submitted comments on Part One of the draft TMDLs for the San Juan River watershed. In those comments, SJWC expressed significant concerns with the methodologies used by SWQB to develop TMDLs for sediment/siltation and bacteria. Unfortunately, SWQB's responses to those comments did not alleviate those concerns. Similarly, SJWC's review of the proposed TMDLs for dissolved oxygen and nutrients that are now open for public comment has raised questions about the scientific validity of SWQB's newest proposals, as discussed below. As noted in SJWC's April 13 comments, it is imperative that impairment determinations be made, and TMDL calculations be developed, applying appropriate assumptions and using a valid data set. For the reasons explained, SJWC believes that neither SWQB's impairment determinations nor SWQB's newest TMDL calculations are appropriate, and SJWC requests that SWQB revise its Draft TMDL Document as suggested. SJWC's specific comments identify SJWC's concerns. SJWC's requests for additional information and proposals to modify the final TMDL document are noted in bold type.

Specific Comments

A. NITROGEN AND PHOSPHOROUS—ANIMAS RIVER (SAN JUAN RIVER TO ESTES ARROYO)

1. **Animas River from the San Juan River to Estes Arroyo**: This 16-mile reach has been identified by SWQB as exceeding the narrative nutrient standard. It is classified as a marginal cold water fishery.

2. **Point Sources**: The only point source in this assessment unit is the wastewater treatment plant owned and operated by the City of Aztec. There are no individually permitted municipal separate storm sewer systems (MS4) units in this assessment unit.

3. **Finding of Non-Support**: In section "4.0 Nutrients," SWQB determines that "nutrients will be added as cause of non support" for the Animas River. This decision was based on a water quality survey conducted in August 2003 and comparison of the results of that survey with generalized literature of values. SWQB's Draft TMDL Document acknowledges that "[t]here is a great deal of variability in nutrient levels and nutrient responses throughout the country due to differences in geology, climate, and waterbody type." However, SWQB has not considered site specific circumstances in the Animas River in its finding of non-support. Further, there is no indication, supporting analysis, or demonstration that the generalized literature values used by SWQB are applicable to the Animas River. Therefore, the finding that nutrients are a cause of non-support is not demonstrated to be valid in SWQB's Draft TMDL Document.

4. **Water Quality Standards and Criteria**: As stated by SWQB, "[t]he plant nutrient standard leading to an assessment of use impairment" is a narrative standard "as follows (NMAC 20.6.4.12.E):

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

. . . .

Currently, there are no numeric standards applicable to this assessment unit for total phosphorus (TP) and total nitrogen (TN)." To derive numeric criteria for its TMDL calculations, SWQB applied total phosphorous and total nitrogen criteria theoretically applicable to an entire ecoregion (Level III Ecoregion 22—the Arizona/New Mexico Plateau). In order to calculate the ecoregion numeric criteria, USGS developed generalized numeric nutrient targets based on analysis of available total phosphorus and total nitrogen data. However, the USGS methodology is not described in the Draft TMDL Document. The USGS-proposed ecoregion criterion for total phosphorus is 0.07 mg/l, and the ecoregion criterion for total nitrogen is 0.42 mg/l.

The USGS ecoregion values are based on historical data, and are not supported by an analysis showing that exceedences of the values would violate the narrative standard for plant nutrients, *i.e.*, "produce undesirable aquatic life or result in the dominance of nuisance species" in the Animas River. As already noted, the Draft TMDL Document acknowledges that "[t]here is a great deal of variability in nutrient levels and nutrient responses throughout the country due to differences in geology, climate, and waterbody type," yet SWQB apparently has not considered the site-specific circumstances in the Animas River.

SJWC requests that a general description of the data base, including time period and geographic spread, along with the methods, assumptions, and procedures used by USGS to calculate the ecoregion criteria, be included in the text of the final TMDL document or in an appendix.

Response: It is out of the scope of this study to include the entire USGS process in this document. A synopsis of the USGS study is included within the text of the TMDL and additional details regarding the National Nutrient Water Quality Criteria program and National Nutrient Database can be found on the web at: http://www.epa.gov/waterscience/criteria/nutrient/.

The National Nutrient Database was developed by the EPA to store and analyze nutrient water quality data and serves as an information resource for states, tribes, and others in establishing scientifically defensible numeric nutrient criteria. It contains ambient data for waterbodies of the United States from EPA's Legacy STOrage and RETrieval (STORET) data system, the US Geological Survey's National Stream Quality Accounting Network (NASQAN) data and National Water Quality Assessment (NAWQA) data, and other relevant sources such as universities and states/tribes. The database allows states, tribes and stakeholders to replicate EPA's data analysis and to perform their own independent analyses. It also gives states and tribes access to data for refinement of EPA's criteria and helps states and tribes share data within nutrient ecoregions regardless of political boundaries. The ultimate use of the data is to derive ecoregional waterbody-specific numeric nutrient criteria.

EPA (Region 6) contracted with USGS-Austin, TX to provide technical support to states in the development of ecoregional waterbody-specific nutrient criteria that fully reflect localized conditions and protect specific designated uses. As part of this assistance, the USGS modified the proposed EPA ecoregional numeric criteria for the Arizona/New Mexico Plateau based on further stratification and analysis of the available TP and TN data from the National Nutrient Database. Data sets from Legacy STORET, NASQAN, and NAWQA were used to assess nutrient conditions from 1990-1998. The aggregate ecoregions used by the USGS were stratified to Level III Ecoregions (Omernik, 1987). Criteria were calculated by first taking the median concentration for each site within the Level III Ecoregion. Then the median of these medians became the numeric criteria. This waterbody-specific analysis resulted in criteria of 0.07 mg/L for total phosphorus (TP) and 0.42 mg/L for total nitrogen (TN), which are the numeric criteria that were used in this TMDL.

In 2002, SWQB conducted a water quality survey of the San Juan River watershed, including the collection of samples from four sites on the Animas River at 8 times between April and October. These data were used to conduct a Level I Nutrient Assessment. The Level I Nutrient Assessment includes examination of a number of parameters, which are collected during routine intensive water quality surveys Based on the results of the Level I Assessment, SWQB conducted a Level II nutrient survey in 2003 in cooperation with members of the San Juan Watershed Group including the San Juan Citizens Alliance, Ute Mountain Ute Tribe, Southern Ute Indian Tribe, and the State of Colorado Water Quality Control Division. Information on SWQB's Assessment Protocols for Streams is available on the web at:
http://www.nmenv.state.nm.us/swqb/protocols/index.html

In addition to the ecoregion-based nutrient criteria, SWQB also evaluated the following indicators of nutrient enrichment when assessing nutrient impairment of the Animas River: Dissolved Oxygen (DO) saturation, DO concentration, pH, algal productivity (i.e. Chlorophyll a and Ash Free Dry Mass), and the Hilsenhoff Biotic Index. For each indicator, values that are indicative of nutrient enrichment were identified through an extensive literature review and come from EPA guidance documents, peer-reviewed literature, and NMED water quality standards. According to SWQB's nutrient assessment protocol, exceedence of more than two of these criteria indicates nutrient impairment. The Animas River (San Juan River to Estes Arroyo) exceeded 5 out of the 8 indicators, which included TP, TN, DO saturation, Chlorophyll a, and Ash Free Dry Mass.

5. **Algal Bioassay**: Section 4.0 refers to an algal bioassay ("Appendix A: Algal Growth Potential (AGP) Assays"). While the bioassay produced a variety of results, the authors concluded that

> the Animas River has MODERATE PRODUCTIVITY. With nitrogen and phosphorus additions, productivity increases *but never exceeds the lower range of MODERATELY HIGH PRODUCTIVITY.* Singular additions of P or N to the level tested would not increase algal productivity. However, management procedures should prevent the addition of both P and N to the Animas River.

(Emphasis added.) The algal bioassay also indicated that both studied sites were limited by iron for algal growth. Significantly, however, the authors do not equate "moderately high productivity" to a violation of the narrative standard or ecoregion criteria, nor do they attempt to establish relationships among the bioassays and the standard or criteria. In fact, there are no established relationships between the results of the algal bioassay test and the narrative standard or ecoregion criteria. Likewise, there is no indication that an exceedence of the regional criteria calculated by USGS, which are applied by SWQB in the TMDL analysis, would result in increased algal growth.

Response: Both Chlorophyll a and Ash Free Dry Mass, which are indicators of algal productivity, exceeded their respective criteria of 10 ug/cm^2 and 5 mg/cm^2 within this assessment unit. SWQB has developed a nutrient assessment protocol that uses a weight-of-evidence approach, which includes a number of indicators of nutrient enrichment such as Total Phosphorus (TP), Total Nitrogen (TN), Dissolved Oxygen (DO) saturation, DO concentration, pH, algal productivity (i.e. Chlorophyll a and Ash Free Dry Mass), and the Hilsenhoff Biotic Index. SWQB used this weight-of-evidence approach when assessing nutrient impairment of the Animas River. For each indicator, values that are indicative of nutrient enrichment were identified through an extensive literature review and come from EPA guidance documents, peer-reviewed literature, and NMED water quality standards. According to SWQB's assessment protocol, exceedence of more than two of these criteria indicates nutrient impairment. The Animas River (San Juan River to Estes Arroyo) exceeded 5 out of the 8 indicators, signifying nutrient impairment along this assessment unit.

6. **Load Calculations:** SWQB calculated the allowable level based on the critical low flow conditions (57.4 mgd) that are used in discharge permits (4Q3 flow) and the ecoregion numeric criteria, which resulted in a TMDL of 33.5 lbs/day of total phosphorus and 201 lbs/day of total nitrogen during critical low flow conditions (Table 4.3). To determine whether a violation of the standard occurred, SWQB next calculated what it referred to as "measured loads" for total phosphorus and total nitrogen. However, SWQB *incorrectly* asserts that this calculation represents the loads in the river under critical low flow conditions. This assertion is not factually based.

SWQB apparently sampled the Animas River near Flora Vista and at Farmington to obtain data for the TMDL. In a process that *virtually ensured* a violation of the ecoregion criteria would be calculated, SWQB took the geometric mean of *only the collected data that exceeded* the numeric ecoregion criteria and applied that data to the calculated critical low flows (4Q3) to calculate the "measured load." This approach, of course, resulted in exceedences of the allowable load because, rather than use all of the data it collected, SWQB only used data that "exceeded" the numeric criteria. As shown in Table 4.4, the so-called "measured load" calculation was based on six data points. The data that exceeded the numeric criteria were taken from the Animas River near Flora Vista on September 19, 2002, August 25, 2002, and April 23, 2004. Data from the Animas River at Farmington that exceeded the criteria were collected on July 16, 2002, September 17, 2002, and August 25, 2003.

Based on the statement in the Draft TMDL Document that "[t]he geometric mean of the collected data that *exceeded* the numeric criteria was substituted for the numeric target in Equation 1 (Table 4.4)" (emphasis in original), apparently other data was collected at these sites. In fact, Table 4.4 excludes a total phosphorous data point on July 16, 2002 at Farmington, but includes a nitrogen data point for the same date.

SWQB filtered out the data that did not exceed the criteria, did not use that data in its calculation to provide a valid assessment of water quality conditions in the Animas River, and did not provide the filtered data in the Draft TMDL Document. Further, SWQB did not indicate whether the flows in the Animas River on the dates of the exceedences were below the calculated low flows. If so, the assumption that the criteria are violated at the critical low flow is invalid.

Was the phosphorous data point for July 16 taken, but excluded because it did not exceed the ecoregion criteria? If so, please provide SJWC with the missing data. Please also provide all of the data collected with respect to the Draft TMDL Document.

Was flow data collected with the water quality data? If so, please provide that data to SJWC.

Table 4.6 shows that SWQB used data collected on twelve occasions at the Hwy 550 Bridge and ten occasions at the Colorado state line to define "ambient upstream conditions." Was data collected at Flora Vista and at Farmington on the same dates it was collected as shown in Table 4.6? If so, why was that data not presented in the Draft TMDL Document? If collected, please provide that data to SJWC.

Response: SJWC is misinterpreting how the SWQB assesses water quality data. SJWC states, "To determine whether a violation of the standard occurred, SWQB next calculated what it referred to as "measured loads" for total phosphorus and total nitrogen." Measured loads are *calculated to help determine the load reductions that would be necessary to meet the target loads and are not a required element of a TMDL document. Impairment determinations are based on application of the Assessment Protocols (NMED/SWQB 2004a),* not *on measured loads. Information regarding the original impairment listings that led to development of these TMDLs can be found in the Integrated Clean Water Act 303(d)/305(b) List (NMED/SWQB 2004b), and associated Record of Decision (ROD) (NMED/SWQB 2004c). The assessment protocol is periodically updated and is generally based on current EPA assessment guidance. The assessment protocol and all associated appendices are available on the SWQB web page:* http://www.state.nm.us/swqb/swqb.html

SWQB has developed a nutrient assessment protocol that uses a weight-of-evidence approach, which includes a number of indicators of nutrient enrichment such as Total Phosphorus (TP), Total Nitrogen (TN), Dissolved Oxygen (DO) saturation, DO concentration, pH, algal productivity (i.e. Chlorophyll a and Ash Free Dry Mass), and the Hilsenhoff Biotic Index. SWQB used this weight-of-evidence approach when assessing nutrient impairment of the Animas River. For each indicator, values that are indicative of nutrient enrichment were identified through an extensive literature review and come from EPA guidance documents, peer-reviewed literature, and NMED water quality standards. According to SWQB's nutrient assessment protocol, exceedence of more than two of these criteria indicates nutrient impairment. The Animas River (San Juan River to Estes Arroyo) exceeded 5 out of the 8 indicators, signifying nutrient impairment along this assessment unit.

References:

NMED/SWQB. 2004a. State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report. Santa Fe, NM.

———. 2004b. State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

———. 2004c. Record of Decision for the State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

7. **Wasteload Allocations**: Table 4.6 provides the data used to calculate ambient upstream conditions: (i) 12 samples taken from the Animas River at Highway 550; (ii) 10 samples taken from the Animas River at the Colorado state line; and (iii) the aggregate Ecoregion III Level III Ecoregion 22 samples. The data from the Animas River at Highway 550 ranges from April 16, 2002 to November 18, 2004. The data from the Animas River at the Colorado state line ranges from April 17, 2002 to October 6, 2003. Apparently this was the data that was collected by SWQB to assess water quality. Most of the data comes from April through October 2002, one of the driest periods on record. In addition, although the aggregate Ecoregion III Level III Ecoregion 22 data was incorporated into the ambient calculation, the method by which it was applied is not described. Footnote "a" states: "Taken from USEPA's ecoregional nutrient criteria dataset. Median values for each season are shown. (USEPA 2000)." There is no indication that the ecoregion data set contains any data from the Animas River.

Is any of the ecoregion data shown in Table 4.6 from the Animas River? If so, please indicate when and where it was collected.

How was the ecoregion data incorporated into the calculation of ambient values, *i.e.*, was it weighted based on the number of samples, each seasonal value counted as one data point, etc.?

What is the basis for including the ecoregion data in the calculation of ambient values? Does it not skew those values upward?

In section 4.1, SWQB states that it used a USGS modification of EPA's ecoregion values for the Draft TMDL Document. Is the ecoregion data in Table 4.6 data that was modified by USGS or is it the original EPA-calculated ecoregion data?

Response: The ecoregional data used to calculate ambient conditions in the Animas River was taken from EPA's 2000 publication, Ambient Water Quality Criteria Recommendations Information Supporting the Development of State and Tribal Nutrient Criteria: Rivers and Streams in Nutrient Ecoregion III (EPA 822-B-00-016)*. Several sites were located along the Animas River, including the Animas River at Farmington, Animas River 300 meters below the Aztec Wastewater Treatment Plant, and Animas River at Aztec at Highway 550 Bridge. Data sets from Legacy STORET, NASQAN, and NAWQA were used to assess nutrient conditions from 1990-1998. Data from EPA's National Nutrient Database can be accessed on the web at:* http://www.epa.gov/waterscience/criteria/nutrient/*. The EPA determined nutrient criteria for specific ecoregions using reference conditions (see USEPA 2000 for details). Reference conditions represent the natural, least impacted conditions or what is considered to be the most attainable conditions.*

*To calculate an average ambient concentration for this TMDL, the data were weighted based on the number of samples that were taken. For example, the annual ambient TP concentration = [(mean SWQB upstream concentration * 22) + (mean EPA fall concentration * 78) + (mean EPA spring concentration * 83) + (mean EPA summer concentration * 82) + (mean EPA winter concentration * 58)]/323. By including EPA's data, the number of data points increases drastically giving more confidence in the calculated values. In addition, it provides a better representation of the actual conditions of the waterbody because it includes data from all four seasons and across multiple years.*

In response to SJWC's question regarding Section 4.1, the ecoregion data in Table 4.6 is from the National Nutrient Database, which is the same data that was used for EPA's initial nutrient criteria analysis and for USGS's further stratification and analysis of the same data.

Significantly, even though Table 4.6 contains mostly dry-year data, most of the values *do not exceed* the recommended USGS ecoregion criteria. In fact, the values that do exceed the ecoregion criteria were collected on the same dates as the exceedence data used to calculate the violation of criteria, as shown in Table 4.4 for the stations near Flora Vista and at Farmington. Table 4.6 clearly shows that the average ambient concentration of total phosphorus is 0.051 and the average ambient concentration of total nitrogen is 0.374. Both of these calculated ambient values are less than the USGS criteria.

If all of the data collected near Flora Vista and at Farmington were averaged, would that data show that the USGS ecoregion criteria would be met?

Response: This TMDL was written because the USGS ecoregional criteria are currently not being met in this assessment unit, Animas River (San Juan River to Estes Arroyo). The exceedence ratios for TP and TN were 21% and 26%, respectively. According to the weight-of-evidence approach, exceedence ratios greater than 15% are considered to be indicators of nutrient impairment. Table 4.6 represents ambient, or background, conditions calculated from data collected from sites located upstream of this assessment unit. The upstream sites were not listed as impaired for nutrients. Therefore, the Animas River (Estes Arroyo to CO Border) should have nutrient concentrations that are less than the numeric criteria.

The loading for the City of Aztec's wastewater treatment plant was estimated based on *only one* grab sample collected on June 13, 2005 by SWQB staff. Total concentrations measured were 0.833 mg/l total phosphorus and 2.56 mg/l total nitrogen. Based on the 1 mgd discharge in the City's permit, the grab sample concentrations computed to a loading from the Aztec plant of 6.95 lbs/day total phosphorus and 21.3 lbs/day total nitrogen, as opposed to an allowable additional waste loading of 9.32 lbs/day of total phosphorus and 25.3 lbs/day of total nitrogen. This calculation does not allow a lot of room for growth for Aztec above the current design level. A 20-percent increase in design flow would possibly result in violating the total nitrogen TMDL, and a 23-percent increase in design flow would result in violation of the total phosphorus TMDL.

Concerning implementation, SWQB has noted that "reductions from point sources will be addressed in revisions to NPDES discharge permits." Table 4.13 indicates that the Aztec treatment plant is contributing 6.95 lbs/day, or nine percent of the total load for total phosphorus. Ninety-one percent (67.3 lbs/day) comes from nonpoint sources. Approximately the same ratios apply for nitrogen: 21.3 lbs/day (7 percent) is coming from the Aztec plant, and 290 lbs/day (93 percent) is coming from nonpoint sources. It is not clear from the Draft TMDL Document whether additional discharge limits will be imposed on the Aztec plant in the future.

SJWC requests that SWQB include a statement concerning the potential impacts (or lack of impacts) now and in the future on the City of Aztec wastewater treatment plant.

Response: According to 4Q3 low-flow, WWTP design capacity, and grab sample data, the City of Aztec WWTP currently contributes approximately 2% of the flow, 9% of the total phosphorus, and 7% of the total nitrogen in this assessment unit. The current NPDES permit for the City of Aztec WWTP will be revised based on the assigned WLA in this TMDL document. NPDES permits generally are renewed every 5 years. If the WWTP wishes to expand in the future, SWQB will revise the TMDL according to the proposed design capacity and any additional, relevant data collected since the 2002 intensive watershed survey. A new wasteload allocation (WLA) will be assigned and a revised NPDES permit will be written to accommodate the plant expansion.

8. **General Comment:** SWQB has failed to demonstrate that violation of the calculated ecoregion criteria for total phosphorous or total nitrogen will result in a violation of the narrative standard applicable to the Animas River, and that TMDLs for phosphorous and nitrogen are needed. No relationship is established between the ecoregion criteria and the narrative standard. The algal bioassay likewise fails to demonstrate that violation of the theoretical ecoregion criteria will result in violation of the narrative water quality standard applicable to this segment of the Animas River. SWQB's use of *only* the data exceeding the numeric criteria *ensures* calculation of loads that exceed theoretically allowable loads based on ecoregion criteria. However, such procedures are not a technically valid methodology for characterizing water quality conditions. The information presented in the Draft TMDL Document does not support the determination that the segment is impaired, that the segment should be on the 303(d) list, that TMDLs are warranted, or that the draft TMDLs are valid.

Response: SJWC is misinterpreting how the SWQB assesses water quality data. Impairment determinations are based on application of the Assessment Protocols (NMED/SWQB 2004a), not on measured loads. Information regarding the original impairment listings that led to development of these TMDLs can be found in the Integrated Clean Water Act 303(d)/305(b) List (NMED/SWQB 2004b), and associated Record of Decision (ROD) (NMED/SWQB 2004c). The assessment protocol is periodically updated and is generally based on current EPA assessment guidance. The assessment protocol and all associated appendices are available on the SWQB web page: http://www.state.nm.us/swqb/swqb.html

SWQB has developed a nutrient assessment protocol that uses a weight-of-evidence approach, which includes a number of indicators of nutrient enrichment such as Total Phosphorus (TP), Total Nitrogen (TN), Dissolved Oxygen (DO) saturation, DO concentration, pH, algal productivity (i.e. Chlorophyll a and Ash Free Dry Mass), and the Hilsenhoff Biotic Index. SWQB used this weight-of-evidence approach when assessing nutrient impairment of the Animas River. For each indicator, values that are indicative of nutrient enrichment were identified through an extensive literature review and come from EPA guidance documents, peer-reviewed literature, and NMED water quality standards. According to SWQB's assessment protocol, exceedence of more than two of these criteria indicates nutrient impairment. The Animas River (San Juan River to Estes Arroyo) exceeded 5 out of the 8 indicators, signifying nutrient impairment along this assessment unit.

B. **DISSOLVED OXYGEN—LA PLATA RIVER (MCDERMOTT ARROYO TO COLORADO STATE LINE)**

1. **La Plata River from McDermott Arroyo to the Colorado State Line:** This segment is classified as a marginal coldwater fishery. The dissolved oxygen standard is 6.0 mg/l.

2. **Point Sources:** There are no point sources on this segment.

3. **Sample Data:** Grab samples for the LaPlata were collected at the LaPlata station (station 14) six times between April 16 and July 16, 2002, and eight times at the New Mexico-Colorado state line station (station 13) between April 17 and October 22, 2002. Samples were not collected at station 14 after July 16 because river levels were too low to allow for sample collection. One reading from station 14 was below the 6.0 mg/l criteria. No grab samples at station 13 (New Mexico-Colorado state line) were below the dissolved oxygen criteria. Data also were collected June 19-21, 2002 at station 14 using a "data sonde." Sixty-three percent of the dissolved oxygen measurements were below 6.0 mg/l at La Plata station 14 during the June 2002 sonde deployment sampling.

There is a huge difference in data reported from the grab samples and data collected with the sonde to the extent that the accuracy of the data collected with the sonde is highly questionable, and perhaps should be discarded.

Was the data sonde collected data within its calibration limits? Was the sonde calibrated prior to use in the La Plata, and for those conditions of temperature? Please provide the calibration procedures that were applied before the June 19-21 sampling of the La Plata, and the dates of calibration.

Apparently, this data was collected under extreme low flow conditions (see comments below). What was the ambient air temperature? What was the water temperature? What is the DO saturation level at that water temperature even if the $TBOD_U$ load is zero? Do these conditions reflect conditions appropriate for classification of this stream as a "marginal coldwater fishery"?

Response: The data collected with the YSI sonde was properly calibrated and the data was reviewed for accuracy. Calibration and operation procedures for the YSI sonde are available in the SWQB's Standard Operating Procedures for Sample Collection and Handling available on the web at http://www.nmenv.state.nm.us/swqb/MAS/index.html. Data collected over an extended period of time using the YSI sonde is considered to be more accurate than a grab sample collected which takes a "snapshot" of one time during a day. Grab samples generally do not account for diurnal swings in dissolved oxygen that can be detected using a continuous monitoring approach.

SWQB agrees this data was collected under extreme low flow conditions, but the New Mexico Surface Water Quality Standards apply to water's of the state even under low flow conditions.

4. Low Flow Conditions: The critical low flow for this TMDL was the low flow corresponding to June 2002 when the lowest dissolved oxygen measurements were collected. That low flow was reported as .005 cfs—.0032 mgd or *2.2 gallons/minute*. The method of applying the extreme low flow is not consistent with the method used in section 4.0 to develop the phosphorus and nitrogen low flow, which used the calculated 4Q3: "The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. It is assumed that 4Q3 flows will be the critical periods for aquatic life."

How was the flow measured?

What were the corresponding velocities, depths, and channel cross-sections that were incorporated into the model at this flow level?

Are these conditions supportive of a classification of marginal coldwater fishery?

Given that the 6.0 mg/l is an aquatic life standard, why was not the 4Q3, rather than the extreme low flow, used for the TMDL?

Response: The 4Q3 method used in Section 4.0 of the TMDL could not be used to determine a 4Q3 for the La Plata River. The USGS gaging station is located at the New Mexico – Colorado Border on the most upstream boundary of the assessment unit. In order to calculate a 4Q3 for the downstream portion of the assessment unit near La Plata, NM this value would need to be adjusted to account for the numerous ungaged agricultural diversions between these two sites. Unfortunately information on the amount of water diverted in 2002 was not available. The SWQB attempted to quantify the amount of diversions by talking with the local Water Master, but since diversion amounts were not recorded in 2002 and the diversions are extremely variable we were not able to use the 4Q3 method in this TMDL.

A marginal coldwater fishery is defined by the New Mexico Water Quality Standards as "a surface water of the state known to support a coldwater fish population during at least some portion of the year, even though historical data indicate that the maximum temperature in the surface water of the state may exceed 20°C (68°F)" (20.6.4.7 NMAC). There is evidence of an existing coldwater fishery in the La Plata River therefore it meets the requirements of this definition and has been classified as a marginal coldwater fishery.

5. Water Quality Model: To calculate the dissolved oxygen TMDL, SWQB used the QUAL2K (Q2K) model. SJWC has serious doubts (i) regarding whether this model was calibrated at flows of 2.2 gallons per minute and (ii) about the validity of model results at this extreme condition.

SJWC requests that SWQB provide information regarding the model and its range of calibration.

Response: There are no minimum flow requirements for the calibration of the QUAL2K model, but the model can be run and calibrated at any flow value above zero. Therefore the SWQB believes that the QUAL2K model was properly calibrated.

6. **General Comment:** SWQB's continuing tendency to collect data under extreme low flow conditions (such as 2.2 gallons/minute) and use it both to determine impairment and calculate TMDLs is not in the best interests of the State in general or the San Juan Basin in particular. Such actions most likely will result in the placement of nearly every stream in the state on the section 303(d) list of impaired waters, as well as scientifically invalid TMDLs.

Response: Impairment determinations are based on application of the Assessment Protocols (NMED/SWQB 2004a). Information regarding the original impairment listings that led to development of these TMDLs can be found in the Integrated Clean Water Act 303(d)/305(b) List (NMED/SWQB 2004b), and the associated Record of Decision (ROD) (NMED/SWQB 2004c).

As stated in the Assessment Protocol, data collected during all flow conditions, including low flow conditions (i.e., flows below the 4Q3), will be used to determine designated use attainment status during the assessment process. Impairments due to pollutants as identified during the assessment process led to TMDL development as required by the Clean Water Act. 4Q3 values are to be utilized as minimum dilution assumptions for developing discharge permit effluent limitations. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions. SWQB contends that it is the intent of the Clean Water Act to consider all available data from any flow conditions when determining designated use attainment status and has stated so in the Assessment Protocols. USEPA Region 6 has reviewed and provided comment on the Assessment Protocols and did not express any concerns with this understanding.

In addition, researchers have shown that variability in hydrologic conditions is the norm in New Mexico (Grissino-Mayer 1996). New Mexico is currently within this range of variability. If we consider hydrologic condition in terms of decades, the drier conditions New Mexico has experienced over the last several years could be considered typical or normal. Paleo-environmental records indicate that our region has experienced long periods of drought that lasted decades (Grissino-Mayer 1996). The drier conditions the San Juan Basin experienced during the survey period could actually be the mean hydrologic condition when considering this longer time frame. Also, the drier conditions New Mexico recently experienced could last years to decades (Dr. Craig Allen, USGS – Jemez Mountain Field Station, personal communication). SWQB must continue to monitor, assess, and make use impairment determinations under these conditions in order to protect and enhance water quality in New Mexico.

As previously stated, the New Mexico Surface Water Quality Standards apply to water's of the State even under low flow conditions. The SWQB continues to design intensive surveys to sample on a seasonal basis in order to assess New Mexico's waters over varying flow conditions. We believe this is the best approach for assessing and protecting the waters of the state.

References:

Grissino-Mayer, H. 1996. A 2129-year reconstruction of precipitation for northwestern

New Mexico, U.S.A. Pages 191-204 in J. S. Dean, D. M. Meko, and T. W. Swetnam, editors. Tree Rings, Environment and Humanity. Radiocarbon, Tucson, AZ.

NMED/SWQB. 2004a. State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report. Santa Fe, NM.

———. 2004b. State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

———. 2004c. Record of Decision for the State of New Mexico 2004-2006 Clean Water Act Integrated §303(D)/ §305(B) List of Assessed Waters. December. Santa Fe, NM.

Conclusion

Based on the discussion above, and as SJWC repeatedly has stressed to SWQB, SJWC urges SWQB to carefully review its methods for determining stream impairment in general to ensure that no impairment decision is based on inadequate data. If a stream is impaired, appropriate actions need to be taken to improve its quality under both state and federal law. However, if a stream is not truly impaired, an improper impairment designation may have unintended and long-term adverse consequences. Further, SJWC requests that SWQB revise its Draft TMDL Document to address the specific concerns raised above. The TMDLs, as proposed, are neither scientifically valid nor in the best interests of the state.

Thank you for your consideration of these comments. If you have any questions, please do not hesitate to call me. I look forward to receiving the information we have requested in these comments at your earliest convenience.

Sincerely,

L. Randy Kirkpatrick, Executive Director
San Juan Water Commission

Comment Set B:

(PDF of letter received inserted)

Domestic Return Receipt Article Number
7005 1820 0000 0608 5176 initial
public comment on draft
TMDL for San Juan
Watershed Part Two made
before deadline but in the
hopes of being able to review
draft after receiving it in mail
and submitting a revised comment
before deadline.

Page 1 of 3

September 24, 2005
135 Rincon Valverde
Ponderosa, NM 87044

RECEIVED
SEP 27 2005
SURFACE WATER QUALITY BUREAU

Jennifer Ickes
New Mexico Environmental Department
Surface Water Quality Board
Room N2109
P.O. Box 26110
Santa Fe, NM 87502

Dear Jennifer,

I do not have access to computer or telephone. I pay land taxes to Sandoval County and live in the Rio Jemez Watershed near where Rito Vallecito has a confluence with Rio Jemez. I wish to make written comment for inclusion in the public record after I have reviewed draft "total maximum daily load" documents for the San Juan Watershed, defined as Navajo Nation Boundary at the Hogback to Navajo Dam (Draft Part Two also

Domestic Return Receipt Article Number
7005 1820 0000 0608 5176
public comment on draft TMDL for
San Juan Watershed Part II made before deadline
but in the hopes of being able to review
draft after receiving it in mail and
submitting a revised comment after deadline

September 24, 2005

including Animas River and La Plata River). This is also a request for Total Maximum Daily Load For The San Juan Watershed Part One, as well as Total Maximum Daily Load San Juan Watershed Part Two to be sent, immediately, respectfully, so that I may be able to have reasonable time to make an informed request. Should I, for some unforeseen reason, not be able to review the documents requested (and, also, physical descriptions or maps of pertinent areas), my initial comment on Total Maximum Daily Load For The San Juan Watershed Part Two is as follows:

" This is only my initial public comment and will stand if I do not receive necessary documents to review in a timely manner so that I might revise this comment. I hope the

[illegible]

Domestic Return Receipt Article Number 7005 1820 0000 0608 5176 initial public comment on draft TMDL for San Juan Watershed Part Two made before deadline but in the hopes of being able to review draft after receiving it in mail and submitting a revised comment before deadline

September 24, 2005

officials putting this plan into action address what's caused by the biggest polluters as the major priority. It was depressing, as a homeowner/homebuilder here in rural Ponderosa to see the details Sandoval County officials "wore scalps on their belts" devising to look like they were going after the "major polluters". Intel continues to spew but the rest of us country folk have to look over our shoulders to make sure a police officer isn't coming when we're trying to fireproof our property.

Respectfully,

[signature]

(P.S. Please send revised draft document as amended as soon as it is ready.)

Response: Thank you for your comment and request for the San Juan Watershed Part 1 and 2 TMDL documents. The documents you requested were sent out via U.S. Postal Service certified mail on September 30, 2005 and received on October 5, 2005.

Comment Set C:

(PDF of letter received inserted)

Domestic Return Receipt Article Number 7005 1820 0000 0608 5282 for revising public comment on Draft Total Maximum Daily Load for The San Juan watershed (Part Two) that was submitted 9-24-05 to Jennifer Ickes Domestic Return Receipt Article Number 7005 1820 0000 0608 5176. This final 10-14-05 comment reaches you before 10-23-05.

Page 1 of 6

Rebecca D. Perry Rpm

October 14, 2005
135 Rincon Valverde
Ponderosa, NM
87044

Jennifer Ickes
New Mexico Environmental Department
Surface Water Quality Board
Room N2109
P.O. Box 26110
Santa Fe, NM 87502

RECEIVED
OCT 20 2005
SURFACE WATER QUALITY BUREAU

Dear Jennifer,

I wrote you an initial comment on the Draft Total Maximum Daily Load or the San Juan Watershed (Part Two) Navajo Nation Boundary At The Hogback To Navajo Dam, September 23, 2005, New Mexico Environmental Department Surface Water Quality Bureau, public comment period on same ending October 23, 2005, that I am revising in this letter.

One meeting on the above in Farmington is inadequate. Before you can enact the above you must publish the

Domestic Return Receipt Article Number 7005 1820 0000 0608 5282 for revising public comment on Draft Total Maximum Daily Load For The San Juan Watershed (Part Two) that was submitted 9-24-05 to Jennifer Ickes Domestic Return Receipt Article Number 7005 1820 0000 0608 5176. This final 10-14-05 comment reaches you before 10-23-05.

October 14, 2005

drafts for the TDML of the Upper, Middle and Lower Rio Grande with more details on subjects discussed/displayed on pages 34, 35, 37 and 55 of Draft Total Maximum Daily Load For The San Juan River (Part Two) Navajo Nation Boundary At The Hogback To Navajo Dam. The entire potentially impacted populace of the Upper, Middle and Lower Rio Grande must get a chance to learn about and comment on the NMED/SWQB's TMDL before any component of the total plan is considered approved and implementation is initiated.

My comment is as follows:

"Staff needs to quantify and present to the public what fines this TMDL's violation will impose on small-scale private landowners living within 100 meters of an impaired waterbody, or, with staff taking a more holistic watershed approach in implementation, upland and upstream of the impaired waterbody, and said

Rebecca M. Perry-Piper

Domestic Return Receipt Article Number 7005 1820 0000 8608 5282 for revising public comment on Draft Total Maximum Daily Load For The San Juan Watershed (Part Two) that was submitted 9-24-05 to Jennifer Tele's Domestic Return Receipt Article Number 7005 1820 0000 8608 5176. This final 10-14-05 comment reaches you before 10-23-05.

October 14, 2005

Richard G. Perry, Rp[illegible]

small-scale private landowners owning on-site waste disposal systems (septic tank/cesspool), and/or engaging in landscape maintenance, and/or owning backyard livestock, and/or owning pets adjacent to or impacting an impaired riparian corridor. I am curious as to how many of the small-scale private landowners of the 131 houses located within 100 meters of the Animas River in New Mexico (Pages 35 and 37 of Draft Total Maximum Daily Load For The San Juan River Part Two) Navajo Nation Boundary At The Hogback To Navajo Dam) were contacted by staff to attend the October 12, 2005 public meeting in Civic Center Room C, Farmington, New Mexico at 6:00 P.M. If there wasn't a quorum of the small-scale private landowners, displayed on said Page 37, in attendance of this meeting, it was an invalid public meeting. These small-scale private landowners on Page 37 need to know what sort of civil

Domestic Return Receipt Article Number 7005 1820 0000 0808 5282 for revising public comment on Draft Total Maximum Daily Load For The San Juan Watershed (Part Two) that was submitted 9-24-05 to Jennifer Ickes Domestic Return Receipt Article Number 7005 1820 0000 0608 5976. This final 10-14-05 comment reaches you before 10-23-05.

October 14, 2005

action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in New Mexico's Water Quality Act) have resulted in a violation of a water quality standard including a violation caused by a nonpoint source in terms of dollars and cents correlated with degree of contributing to impairment of an adjacent, downstream or downland riparian corridor. These small-scale private landowners on Page 37 need to know if the State of New Mexico Surface Water Quality Standards (NMAC 20.6.4.10.C, NMAC 2002) grant "the Commission" or any other entity the power to take away property rights if voluntary compliance to nonpoint source water pollution concerns does not occur, i.e. the small-scale private landowner does not have a wastewater treatment system to access, does not wish to landscape as told to, does not wish to stop owning backyard livestock,

Rebecca M. Rowy [illegible]

Domestic Return Receipt Article Number
7005 1820 0000 0608 5282 for
revising public comment on Draft Total Maximum Daily
Load for The San Juan Watershed (Part Two) that was
submitted 9-29-05 to Jennifer Ickes
Domestic Return Receipt Article Number
7005 1820 0000 0605 5176. This final
10-14-05 comment reaches you before 10-23-05.

October 14, 2005

and/or does not wish to stop owning pets. This Draft Total Maximum Daily Load (TMDL) For The San Juan River Watershed (Part Two) Navajo Nation Boundary At The Hogback To Navajo Dam cannot be implemented, nor considered to have received appropriate public comment, until the public has been presented the entire plan for the waterstreams of New Mexico. The public needs to see how you've mapped them and scrutinized them. They need to see how you plan to impose yourself on their Constitutional rights, stripped as they have been since the revisitation of where emminent domain and condemnation stand these days with the recent U.S. Supreme Court ruling on Kelo vs. New London, to life, liberty and the pursuit of happiness. Show the public the whole plan; especially show all smale-scale private landowners affected in each watershed what's in store for them if they can't comply.

Domestic Return Receipt Article Number 7005 1820 0000 0008 5282 for revising public comment on Draft Total Maximum Daily Load For The San Juan Watershed (Part Two) that was submitted 9-29-05 to Jennifer Fekes Domestic Return Receipt Article Number 7005 1820 0000 0608 5176. This final 10-14-05 comment reaches you before 10-23-05.

October 14, 2005

Then have meetings, have a comment period for the whole plan for all affected. This is pretty much an "underpopulated area speaking for all the uninformed populated areas" or a "divide and conquer" type of approach that New Mexico Environment Department Surface Water Quality Bureau is taking. If what you are doing is a good thing you'll show every aspect of it to the public and they'll get a true majority up to back it." end of comment

Respectfully

Rebecca G. Perry-Piper

Rebecca G. Perry-Piper
small-scale private landowner, with a septic tank, upstream of an impaired riparian corridor

Response: Thank you for your additional comments on the San Juan Watershed Part 2 TMDL. Since the TMDL is not a regulatory document the SWQB to date has not imposed fines on small-scale private landowners for not meeting the designated TMDL for a waterbody. Neither the SWQB nor the WQCC has the power to take away property rights if voluntary compliance of a nonpoint concern does not occur.

The TMDL values are used when the U.S. Environmental Protection Agency (Region 6) is issuing or revising NPDES or industrial permits within an impaired watershed. For nonpoint source pollution from septic tanks, landscape maintenance, livestock grazing, or pets adjacent to the riparian corridor, implementation of the TMDL is on a voluntary basis through watershed group formation and the development of watershed restoration action strategies by watershed groups and stakeholders. NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a nonpoint source. The NMED nonpoint source water quality management program has historically strived for and will continue to promote voluntary compliance to nonpoint source water pollution concerns by utilizing a voluntary, cooperative approach.

TMDL meetings are voluntary and do not require a quorum. SWQB holds TMDL public meetings as stated in the Public Participation flowchart in Appendix F. TMDL meetings are held in the watershed of concern. We also place a public notice in the legal section of the newspapers of greatest distribution (i.e. Albuquerque Journal and Santa Fe New Mexican.