Watershed-Based Water Quality Plan

Ute Reservoir Watershed

New Mexico

WATERSHED–BASED WATER QUALITY PLAN
UTE RESERVOIR WATERSHED
QUAY COUNTY, NEW MEXICO

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Prepared under New Mexico Environment Department/US Environmental Protection Agency grant (99610116) for development of a watershed-based water quality plan to:

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ABBREVIATIONS

ASC	Agricultural Science Center at Tucumcari
BLEST	Bacteria Loading Estimator Spreadsheet Tool
BMP	Best Management Practices
cfu/day	colony-forming unit per day
CRCC	Canadian River Compact Commission
CRRRP	Canadian River Riparian Restoration Project
CRSWCD	Canadian River Soil and Water Conservation District
ENMWUA	Eastern New Mexico Water Utility Authority
ft msl	feet above mean sea level
HUC	Hydrologic Unit Code
lbs/day	pounds per day
MDEQ	Michigan Department of Environmental Quality
MPN	Maximum Probable Number
mybp	million years before present
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMISC	New Mexico Interstate Stream Commission
NMSU	New Mexico State University
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NRC	National Research Council
NRCS	Natural Resource Conservation Service
NRI	National Resources Inventory
RUSLE	Revised Universal Soil Loss Equation
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
STORM	STormwater Outreach for Regional Municipalities
SWQB	Surface Water Quality Bureau
TCEQ	Texas Commission for Environmental Quality
TMDL	Total Maximum Daily Load
US EPA	United States Environmental Protection Agency
USFS	United States Forest Service
URWA	Ute Reservoir Watershed Alliance
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

This plan sets out a process for reducing non-point source pollution for the subject area, the Ute Reservoir Watershed (Watershed). It has been written under the oversight of the New Mexico Environment Department, Surface Water Quality Bureau (SWQB) by the Canadian River Soil and Water Conservation District (CRSWCD) and the Eastern New Mexico Water Utility Authority (ENMWUA). As duly organized sub-entities of the State of New Mexico, with authority to plan on a regional basis, these two agencies are uniquely appropriate to develop a management plan for the watershed.

1.1 PURPOSE AND NEED FOR THE PLAN

The CRSWCD is authorized under the Soil and Water Conservation District Act (73-20-25 through 73-20-48 NMSA 1978) to:

- Control and prevent soil erosion
- Prevent floodwater and sediment damage
- Further the conservation, development, beneficial application, and proper disposal of water
- Promote the use of impounded water
- Conserve and develop the natural resources of the state

In order to advance these objectives, the Canadian River Riparian Restoration Project (CRRRP) in 2004 was initiated by group of local landowners and agencies. The Canadian River SWCD eventually became the fiscal agent for the project.

The ENMWUA is a duly constituted subdivision of the State of New Mexico, organized under NM Stat § 73-27-4 and created to:

> '. . . plan, design, develop, purchase, acquire, own, operate, establish, construct and maintain the eastern New Mexico rural water system . . .'
>
> - NM Stat § 73-27-4

As such, the State Legislature has authorized the ENMWUA to engage in municipal and county comprehensive water planning, where the interests of ENMWUA's member communities are impacted. Given this, ENMWUA is clearly a major stakeholder in all water quality issues at Ute Reservoir and also a water quality management planning as defined under sections 205(j) and 303(e) of the Clean Water Act.

1.2 WATERSHED-BASED PLANNING

Given these responsibilities and duties, in 2014 the CRSWCD and ENMWUA initiated a grant application to SWQB for US Environmental Protection Agency (EPA) funding to write a watershed-based water quality plan. Section 319 of the Clean Water Act provides funding for the control and reduction of non-point source (NPS) pollution, aquatic stressors that originate from diffuse processes across the landscape (33 U.S. Code § 1329). Before funding can be awarded, the regulations require the acceptance by EPA of a specifically defined watershed-based water quality plan for the efforts.

Watershed-based water quality plans are defined by EPA using nine essential action elements. These include (followed by their location in this plan)

1. Identify causes and sources of pollution (Section 2 and 3)
2. Estimate pollutant loading into the watershed and the expected load reductions (Section 4 and 6)
3. Describe management measures that will achieve load reductions and targeted critical areas (Section 5)
4. Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan (Section 9)
5. Develop an information/education component (Section 7)
6. Develop a project schedule (Section 8.1)
7. Describe the interim, measurable milestones (Section 8.2, Table 8-1)
8. Identify indicators to measure progress (Section 8, Table 8-1)
9. Develop a monitoring component (Section 8.3)

The current Ute Reservoir Watershed-Based Water Quality Plan (the Plan) has been written to address each of these nine action elements. The plan has been written to cover a five-year planning period. Major revisions and amendments will provide direction for the subsequent years.

1.3 THE UTE RESERVOIR PLANNING GROUP

Under Element 9, the plan must describe the way it will include the community in the implementation and evaluation of progress towards a reduction in NPS pollution; however, there is no need - - or good reason - - not to include the community from the very start. The developers of the Plan have whole-heartedly embraced that philosophy. Further, although there is a requirement that the plan directly address the stressors identified in the state report to Congress on water quality impairments (see section 1.4 for a discussion of the 303d-305b Report), there is no requirement that the plan be confined just to these aquatic stressors. If the stakeholders are concerned with other water quality issues, they can be included.

The Ute Reservoir Watershed Alliance (URWA) was formed to develop a watershed-based plan that covered general watershed health. The group began to form when participants in the CRRRP and the ENMWUA realized a common desire to promote watershed health, to reduce polluting impacts and to increase watershed yield to the reservoir and to control invasive species in the reservoir. It was recognized by both groups that an uncoordinated approach to these goals may result in opposing objectives and ineffective use of public funds.

The Plan was initiated at a meeting of the URWA and received active input from the group at a series of public meetings. As discussed in detail in Section 7, the intention is to keep the group together indefinitely and revisit the Plan many times over its life.

1.4 THE REGULATORY STATUS OF THE WATERSHED

Parts of the Ute Reservoir Watershed are listed as impaired by the State of New Mexico CWA §303(d)/§305(b) Integrated List & Report (303d-305b Report) (NMED 2011). As this is written, the SWQB is working on a two-year assessment of the Canadian River and Dry Cimarron River Watersheds that will be complete in 2016 (NMED 2015); however, the listing of waterbodies in the Ute Reservoir Watershed is based upon an evaluation done in 2006 (NMED 2006a, b).

The State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) that apply to the waterbodies are:

Waterbody	Designated Use	Criteria
N.M.A.C. 20.6.4.301 - The main stem of the Canadian river from the New Mexico-Texas line upstream to Ute dam, and any flow that enters the main stem from Revuelto creek.	Irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat.	(1) In any single sample: pH within the range of 6.6 to 9.0, temperature 32.2°C (90°F) or less and TDS 6,500 mg/L or less at flows above 25 cfs. (2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.
N.M.A.C. 20.6.4.302 -Ute reservoir.	Livestock watering, wildlife habitat, public water supply, industrial water supply, primary contact and warmwater aquatic life.	The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.
N.M.A.C. 20.6.4.303 -The main stem of the Canadian river from the headwaters of Ute reservoir upstream to Conchas dam, the perennial reaches of Pajarito and Ute creeks and their perennial tributaries	Irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and secondary contact.	(1) In any single sample: pH within the range of 6.6 to 9.0 and temperature 32.2°C (90°F) or less. (2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.

In addition, numeric use-based criteria also exist for these waters.

The 2006 assessment resulted in a designation of non-attainment for various reaches of the Ute Reservoir watershed (NMED 2012). These water quality impairments include E. coli and plant nutrients (nitrogen and phosphorus) for the Canadian River (Ute Reservoir to Conchas Reservoir, NM-2303_00, WQS 20.6.4.303) and Pajarito Creek (Canadian River to headwaters, NM-2303_10, WQS 20.6.4.303).

Based upon these water quality impairments, a Total Maximum Daily Load (TMDL) analysis was initiated for the affected waterbodies by SWQB. The TMDLs for each of the impaired waterbodies (Table 1) includes a reduction in E. coli of 88% for the Canadian River and 84% for Pajarito Creek, a reduction in total nitrogen of 95% and total phosphorus of 99% for Pajarito Creek.

The TMDLs for Pajarito Creek have translated into discharge requirements placed on the National Pollutant Discharge Elimination System (NPDES) permit for the Tucumcari Wastewater Treatment Plant (WWTP) (NM0020711). The US EPA and State have acknowledged that it will be difficult for the City to meet the nutrient reduction using existing technology. For this reason, a phased implementation has been approved that encourages 100% reuse of effluent. Phase 1 effluent limitations for the WWTP are currently in place (Table 2).

Ute Reservoir itself was not included in the latest round of TMDLs. The current impairments, for mercury and aluminum, require further regulatory action before SWQB calculates the TMDLs. Mercury in US surface waterbodies is thought to originate from atmospheric deposition and to reflect loading of mercury by coal-burning power plants. In June of 2013, EPA approved a change in the New Mexico surface water standard for aluminum. The new standard uses a hardness-based aluminum criteria equation for those waters where pH is equal to or greater than 6.5. The new standard will probably result in the de-listing of Ute Reservoir for aluminum in the next 303d-305b Report.

Although SWQB has not established TMDLs for the Ute Reservoir, they have not yet assessed the waterbody for industrial and public water supply uses. Neither use is occurring at this time; however, the Ute Pipeline Project will obviously fall within the latter.

1.5 GOALS AND OBJECTIVES OF THE PLAN

As was discussed in Section 1.3, the initial act of the CRSWCD and ENMWUA was to convene a meeting of key stakeholder within the Watershed. Discussions of the purpose and need for the Plan and the URWA were held in a variety of venues and the URWA was formally created on March 18th 2015 in Tucumcari. Attendees at the meeting included representatives of:

- Canadian River Riparian Restoration Project
- Canadian River Soil and Water Conservation District
- Eastern New Mexico Water Utility Authority
- New Mexico Environment Department, Surface Water Quality Bureau
- Quay County
- City of Tucumcari
- Village of Logan
- Village of Grady
- Trigg Ranch
- T4 Cattle Company
- Mesa Redonda Ranch
- New Mexico State University
- Arch Hurley Conservancy District

At the meeting, a presentation was made on the Watershed, the EPA 319(h) program, the SWQB grant and the basics of writing a watershed-based water quality plan. The attendees all indicated their interest in helping to steer the plan and provide the nucleus of a planning group, also known as the Ute Reservoir Watershed Alliance.

A discussion began of the values of the Watershed to the stakeholders, present and absent. The discussion was free-wheeling and thorough, resulting in a list of fifteen items that gave values to the Watershed and an overall values statement (Appendix A). These values lead to a series of goals and objectives for the plan.

The goals and objectives of the Ute Reservoir Watershed-Based Water Quality Plan are:

1. ***Water quality of Ute Reservoir.*** Water quality, in its broadest definition, is one of the unifying goals of the watershed plan. In addition to the sources of impairment described in NMED (2011), the URWA defined a number of other goals important to preserve the health of the watershed and avoid degradation of the reservoir water quality. Preservation of the reservoir as a drinking water source is a major overall goal that is of primary importance to all stakeholders.

    1.1. ***Reduce impairments to the listed waterbodies.*** As the overarching goal of this plan, it must provide confidence to NMED that the measures implemented will result in the eventual attainment of water quality standards for the listed waterbodies (Section 1.4) on the timeline establish within this plan.

1.2. ***Control salinity of inflow.*** Because of the varied levels of the reservoir and surface evaporation, the salinity of the reservoir can increase and affect the use. The Canadian River Water Authority currently monitors salinity downstream of Ute Dam and has identified a number of saline springs and seeps in the area. Since these loadings of total dissolved solids are difficult to control, it is critical that surface runoff be protected from any new sources of salts.

1.3. ***Manage Tucumcari WWTP for 100% effluent reuse.*** As discussed in Chapter 1.4, the Tucumcari WWTP is named by NMED (2011) as a wasteload source. Although it does not contribute to non-point source loading of the reservoir, it is a key element of the water quality management of the watershed and is a critical facility. The currently identified best technology for disposal of the effluent is for the research programs in agricultural irrigation of crops at the New Mexico State University (NMSU) Agricultural Science Center at Tucumcari (ASC). Both the City and NMSU have committed to go to full use of the plant effluent for research and demonstration projects.

1.4. ***Support Village of Logan efforts to build out village wastewater treatment system to south side of Ute Lake.*** Although the entire north side of the Village of Logan is connected to a wastewater treatment system, the south side and unincorporated area around it is on septic tanks. Failed septic tanks are identified by the EPA as a significant source of bacterial contamination. Logan has plans to extend the system to the south side but currently lacks the funding.

2. ***Capacity of reservoir and watershed yield.*** Although sediment is not listed as a stressor in NMED (2011), it is a critical measure of 'health' to the members of the URWA. Each year the reservoir loses capacity as waterborne sediment settles, increases the elevation of the reservoir bottom and decreases the capacity behind the dam. Because of the wording of the Canadian River Compact Commission (CRCC 195?), measurement of the reservoir volume is monitored by the New Mexico Interstate Stream Commission (NMISC 2012) and a rate of sediment accumulation is estimated every ten years.

   The runoff yield of the reservoir is also not a direct water quality concern of NMED (2011) and most watershed restoration goals do not necessarily include increased stream discharge as a benefit; however, increasing the flow in streams has a number of indirect water quality benefits. By increasing the stream discharge, there will be fewer hot spots of pollutant accumulation, creating a greater opportunity for dilution of acute chemical stressors. Reducing stagnant stream reaches will avoid concentrations of bacterial life and the formation of nuisance aquatic plants. More frequent periods of streamflow will recharge shallow aquifers and strengthen riparian plant communities.

2.1. ***Limit sediment loading.*** Natural erosion is a process that is water quality neutral; destructive erosion threatens land use and upsets the balance of sediment in downgradient waters. There are a number of land use practices that contribute to destructive erosion and these are called out in subsequent Goals and Objectives. This objective concerns the cumulate effect on the reservoir.

2.2. ***Control phreatophyte consumptive use***. The CRRRP was created in 2004 and since that time has eliminated 33,000 acres of tamarisk-infested habitat.

2.3. ***Control pinon-juniper encroachment***. 2015 NMG&F received 2.5 million dollars for habitat enhancement on watershed.

3. ***Rangeland Health.*** The primary use of the Ute Reservoir watershed is cattle ranching. Ranching cannot be successful without protecting the grassland ecosystem that supports grazing. Further, sustainable grazing demands that grasslands ecology be as self-regulating as possible, gaining nutrients and energy from the natural environment (Savory 1999, Holechek et al 1998). This strategy also provides the least destructive disturbance to grassland watersheds. For these reasons, the URWA strongly supports ranching that promotes and preserves rangeland health as part of this plan.

3.1. ***Protect ranch roads and stream crossings from excessive erosion.*** Abundant work by the US Forest Service and other federal agencies, combined with on-the-ground experience in the western US has demonstrated that poorly constructed roads and stream crossings create numerous problems on both upland and riverine lands (Reid and Dunne 1984; Montgomery Ziegler et al., 2004, Zeedyk 1996, Kang and Marston 2006, Dunaway et al 2010). Zeedyk (1996) has developed a set of ranch road and stream crossing guidelines that work well in rural New Mexico.

3.2. ***Improve grasslands.*** The most effective way to improved rangeland that is actively grazed has been researched by land-grant colleges and universities across the western US. In 1912, New Mexico State University established the Jornada Experimental Range for this purpose and provides world-class tools for rangeland assessment.

4. ***Ranching/farming customs, collaboration and culture.*** It is essential to any non-point source pollution plan to nurture good land stewardship among the people that occupy it. Urban populations do not always depend upon the land they live on to feed and clothe them; however, for time immemorial, the people of the Canadian River watershed have lived off of the land. This cultural attribute, shared by both the indigenous tribes and current ranching communities has created a collaborative tradition of cautious and rational land use that can enormously benefit the successful implementation of this Plan.

4.1. ***Protect agricultural land use of watershed.*** There are very few stakeholders in the URWA that are not actively involved with or dependent upon the current agricultural use of the watershed, with about 95% of the land in active grazing.

4.2. ***Provide an incentive for group work on watershed health.*** The URWA is an outgrowth of several collaborative efforts to control non-point source pollution and promote watershed health. The management programs and on-the-ground projects will be greatly improved by synergistic support from compatible programs across the watershed.

4.3. ***Support and spread non-point source pollution awareness among community.*** Developing an education and outreach group is one of the required components of a watershed-based plan. Several of the goals and objective assume that a way of getting information on water quality and best management practices to the community. This objective will develop an education, outreach and participation committee and funding source to disseminate the plan among the ranching and urban communities.

4.4. ***Teach children to respect land and use good practices***. A number of large ranches in the watershed have maintained sustainable practices for generations and the region has a strong ethical tradition of respect for good stewardship; however, new methods of sustaining that tradition need to be found that appeal to current and future young people.

4.5. ***Teach students about historical watershed health practices***. Similar to 4.4, the CRRRP has been working with local high school students and groups (FFA) for several years implimenting watershed restoration training.

4.6. ***Promote rainwater harvesting***. In 2016, Mosquero School District applied for a $121,000 grant to develop a rainwater harvesting system.

5. ***Ecosystem services and forest health.*** It is clear that watershed health depends upon an intact ecosystem and that water quality is diminished when the plant and animal community is degraded. Further, the health of downstream aquatic systems in the reservoir can only be maintained by protecting the sources of water.

5.1. ***Keep habitat intact for birds and wildlife.*** As the grassland, shrub land and riparian habitat becomes fragmented, normal migratory and foraging behavior of wildlife becomes impaired. It is critical that habitat stay intact.

5.2. ***Manage entire watershed for benefit of multiple uses.*** Rangeland habitat can be best maintained when active sustainable management of the land is taking place.

5.3. ***Protect and enhance riparian habitat.*** Riparian habitat in rangeland requires special protection to avoid destruction through over use. In some degraded areas, ex-closure of riparian zones may be the best solution to the problem.

5.4. ***Protect playa lake ecological function (habitat, recharge, etc.)*** The NM playa lakes are a unique and valuable ecological feature that need to be preserved.

6. ***Tucumcari Agricultural Science Center (ASC).*** New Mexico State University's (NMSU) 470-acre ASC at Tucumcari has been in continuous operation at its current location since 1912 with a diverse research programs in field crop and livestock production, windbreak and farmstead tree and shrub evaluations, vegetables, and turfgrass. Currently, the ASC is working with the City of Tucumcari on effluent reuse and is proposing an expansion in that and into other areas of applied watershed science and low-input local food production. The Station will be an essential link between the watershed plan and the larger academic and research community. The efforts described below would be integrated with applied research in the Ute Reservoir watershed and the results could provide best management practice data and insight for the implementation of the watershed plan.

6.1. ***Evaluate the possibilities and impact of reusing treated municipal effluent.*** The ASC is currently using effluent for agricultural irrigation on the crops, the soil, and the environment. This project has demonstrated the safety and efficacy of Tucumcari WWTP effluent when applied in this manner; however, the system is currently underutilized and impacts on crop production, soil health, and the overall environment have not been studied. Beginning in 2012, the Advisory Committee to the ASC also is promoting a program enhancement initiative to secure legislative funding to add faculty in soil-plant-water quality-environment relationships, support staff, and operating funds to conduct research on the feasibility of using treated municipal wastewater for agricultural irrigation, including the environmental fate of nutrients, pathogens, and trace organic compounds of concern (pharmaceuticals and personal care products).

6.2. ***Develop systems to restore rangeland/riparian health and disseminate best management practices.*** In 2012, The Advisory Committee to the ASC began promoting a program enhancement initiative to secure legislative funding to add a faculty, support staff, and operating funds to conduct research to gain more local information than can be provided by the Jornada Experimental Range, which is in southern New Mexico, and educational programs related to rangeland and riparian ecology, restoration, and sustainable management.

6.3. ***Evaluate options for low-input horticultural production for small landholders.*** Owners of small acreage (<20 acres) and wells with low output need options to maximize productivity and minimize the potential impact of intensive agriculture on the watershed. Since 2012, The Advisory Committee to the ASC has been promoting a program enhancement initiative to secure legislative funding to add a faculty, support staff, and operating funds to conduct research on the production of high-value horticultural crops in low-input situations. Already, in collaboration with NMSU's State Fruit Specialist, the center has planted 36 varieties (some experimental) of jujube (Chinese date) to evaluate local adaptation and productivity on 0.4 acres using a domestic well (2-3 gpm) for above surface drip irrigation. Additionally, blue corn and tepary beans, both native species, are being tested as locally-grown human food crops, but other options must be explored.

7. ***Public road and municipal infrastructure.*** The existing municipal and transportation infrastructure, including Interstate 40, is essential to the economic viability and daily life of the watershed state holders. For these reasons, water quality measures for urban and transportation corridors must be used that do not limit the current uses of those resources.

    7.1. ***Integrate New Mexico Department of Transportation (NMDOT) goals for stormwater management.*** Under the NMDOT NPDES storm water permit, the agency employs specific Best Management Practices (BMPs) to reduce non-point source pollution. These BMPs are assumed to be reviewed and approved by U.S. EPA Region 6.

    7.2. ***Support city/county/village goals for stormwater management.*** Stormwater quality management is important to the municipal entities (city/county/village) represented by the watershed group.

    7.3. ***Co-lead public awareness efforts of state and county in stormwater quality protection for the watershed.*** Under the essential elements of a watershed-based, non-point-source pollution protection plan, public participation and education is an essential element. The watershed group has an obligation to assist and co-lead with state government a public awareness program.

    7.4. ***Assist Logan, Tucumcari, and Mosquero School District in developing watershed education programs.*** It is essential that children grow up understanding that watershed protection begins with good habits and understand of the role of runoff in transporting pollutants to downstream waterbodies.

    7.5. ***Promote rainwater harvesting and use in urban/suburban areas.*** As both the US EPA and New Mexico Environment Department (NMED) have demonstrated, the best protection for municipal stormwater is to regard rainwater as a resource to be used locally and not a wastewater to be discharged to surface water bodies. Rainwater harvesting for landscape irrigation, use or infiltration to groundwater is an ideal use for the stormwater that can be captured from rooves, parking lots and other impervious surfaces.

8. ***Recreation.*** Ute Reservoir is a multi-use resource and the State has a commitment to manage and promote the recreational benefits of the waterbody, primarily through administration and good stewardship of Ute Lake State Park. The loading of the reservoir with pollutants, particularly the stressors identified by NMED in the watershed, plant nutrients and E. coli, could have disastrous impacts upon the

    8.1. ***Support runoff protection and NPS pollution control at Ute Lake State Park.*** The Park is both a target and a source of NPS pollution. For this reason, it is essential that surface water be controlled and managed within the park.

    8.2. ***Support boat dock policies that protect water quality of Park.*** NM State Parks Division has targeted incorrectly designed, operated and maintained boat docks a potential source of pollution for the reservoir.

    8.3. ***Support and promote aquatic invasive species protection for Park.*** The control of invasive aquatic species (for example, Quagga mussels) at Ute Reservoir is essential to the management of the reservoir as habitat.

9. ***Development/Property value.*** The protection of property values and development potential at the reservoir is a major economic goal for Tucumcari, Logan and Quay County. By supporting homeowners

and developers that protect the water quality of the reservoir, the plan can contribute to both the economic and environmental goals of the region.

9.1. ***Promote low impact development and green infrastructure (LID/GI) for lakeside area.*** US EPA and NMED have developed guidance for residential development that pays particular attention to the conservation of water, the inclusion of habitat and the protection of surface waterbodies in plans.

9.2. ***Educate and involve developers/homeowners in eliminating excessive use of plant nutrient, herbicides and pesticides.*** A major source of plant nutrients come from the overuse of gardening and lawn maintenance chemicals by homeowners.

9.3. ***Develop public participation and education programs in Logan on non-point source pollution.*** Since Logan is the closest community to the reservoir, the impact on property values there is the most vulnerable.

9.4. ***Encourage the perception that clean water builds property values.*** Clean water is a major attractor for living within the watershed of Ute Reservoir.

These goals and objectives represent the interests of the URWA and the watershed stakeholders. Although they extend beyond the regulatory requirements of the 319(h) program, the goals and objecting in this section complement these requirements in a way that is inclusive of the nine basic elements of an EPA plan. The remainder of the Plan discusses the way in which the basic elements will be met.

2.0 WATERSHED BACKGROUND

Ute Reservoir watershed comprises the drainage basins in northeastern New Mexico that supply source water to Ute Reservoir on the Canadian River (Figure 1). The highest-order stream of the watershed is 56 miles (90 km) of the Canadian River between Conchas Dam and Ute Dam, the most downstream 8.4 miles (13.6 km) being Ute Reservoir itself. Two major tributaries (La Cinta and Atarque Creeks) enter the Canadian River and two enter the reservoir, Ute Creek and Pajarito Creek.

The entire watershed includes 3,852 square miles (9,976 square kilometers) of Colfax, Union, Harding, San Miguel, Guadalupe and Quay Counties and 43 12-digit watersheds within the Upper Canadian-Ute Reservoir Hydrologic Unit Code (HUC 11080006) and Ute (HUC 11080007) watersheds (Table 3). Approximately 45% of the combined watershed is in HUC 110800006 with 55% of the area in HUC 11080007.

Priority stream reaches within the watershed are 63.34 miles (102 kilometers) of the Canadian River (Ute Reservoir to Conchas Reservoir, NM-2303_00, WQS 20.6.4.303) and 55.88 miles (90 kilometers) of Pajarito Creek (Canadian River to headwaters, NM-2303_10, WQS 20.6.4.303). With a few exceptions, every HUC 11080006 watershed listed in Table 3 drains into these two impaired streams. Ute Creek and Ute Reservoir are not listed in the 303d-305b Report; however, because of stakeholder concerns and the potential for water quality degradation, this Plan is considering them threatened by excess sediment, plant nutrients and E. coli.

2.1 GEOGRAPHY AND GEOLOGY

The Ute Reservoir watershed includes a vast bottomland bordered on the south by the escarpment of the Llano Estacado, at 5590 feet (1703 m) above mean sea level (ft msl) and on the north by the High Plains and volcanic tablelands of the Colorado-New Mexico Border at 6670 ft msl (2033 m). This erosional surface slopes in a generally eastward direction from a point near the village of Cuervo at approximately 4860 ft msl (1481 m) to Ute Dam spillway at 3788.86 ft. msl (1154.84 m). Throughout the northern half of the watershed, Ute Creek, Atarque Creek and their tributaries have cut steep-sided canyons into the higher tablelands and mesas.

The geology of the area closest to the reservoir include flat-lying, red-brown to buff to maroon to gray mudstone, siltstone, and sandstone assigned to the Upper Triassic Chinle Group. These rocks comprise sediment derived from a continental fluvial and lacustrine environment that is about 220 million years before present (mybp) in age (Lucas et al., 1985). As the watershed begins to climb northward into the highlands near Mosquero, Jurassic and Cretaceous Period sedimentary rocks are encountered, culminating in the Tertiary Ogallala Formation (Lucas et al., 1987) Quaternary/Tertiary basalt caps most of the mesas above Ute Creek and the stream heads up in a complex of eroded alkaline intrusive rocks centered on Laughlin Peak (Staatz 1985). On the south and west, a similar sequence of geologic units is encountered, minus the igneous rocks (Lucas et al., 1985).

The regional tectonics of the area best exposed include Laramide-age impinging of the Rocky Mountain foreland upon the North American craton, which resulted in a series of broad, northeast-southwest oriented flexures (Woodward 1987). The climax of Laramide deformation resulted in the shedding of the Ogallala Formation as a series of lobate alluvial fans aggraded from streams discharging from highlands west of the Rocky Mountain front (Gustavson and Winkler 1988). Intrusion and volcanism followed, along with initiation of Rio Grande rifting. Integration of the Canadian River basin also followed rift-related uplift in the Pliocene, focused by dissolution of evaporates along the Texas reaches of the river (Wisniewski and Pazzaglia 2002).

2.2 HYDROLOGY OF THE WATERSHED

Ute Reservoir impounds the Canadian River in Quay County, New Mexico, 32.1 miles upstream from the Texas border (Figure 1). Originally built in 1962, the reservoir has a capacity of over 246,600 acre-feet. The conservation pool is limited to 200,000 acre-feet under the 1993 U.S. Supreme Court decree in Oklahoma and Texas v. New Mexico. The State of New Mexico funded and constructed the reservoir to supply municipal drinking water to the communities of Quay, Curry, Roosevelt and Lea Counties along the New Mexico/Texas state line; however, a water-supply conveyance system was not included in the original construction. Congress authorized a project to construct a system, limited now to Curry and Roosevelt Counties, in 2009 through the U.S. Bureau of Reclamation. The project is titled the Eastern New Mexico Rural Water System, or informally, the Ute Pipeline project and is managed by ENMWUA.

2.2.1 Surface Water

Ute Reservoir watershed includes 4,497.4 square miles (11,648 square kilometers) of Union, Harding, San Miguel and Quay Counties. Although Ute Reservoir is located on the Canadian River, Conchas Dam, operated by the US Army Corps of Engineers, impounds most of the Upper Canadian Basin stream flow and very rarely releases flow.

The primary source of water to Ute Reservoir is Ute Creek, an interrupted stream, comprising perennial, intermittent and ephemeral reaches, that flows about 100 miles south from the Capulin volcanic field in Union County to the reservoir, which is west of Logan, New Mexico. Most intermittent reaches of Ute Creek are irrigation return flows that experience high transmission losses.

Additional flow reaches the western end of the river from the Canadian River below Conchas Dam. Three major ephemeral streams enter this reach of the Canadian River. Atarque Creek and La Cinta Creek extend to the north and Pajarito Creek drains the southwestern sector of the watershed. Similarly, all of the other tributaries of the Canadian River between Conchas and Ute Dams are ephemeral for most of their length, with only short stretches of seepage or irrigation-supported perennial flow.

A USGS gaging station (USGS 07226500 Ute Creek near Logan, NM) has been discontinuously operated on Ute Creek for many years. Since the stream is ephemeral at the gaging point, peak flows are the only discharge observations made at the station. Another USGS gaging station (USGS 07227000 Canadian River at Logan, NM) is located downstream of Ute Dam on the Canadian River.

2.2.2 Groundwater

Several regional aquifers underlie the watershed. The Ogallala, or High Plains, aquifer, occupying the Tertiary Ogallala Formation, is present in the upper subwatersheds of Ute Creek. The Ogallala aquifer is an extensive aquifer that is used as a groundwater source by many communities in eastern New Mexico and western Texas; however, in the Ute Reservoir watershed the formation is laterally discontinuous and thin, offering a generally unreliable source of water. The village of Roy is the only community in the watershed pumping water from the Ogallala aquifer.

More reliable, but deeper, water supplies are found in the Mesozoic formations underlying the watershed. The Triassic Santa Rosa formation is used as a water supply by the village of Logan, New Mexico, with wells on the north side of Ute Reservoir. The Middle-Jurassic, Entrada Formation supplies water to Tucumcari, New Mexico, which also pumps local alluvial aquifers. Water in the Upper-Cretaceous, Chinle Formation is also used where locally available. The Upper-Cretaceous, Dakota Formation provides a source of water to the village of Mosquero, New Mexico.

Other deeper, pre-Triassic formations have limited ground water supplies or generally brackish water quality. Permian formations downstream of Ute Dam discharge saline water which degrades the river water quality of the Canadian River.

Recharge of ground water occurs in several ways (Stone and McGurk, 1985). Direct precipitation and channel seepage recharges surface outcrops of these formations. Additional recharge occurs at mountain fronts along the Sangre de Cristo and other ranges. An important mechanism of recharge in the watershed is afforded by numerous playa lakes scattered across northeastern New Mexico and the Texas Panhandle (Osterkamp and Wood, 1987; Ganesan et al, 2016).

2.3 ECOLOGY OF THE WATERSHED

The watershed straddles several physiographic provinces, including the highly-dissected, upper Pecos Valley and volcanic, Raton section of the Great Plains Province (Trimble 1980). It includes part of the Southwestern Tablelands and Western High Plains of the EPA & Omernik (1997). The vegetation classification of Brown and Lowe (1980) assigns most of the region to the Plains and Great Basin Grassland with small patches of Great Basin Conifer Woodlands on the tops of higher mesas. Dick-Peddie (1993) calls it primarily Plains-Mesa Grassland.

2.3.1 Vegetation

Plant communities in the watershed comprise mostly shortgrass prairie communities United States Forest Service (USFS 2011). Shrubs and forbs cover about 10 to 20% of the area. Blue grama dominates with some needle-and-thread, buffalo grass, and galleta. Playa lakes include mostly mesic vegetation, such as various annuals, milkweeds, western wheatgrass, and inland saltgrass (USFS 2011).

Higher in elevation, some communities of pinyon-juniper have been established and have extended into the shortgrass prairie where suitable conditions exist. Cottonwood-willow riparian areas have been established intermittently along the creeks and Canadian River. Fremont cottonwood and peachleaf willow are the most common species with New Mexico locust, chokecherry, hackberry, skunkbush sumac, and Apache plume along the ephemeral streams (USFS 2011). Tamarisk (spp.), Siberian elm, and Russian olive have invaded some of the riparian communities.

2.3.2 Wildlife

The Arkansas River Shiner is the only threatened or endangered species with critical habitat in the Canadian River drainage but it does not occur upstream of Ute Dam. Several sensitive species could use the watershed for habitat. These include: Plains Leopard Frog, Great Plains Narrow-mouthed Toad, Bald Eagle, White-faced Ibis, Zone-tailed Hawk, Swainson's Hawk, Ferruginous Hawk, American Peregrine Falcon, Lesser Prairie-chicken, Mountain Plover, Burrowing Owl, Loggerhead Shrike, Pale Townsend's Big-eared Bat, Black-tailed Prairie Dog, Sandhills White-tailed Deer, Arid land Ribbon Snake (USFS 2011).

3.0 CAUSES AND SOURCES OF IMPAIRMENT

Given the large area and paucity of data in the watershed, the causes and sources of impairment in the watershed are somewhat speculative. Although NMED was required to make a judgement call in the 303d-305b Report, future monitoring and data collection in the Ute Reservoir watershed may either refine or eliminate some causes for the measured impairment and the sources that are producing them. Nevertheless, the 303d-305b Report remains the best first approximation for these impacts.

Excessive nitrogen and phosphorus in runoff has been repeatedly shown to be an immediate source of impairment in waterbodies suffering from eutrophication. Work by NMED, US EPA and the ENMWUA has demonstrated that summer season data from Ute Reservoir often indicate eutrophic conditions.

Bacterial contamination from human sewage or pet wastes is also a wide-spread water quality problem across the country and in New Mexico. There are two, medium-sized wastewater treatment plants in the Ute Reservoir watershed and numerous septic tanks that could contribute bacteria to surface and ground water.

Excess sediment delivered to Ute Reservoir would be expected to result from destructive overgrazing of rangeland, bank destabilization, and the loss of riparian habitat. Drought would exacerbate these conditions. Excessive runoff from roads and other impervious surfaces would also be a suspected source.

3.1 CAUSES

The 303d-305b Report lists the cause of impairment for the Canadian River segment upstream of Ute Reservoir as E. coli, and for Pajarito Creek, E. coli and nutrient/ eutrophication biological indicators. Since Ute Creek is not impaired the 303d-305b Report does not list that stream; however, to be consistent with the goals of this plan the cause of concern over potential impairment at Ute Reservoir is excess sedimentation, plus any potential pollution from plant nutrients or E. coli.

3.2 SOURCES

Sources of loads causing impairment by E. coli for the Canadian River above Ute Reservoir are listed in the 303d-305b Report as:

- Avian Sources (waterfowl and/or other)
- Drought-related Impacts
- Flow Alterations from Water Diversions
- Rangeland Grazing
- Wildlife Other than Waterfowl

Pajarito Creek water quality impairment by E. coli and plant nutrients is attributed by the 303d-305b Report to be:

- Avian Sources (waterfowl and/or other)
- Drought-related Impacts
- Livestock (Grazing or Feeding Operations)

- Municipal Point Source Discharges
- Rangeland Grazing

Sources for impairment by sediment in the Ute Creek subwatershed, if it were to occur, would most likely be:

- Natural Sources
- Highway/Road/Bridge Runoff (Non-construction Related)
- Loss of Riparian Habitat
- Streambank Modifications/destabilization
- Rangeland Grazing

4.0 WATERSHED MODELING AND TARGET LOADS

Estimates of current watershed loads using both data and analytical modeling is an essential part of developing watershed-based restoration plans (US EPA 2008). Choosing the correct way to estimate the existing load requires careful thought. A balance must be struck between the level of detail and accuracy desired and the level of capable effort of the planners.

For this Plan, effort was focused upon the enormous size of the watershed and the relative scarcity of characterization data at present. Although on-going efforts of the NMED intend to generate many more data, the primary information comes from the establishment of the TMDLs discussed in Section 3 and the on-going monitoring efforts at Ute Reservoir (ENMWUA 2015). These data represent the sum total of pollutant transport that comprises sixteen HUC-10 subwatersheds (99 HUC-12 subwatersheds).

The two classes of watershed pollutant transport models can be classified as physical-process models, in which the physical movement of solute and sediment is understood and explicitly represented in a set of differential equations, and pollutant-load models, in which, simple to complex factors, often empirically derived, are used for specific land uses and the solute and sediment delivered to a point is calculated based upon the product of a contributing area, a distributed runoff volume and a land use factor. As might be guessed, physical-process models, such as SWAT, SWMM, or HSPF National Research Council (NRC 2009) require enormous amounts of spatially explicit data. Not only are these data sets unavailable at present for the Ute Reservoir Watershed, the requirements of this plan are limited Modeling is only required for estimating the projected load reduction of specific BMPs, not absolute measures of plant nutrients or bacteria throughout the sixteen subwatersheds (US EPA 2008).

Pollutant loading models such as GWLF (Haith and Shoemaker, 1987), require quite a bit less data and estimate pollutant concentration (or daily load) at a point. Further, there are several models that allow the user to specify BMPs and evaluate the load reduction possible under various scenarios. For many pollutant loading models, suitable input data can be downloaded from government agency web sites such as the Natural Resources Conservation Service (NRCS), the US Census Bureau, or county planning agencies and pasted into a spreadsheet-style parameter file. Because of all of these advantages, pollutant loading models were created using the modeling programs STEPL for plant nutrients and BLEST for bacteria.

4.1 STEPL MODELING

As part of the TMDL support program, US EPA contracted to create a spreadsheet based, pollutant loading program to model the daily mass of plant nutrients (total nitrogen and total phosphorus) at impaired receiving waters. The program, called the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) (US EPA 2011), uses the commercial spreadsheet program Excel to perform the loading calculations for each subwatershed, which are totalized over the entire modeled area.

4.1.1 STEPL Methodology

Input data can be retrieved from a STEPL input data web site that archives nation-wide data on a county-by-county basis. Loading begins with an average precipitation value using USGS county values, corrected for runoff producing events and average numbers of rainfall days. This is applied to the areas of the subwatersheds using the Revised Universal Soil Loss Equation (RUSLE) (Renard.et. al., 1991) and RUSLE parameters from the NRCS National Resources Inventory (NRI) database. This step generates both a runoff volume and a sediment load.

The runoff volume applied in a weight-distributed fashion to the various land uses in each subwatersheds and generates a total nitrogen and total phosphorus from loading factors. Default loading factors can be used or specified. BMPs can be used at this point to limit the delivered mass of pollutant. Both single and combined BMPs can be modeled.

4.1.2 Calculating the Nutrient Load

STEPL does not have a formal calibration step; however, the use of default or published data can result in unrealistic estimates. As a reality check, the modeling of individual subwatersheds was used where field data was available. As discussed in Section 3, a TMDL for plant nutrients has been written for Pajarito Creek (NMED 2011) that consists of a load allocation of 3.94 pounds per day (lbs/day) of total nitrogen and 0.263 lbs/day of total phosphorus. This loading is thought by NMED to be generated from treated effluent that originates as a point source in the Tucumcari WWTP and migrates to an unnamed tributary of Pajarito Creek within Subwatershed 10.

The wasteload allocation, which represents the non-point source portion of the load is 0.074 lbs/day of total nitrogen and 0.028 lbs/day of total phosphorus. Since the resolution of the Tucumcari WWTP is a permitting issue between EPA Region VI and the city, the Ute Reservoir Watershed Plan does not address the load allocation and no Clean Water Act 317(h) funding can be used to address this resolution. For this reason, the quantitative goals of the plan will only target the wasteload allocation for Pajarito Creek.

Parameters for the model were adjusted to result in an estimate of total nitrogen and total phosphorus out of Subwatershed 7, upstream of the Tucumcari WWTP. Several corrections had to be made to bring the values down to the wasteload allocation computed in the Pajarito Creek TMDL. First, the 50-year average rainfall for Quay and Harding County of 16 inches /year was probably too high for recent events in the watershed. The region has experienced a record drought since about 2000 and a better rainfall value for this period is 14 inches/year.

STEPL uses the land use category “forest” for all undeveloped land and assigns an event mean concentration (minus livestock) for derived runoff of 0.2 mg/L of total nitrogen and 0.1 mg/L total phosphorus. While this is possibly adequate for a true Eastern hardwood forest plant community, the actual biomass of Western rangeland is significantly lower (Beaulac and Reckow 1988). It was found that lowering the runoff event mean concentration by two orders of magnitude produced loads comparable to the TMDL.

Using these corrections, the pollutant loads calculated for Subwatershed 7 were 0.104 lbs/day for total nitrogen and 0.0378 lbs/day for total phosphorus. This is a 140% increase in nitrogen over the TMDL wasteload allocation for Pajarito Creek and a 135% increase in phosphorus. This suggests that load reductions of 35% to 40% in the watershed are expected to achieve the wasteload allocation for plant nutrients on Pajarito Creek. Section 5 will discuss the suggested BMPs and compare the projected load reductions for plant nutrients to this goal.

4.1.3 Calculating the Sediment Load

The STEPL model also calculates sediment delivered to the target subwatershed. The model uses the Revised Universal Soil Loss Equation developed by Renard and co-workers (1991) to calculate the loss of soil from upland areas. Channel erosion is estimated from the method of the Michigan Department of Environmental Quality (MDEQ 1999) using channel lengths and widths and a lateral recession rate. The upland sediment load is added to the channel losses to get the sediment yield for the watershed.

Since there is no sediment impairment within the Ute Reservoir watershed, no TMDL or load allocation has been calculated for any waterbody including the reservoir. Nevertheless, it is a planning goal of the URWA stakeholders to reduce erosion in the watershed, limit sedimentation of Ute Reservoir and extend the serviceable life of Ute Dam.

Despite this, calibrating of the STEPL sediment yield can be accomplished using the decadal bathymetric survey contracted by the NMISC (2012). This work is done in order to adjust the allowable storage behind Ute Dam, as reported annually to the Canadian River Compact Commission. Using this data, the survey reports volume changes that result in a sediment loading rate of 1,628,546 tons/year. This value is confirmed by work done on sediment yield elsewhere in New Mexico for the NMISC (Mussetter Engineering 2004) that indicate a relationship between drainage area and yield, or

$$Y_{10\ year\ event} = 1162.6\ \times area^{0.82}$$

Given a watershed area of 3,852 mi^2 this equation give an annual yield of 1,013,195 tons/year, which is of the same order as the bathymetric survey.

Using the STEPL model and the entire watershed above Ute Reservoir, the estimated sediment yield is 1,850,732 tons/year. This is again of the same order as the bathymetric survey but larger. The model was run with no BMPs and a high lateral erosion rate (0.4 ft/year), which may be unrealistic. Despite this, it suggests that a reasonable reduction goal for sediment yield of about 14%.

4.2 BLEST MODELING

Similar to US EPA, the Texas Commission for Environmental Quality (TCEQ) also requires loading models to calculate and administer TMDLs, specifically, a loading model was required to access E. coli loading of Buffalo and Whiteoak Bayous in Houston, TX (Rifai, et al 2005). Since any current process-based modeling codes for bacteria are extremely cumbersome and difficult to calibrate, TCEQ commissioned a spreadsheet based loading model, the Bacteria Loading Estimator Spreadsheet Tool or BLEST to set bacteria TMDLs for the bayous (Peterson et. al. 2009). For similar reasons, the BLEST program was used to model bacterial loading of Pajarito Creek and the Canadian River between Conchas Dam and Ute Reservoir.

4.2.1 BLEST Methodology

Similar to the plant nutrient impairment of Pajarito Creek, the Tucumcari WWTP discharge permit is being administered as a presumed source of bacterial waste load by way of an unnamed tributary (NMED 2011, 2013). Because the reduction of this load is being achieved under a permit enforcement action, the waste load allocation of 4.39 x 10^9 colony-forming unit per day (cfu/day) cannot be addressed with CWA319(h) funding and will not be a direct subject of this plan.

The load allocation will be addressed by this plan and the BMPs selected for it. As calculated from monitoring data, the load allocation for Pajarito Creek is 5.31 x 108 cfu/day. As was the case with STEPL modeling, the BLEST program was applied to the subwatershed just above the Tucumcari WWTP, Subwatershed 7.

The Canadian River between Conchas Reservoir and Ute Reservoir is also the subject of a TMDL (NMED 2011). Because no point sources were identified above the monitoring points, the stream segment is only impacted by a load allocation (2.56 x 109 cfu/day), reflecting the presumed non-point source generation of E. coli bacteria in the contributing subwatershed. For this reason, BLEST monitoring focused on Subwatershed 15, which includes the impaired reach of the Canadian River.

4.2.2 Calculating the Bacterial Load

The BLEST program is very similar to STEPL and creates, once again, a pollutant loading model and not a physical process model. Physical process models for bacterial migration in watersheds are even more site-specific and data intensive. Unfortunately, much of the process involves the entire ontogeny of the target organism, which is difficulty to generalize in a pollutant loading model. Nevertheless, assuming a relative estimate from the BLEST model it is possible to generate a reduction goal that can allow the choice of BMPs and that is the objective of the model.

The BLEST spreadsheet enters data for the watershed that is broadly similar to STEPL, including the areal extent, annual rainfall and rain events, percentage of land uses, number of septic tanks, extent of storm sewer systems, and the number of birds and dogs. It does not explicitly address livestock. Parameters and processes used in the spreadsheet include SCS curve numbers to simulate runoff (NRCS 1985), land-use specific, event mean concentrations for E. coli wash off and fecal coliform production rates for various animals.

Although cattle are not included, there is a factor for "other animals" that can be replaced with the appropriate values. In order to adequately simulate the Ute Reservoir watersheds, this factor was replaced with values appropriate for grazing (Borel et al 2015). An average stocking rate of 50 acres per calf/cow unit was used to estimate the number of animals and was taken from average of Ute Reservoir watershed ranches (range: 74 to 35 acres per calf/cow unit). This value compared favorably with Holechek and others (2001).

Most other inputs were set to zero. Other than the Tucumcari WWTP, there are no other sanitary or storm water sewers in either watershed. There are numerous septic tanks in the entire Ute Reservoir watershed; however, all are above the water table and septic tank failures have a remote chance of discharging to surface waters. For this reason, the load delivery ratio for failed septic systems was reduced to 2%.

One issue with BLEST is that the estimate made is in units of maximum probable number of colonies (MPN) per day and not cfu/100 ml/day. While this difference remains an artifact of previous laboratory testing methodology, such as establishing TMDLs, the actual units can be used interchangeably for assessment purposes, as indicated by NMED (2014).

Applying the spreadsheet to the watersheds connected to the two listed waters results in an estimated load of 5.50×10^9 MPN for the Canadian River segment and 6.05×10^8 MPN for Pajarito Creek. These estimates represent 2.15 times the load allocation for the Canadian River and 1.14 the load allocation for Pajarito Creek. The estimate is almost entirely dependent upon septic tank failures and direct deposition (dogs, birds and cattle) as contributions of the bacterial load to the stream segments.

4.3 SUMMARY OF LOAD REDUCTION GOALS

These two models probably do not very accurately predict an absolute load of their respective pollutants. It is likely that a well-calibrated process-based model would be more reliable at predicting the exact amount of sediment or nitrogen that annually is deposited in Ute Reservoir. Nevertheless, these models do indicate the relative reductions needed and the BMPs that might be expected to achieve this reduction. In Section 5, this expectation will be expanded upon.

In summary, pollutant loading modeling suggests that the following reductions in load will meet the objectives of this plan:

- For plant nutrients: 29% decrease in total nitrogen and a 26% decrease in total phosphorus
- For E. coli: 53% decrease in the E. coli load
- For sediment: 14% decrease in sediment

5.0 MANAGEMENT PRACTICES AND PROJECTED LOAD REDUCTIONS

The heart of a watershed-based water quality management plan is the set of BMPs used to attain the load reductions computed in Section 4. In general, there are few regulatory methods for enforcing the attainment of non-point source pollution; however, the US EPA and NMED have researched and distributed information on BMPs that can limit the pollutant load in a watershed. These agencies have left it to watershed groups like URWA to encourage the introduction of new, or continuation of existing, management practices that can help impaired waterbodies attain their designated uses.

5.1 BMPS FOR THE UTE RESERVOIR WATERSHED

Following the development of the load reduction objectives of Section 4, the URWA met in Tucumcari to review and augment a list of candidate BMPs for the watershed-based water quality plan. A variety of possible practices were discussed and the primary merits of these BMPs were assessed as to effectiveness, practicality, ease of adoption and measurability. Upon consensus of the group 34 BMPs were selected (Table 4). Each BMP is preceded by the management goal it addresses (Section 1).

6.0 EXPECTED LOAD REDUCTION FROM MANAGEMENT PRACTICES

It is expected that the BMPs listed above will result in an overall reduction in plant nutrients, E. coli bacteria and sediment equal to the reduction goals listed in Section 4. The specific expected reductions will be discussed with reference to the management goals listed in Section 1.

6.1 WATER QUALITY OF UTE RESERVOIR (BMPS 1-4)

Many of the water quality issues associated with wastewater treatment are considered under this goal. If the improvements planned for the Tucumcari and Logan WWTPs are carried out, a large number of septic tank systems in the watershed will be taken out of service and a large component of the non-point source bacteria will be isolated from surface runoff. BLEST modeling indicates that failing septic tanks may contribute 95% of the bacteria daily load to the Canadian River reach below Conchas Dam. For Pajarito Creek, the failed septic tank daily load estimate is 92%. Thus a substantial reduction in septic tank usage could, by itself, make a large impact on the target E. coli reduction for the watershed of 115%.

The other goal for this set of BMPs is reduction of salinity. This would be achieved by reducing direct surface runoff to the reservoir from roads and developed areas that accumulate salts. Studies indicate that detention of stormwater can reduce total dissolved solids concentration by 20% or more.

6.2 CAPACITY OF RESERVOIR AND WATERSHED YIELD (BMPS 5-7)

Increasing surface water yield of the watershed is a management goal of the plan and will have a general beneficial impact of water quality, in addition to adding to the usable water of the reservoir. The persistence of stagnant ephemeral pools and saturated soils has been cited as a persistent source of fecal coliform bacteria long after wet weather transport (Chase et al 2012, Chandrasekaran, et al 2015).

Although sediment is not listed as a stressor in NMED (2011), it is a critical measure of 'health' to the members of the URWA. Each year the reservoir loses capacity as waterborne sediment settles, increases the elevation of the reservoir bottom and decreases the capacity behind the dam. Because of the wording of the Canadian River Compact (CRCC 195), measurement of the reservoir volume is monitored by the NMISC (2012) and a rate of sediment accumulation is estimated every ten years. Evans and Owens (1972) found that, all else equal, drainage discharge had negative correlation to fecal coliform load in a Scottish agricultural district.

Since surface water yield is only a secondary goal of the plan, no quantitative impact has been determined for these BMPs. Nevertheless, decreasing phreatophyte vegetation is expected to increase the surface flows in the Ute Reservoir Watershed.

6.3 RANGELAND HEALTH (BMPS 8 & 9)

Ute Reservoir watershed is primarily made up of private cattle ranches. Within the general category of rangeland management are a number of BMPs that should have an important impact to all three of the watershed quality goals and several of the secondary goals. Of primary impact is the implementation of sustainable livestock management (Pyke et al, 2002), which is already practiced at most of the ranches in the Ute Creek sub-watershed. Following these BMPs can reduce erosion and sediment transport, direct deposition of E. coli by livestock and the loading of plant nutrients in streams.

Well maintained rangeland is defined by a successful grassland plant community that contributes stability to soil and decreases erosion. Management of riparian zones decreases the opportunity of the deposition of cattle manure in streambeds, decreasing the loading of bacteria, nitrogen and phosphorus in the stream. BLEST modeling indicates that 4.9% of the modeled bacteria load comes from direct deposition (livestock and wildlife). STEPL models suggest that 1.12% of the total nitrogen and 0.27% of the total phosphorus loads come from pasture lands, without any BMPs. The existing practice of optimizing rangeland health probably already decreases this considerably and extension of these practices throughout the watershed could reduce the plant nutrient loading to a very low level.

Poorly constructed and maintained ranch roads have been shown to increase erosion and sediment in rangeland (Leopold 1946). Properly built roads (Zeedyk 2006, Woods and Ruyle 2015) have demonstrated that destructive erosion can be avoided. Studies have shown that rotational grazing can reduce sediment transport to 38 to 91% of heavily grazed range (Gamougoun et al. 1984, McCalla et al, 1984, Warren et al 1986, Pluhar et al 1987),

6.4 RANCHING/FARMING CUSTOMS, COLLABORATION AND CULTURE (BMPS 10-15)

This is another BMP that would be implemented as part of the Public Education and Involvement and is difficult to quantify. In any case, the purpose of the BMP is to support, encourage and augment the existing land stewardship culture in the watershed. Several ranches in the Ute Reservoir have been publicized for their implementation of sustainable range management (Crews 2008, Gosnell 2011). By encouraging these commitments and attitudes, the stakeholders of the Ute Reservoir Watershed Alliance are strongly in favor of keeping this cultural inheritance alive for future generations.

6.5 ECOSYSTEM SERVICES AND FOREST HEALTH (BMPS 16-19)

The BMPs associated with this goal are focused on the non-rangeland, undeveloped acreage in the Ute Reservoir Watershed. Many of these BMPs include wildlife habitat restoration projects that are currently part of the CRRRP or other USDA-funded efforts. In any case, the preservation of intact ecosystems has been shown to reduce non-point source pollution on undeveloped lands. For example, US EPA (2012) has cataloged reduction of 81% to 77% of the total nitrogen and total phosphorus reduction in agricultural lands of the Chesapeake Bay area is achieved through re-forestation of disturbed or developed land. Looking at Italian agricultural fields, Balestrini and co-workers (2016) have documented nitrogen removals greater than 90% in riparian buffer forests on the Po River.

6.6 SUPPORT FOR THE TUCUMCARI AGRICULTURAL RESEARCH STATION (BMPS 20-21)

The Tucumcari Agricultural Research Station (Station) is a key partner to the City of Tucumcari Wastewater Treatment Plant and any future efforts to address the load allocation to Pajarito Creek. That role, while not directly part of the watershed plan, has built a valuable resource for reducing non-point source pollution. The Station is a unit of New Mexico State University which has an independent commitment to provide quality research and expertise on the treatment and mitigation of agriculture-related water pollution. Support of the Station would be limited to using the results of non-point source pollution and the bio-treatment of wastewater effluent, where applicable in the watershed. These efforts would be implemented through the Public Education and Involvement program (Section 7).

6.7 PUBLIC ROAD AND MUNICIPAL INFRASTRUCTURE (BMPS 22-26)

Only a small part of the watershed is developed urban or suburban land. Nevertheless, STEPL and BLEST modeling suggest that a large amount of plant nutrient and bacteriological pollution can be generated from urban and roadway non-point sources. This conclusion was also reached by the National Research Council who determined that 99% all stormwater samples from freeway databases exceeded standards for total phosphorus and Kjeldahl nitrogen and all the samples exceeded the fecal coliform standards (NRC 2009). In general, an increase in impervious surfaces associated with urban development has caused a general degradation of water quality in receiving streams (US EPA 1983).

Only the Pajarito Creek watershed contains any appreciable urban land (2018 acres). According to STEPL modeling, an application of combined BMPs in 10% of the Pajarito Creek watershed could reduce the total nitrogen by 52% and the total phosphorus load by 38%. BLEST does not model BMPs; however, the BMP dBase (2014) suggests that E. coli loads can be reduced to from 4.84% to 46.5% of their untreated mass through the use of various detention/retention/biotreatment ponds.

6.8 RECREATION (BMPS 27-29)

Ute Lake State Park is a major user of the reservoir and the maintenance of the water quality of the waterbody is an unambiguous goal of the New Mexico Department of Energy, Minerals and Natural Resources, State Parks Division. Similarly, the continued recreational use of the reservoir is of huge importance to every municipal and county government within the watershed. Fortunately, the State Parks Division has excellent resources for assuring that recreational use of the reservoir is enjoyed without limiting pollutant loading.

The Park has the ability to use the Logan wastewater treatment system to isolate any sources of fecal coliform and stormwater BMPs can keep pollution from originated in runoff from campgrounds and picnic areas. Visitor education can be used to teach boaters and anglers to avoid disposal of pollutant-bearing waste in the reservoir. The Park also administers the boat dock program for residents and water quality is a primary concern of park managers.

Similar BMPs implemented by the City of Los Angeles at Echo Park Lake resulted in a decrease in fecal coliform of 60% and a lowering of Kjeldahl nitrogen by 45% (CDM 2006). Unregulated boat docks were suggested to increase negative water quality by 3 to 5 times background values in a study by Ediger and Martin (2010).

6.9 DEVELOPMENT/PROPERTY VALUE (BMPS 30-33)

As is the case with all local residents, the inculcation of pollution prevention BMPs is best achieved when the residents of a watershed can directly see the value of water quality in their own property. The BMPs under this objective will be implemented as part of the Public Education and Involvement program (Section 7). Primarily and in the case of plant nutrients, this will entail the promotion of the use of low impact lawn care products, rainwater harvesting and low impact development (LID) for housing developments directly fronting the reservoir.

LID and green infrastructure (GI) are catch-all terms for a set of engineering and management practices that stress on-site use and infiltration of storm water and the avoidance of runoff entering streets and waterways. Ahiablame and co-workers (2012) investigated a series of common LID practices and found nitrogen removal rates at 18-33% for bioretention, 75-80% for permeable pavement, 14-61% for grass swales. Phosphorus rates of removal varied from 10 to 99% over the same range.

6.10 BMP SUMMARY TABLE

Although many of the BMPs suggested for the Ute Reservoir Watershed Plan attempt to change human behavior and are hard to quantify, other practices have been implemented and measured in formal research projects. The following reductions in pollutant loads are expected by implementation of the Ute Reservoir BMPs:

BMPs	***Target Pollutant***	***Expected Load Reduction in %***
1 through 4	E. coli Salinity	115% 20%
5 through 7	Plant nutrients, E. coli bacteria and sediment	Not quantified
8 and 9	Sediment, bacteria, nitrogen and phosphorus	38-91% 4.9% lower 1.12% (N) & 0.27% (P) lower
10 through 15	Plant nutrients, E. coli bacteria and sediment	Not quantified
16 through 19	Total nitrogen and total phosphorus	77% to 90%
20 and 21	Plant nutrients, E. coli bacteria and sediment	Not quantified
22 through 26	Total nitrogen Total phosphorus E. coli	52% 38% 4.84% to 46.5%
27 through 29	Fecal coliform Kjeldahl nitrogen	60% 45%
30 through 33	Nitrogen Phosphorus	14% to 80% 10% to 99%

7.0 PUBLIC EDUCATION AND INVOLVEMENT

The process of inclusion for the water quality improvement of Ute Reservoir Watershed has already begun; however, Section 7 will outline both the process and the future implementation steps that will form this plan. Section 1 detailed a very comprehensive series of meetings sponsored by the Canadian River Soil and Water Conservation District and the Eastern New Mexico Water Utility Authority. The product of these meetings was a frank and open discussion of land management values to the mostly rural citizens of the watershed. From these discussions was also born a realization of shared interests and a commitment to cooperation across the landscape.

7.1 PUBLIC INVOLVEMENT

In order to continue and propagate this commitment to cooperation, the URWA will continue beyond the acceptance of this plan and coordinate 319(h) activities of the CRSWCD. This will primarily consist of soliciting proposals from member entities to fund the activities necessary for implementing the BMPs. For this reason, support funding will be solicited from the member entities and external sources to hire a Watershed Coordinator, an employee of the CRSWCD who will work with the URWA and the CRSWCD Board of Supervisors to facilitate the URWA operations, write supporting grants, report on activities to NMED and US EPA and otherwise conduct the business of implementing this plan.

Additional major in-kind and financial support is expected from the CRRRP, the counties comprising the watershed and the individual villages, towns and city (Tucumcari). This support will culminate in a Water Quality Steering subcommittee of the URWA that will directly work with the public to support and renew a stewardship culture of use that involves conserving natural resources while preserving water quality. This group will be modeled after successful water quality steering groups central to other watershed-based plans, such as the Mid Rio Grande Stormwater Quality Team and the Keep the Rio Grande campaign and the STormwater Outreach for Regional Municipalities (STORM, Phoenix metro area).

Initial formation of the water quality subcommittee would be based upon the character of such a group and interests of NMED and US EPA to provide some funding support. The two example groups are primarily urban and are driven by the NPDES permitting requirements of the member municipalities. For the rural to small urban Ute Reservoir Watershed, the size, focus and communication tools would be different. Regardless of that, the group might include representatives from Logan, Tucumcari, Mosquero, Quay and Harding Counties.

Some of the activities of this subcommittee may include: (1) building a Web site to promote the group, the watershed plan and public meetings, (2) developing a database of BMPs that tiers off of the approved watershed-based plan with suggested individual activities to better infuse the practices into the daily life of the public, (3) sponsorship of public "water quality moments," where celebrations of pollutant reduction activities are promoted and circulated in print and other media outlets, (4) activities and outreach at local fairs and festivals, (5) interpretation and promotion of research at the university-level that suggests innovative ways to reduce pollution and monitor water quality in Ute Reservoir and its tributaries, (6) identify and cultivate partnerships with other organizations, charities and social clubs to celebrate and implement water quality successes, (7) hold workshops for groups interested in obtaining grants from water quality improvement funds and (8) solicit local, State and Federal elected officials for water quality support at Ute Reservoir. Many other methods to involve the public are possible and will be explored by the water quality subcommittee.

7.2 PUBLIC EDUCATION

A key principal of watershed-based water quality planning is to ensure that the public understands the consequences of their actions on downstream receiving waters. For this reason, the water quality subcommittee will also work to educate the citizens that they involve and engage.

Public education will begin with the promotion of this plan and the identification in a variety of media of the purpose and values of the plan. The objective will be to teach citizens that they live in the watershed and that the protection of Ute Reservoir and its tributaries can only be accomplished with their involvement. There are many tools that can be used to educate the general public. The first step will be for the Watershed Plan Coordinator to work with the water quality subcommittee and CRSWCD to develop a grant application and secure funding for outreach.

Within the grant would be development of typical communication tools for outreach events. For example, public information posters and displays could be constructed for local events such as fairs and festivals. These materials would be organized around the theme of public awareness of the watershed and the connections between private runoff and impairment of waterways. Signage could also be developed extending NMDOT signage of watershed boundaries to smaller waterbodies, for example, state highway crossings of Ute or Pajarito Creek.

Utility bill inserts are used in other parts of the country to alert the public about watershed issues. In addition, signs in campground, picnicking and angling areas of Ute Lake State Park could warn visitors that dumped fluids drain to the reservoir. Other printed material or giveaways could be developed to distribute at public events. Public service messages can be written for local radio and television stations and billboards developed for major highways.

It will be important to determine if the public awareness is actually increasing. Phone and mail surveys can determine if the message is being absorbed by the public. A social science study of the impact of the campaign, similar to Fore (2013), would be an excellent way to evaluate effectiveness of the program.

K-12 education is crucial to watershed awareness. Several of the BMPs described in Section 5 include working with schools and with members of the community to propagate watershed stewardship and sustainable ranching to the next generation. The Watershed Plan Coordinator can meet with the school districts located in the watershed, such as Mosquero, Roy, Springer, Logan and Tucumcari School Districts, to find teacher/champions for the education goals of the program. Watershed science can be integrated with existing STEM/MESA programs to excite and involve students in quantitative skills that contribute to their communities. Additional resources in sustainable agriculture can be developed through programs like Future Farmers of America and 4H.

Post-secondary education could also be utilized by the involvement of science classes at Mesalands Community College, Eastern New Mexico University and New Mexico State University-Tucumcari Agricultural Science Center. Classes in watershed monitoring could be integrated with programs in geology, biology or environmental science. Independent research by faculty could be initiated in the watershed. The Advisory committee to NMSU's ASC at Tucumcari has a program enhancement initiative to hire a watershed scientist and a soil-plant-water-environment scientist to work at the Tucumcari Agricultural Science Center to conduct research and education/outreach programs on ranching and farming BMPs to reduce pollution in surface waters.

The Public Education and Involvement component of watershed-based water quality plans is the most dynamic part of the plan. With adequate funding and local commitment, these programs are expected to flourish.

8.0 IMPLEMENTATION PLAN, MILESTONES AND MONITORING

Turning this plan into on-the-ground water quality is a big job. Fortunately, a number of programs, state and municipal agencies and stakeholder groups have already begun. This plan would be best used to simply coordinate these efforts and provide a forum for the exchange of information and shared values.

8.1 5-YEAR PLAN OF ACTION

As stated in Section 1, this document is based upon a five-year planning period. During the final stages of that period, it is assumed that the plan will be re-written to address progress to date and future directions. If the impaired waters become de-listed by NMED, a plan will still be needed to keep the waterbodies free of pollutants.

Over the planning period, numerous activities will be occurring simultaneously (Table 2). Attempts were made to balance the work and to schedule grantsmanship activities for the first two years.

8.2 MILESTONES

Milestones for the successful implementation of the plan are based upon similar expectations for other watershed-based water quality plans (Table 2). Clearly, these will become modified as the work progresses and are dependent upon the funding available and the continuation of government funding opportunities.

8.3 SUCCESS MONITORING

Success monitoring is composed of two components: program monitoring and on-the-ground monitoring.

8.3.1 Program Monitoring

As part of the regularly scheduled reports provided to NMED and EPA, progress on each of the BMPs in the adopted plan will measure against the benchmarks and milestones described in Sections 8.1 and 8.2 (Table 2).

8.3.2 On-the-Ground Monitoring

Annual monitoring of Ute Reservoir for plant nutrients, E. coli bacteria and sediment will be continued under funding to be solicited as part of the plan and utilizing the existing monitoring plan (ENMWUA 2014). Monitoring of the Canadian River and Pajarito Creek will also be accomplished under a monitoring plan that will be written during the first year of adoption of this plan. That monitoring plan will be based upon the fact that the two streams are ephemeral and sampling events cannot be scheduled in advance.

Storm water sampling is a mature form of environmental investigation; despite the difficulties it presents. It is hard to predict when and where in a watershed runoff will occur, even if a storm is observed. And it is also hard to distinguish multiple storm events in a way that assures independent results. One way to organize stormwater sampling is to statically discriminate a characteristic storm, using historic records of duration and intensity of precipitation that produce measurable streamflow at a specific point in the watershed. This sort of analysis would be part of the monitoring plan, to be determined.

Finding sampling locations on the impaired reaches of the streams (Canadian River, Pajarito Creek) would also be a challenge. Although a sampling point can be found that is spatially representative of the watershed, there may not be any annual flow at the location. This suggests that multiple sites would be necessary to assure that a representative sample of ephemeral flow occurs during the year.

The logistics of the sampling would be a challenge. It would be critical to have sampling personnel who can mobilize and travel to the sampling site quickly when a storm event is predicted in the watershed. Further, the sampling staff would need to get to a certified laboratory with the holding time for the analytical method, currently six hours for E. coli bacteria analysis. These are not trivial problems; however, a well-written monitoring plan could work out the logistics and procedures of the sampling protocol and produce useful data about the success of the watershed plan.

8.3.2.1 Monitoring Locations

Selection of specific locations for monitoring will largely depend upon access. Most of the watershed is private land. Currently, NMED has nine sites in the watershed that have been used to develop water quality assessments (Table 8.1, from https://gis.web.env.nm.gov/SWQB/). Although statutorily some of these waterbodies are listed as perennial, many only flow in response to precipitation. For this reason, not all of the sites could be sampled according to a set schedule. Nevertheless, the monitoring implementation plan that will accompany funding proposals for this plan will specify which stations will be used and will depend upon access agreements.

8.3.2.2 Sampling Methods

As noted above, sampling of stormwater is problematic. The installation of dedicated, flow-triggered automatic samplers, such as those used in urban stormwater programs, is probably not feasible. Grab sampling during upstream storm events is the most reasonable strategy; however, this will require a coordination of sampling staff. In particular, the six-hour laboratory holding time for *E. coli* samples will be troublesome. One possible way to reduce travel times would be to fund a bacteriological laboratory at either Tucumcari Agricultural Science Center or Mesalands Community College.

8.3.2.3 Quality Assurance/ Quality Control (QA/QC)

A QA/QC plan for monitoring will be written before any data is collected. The QA/QC plan will depend upon data quality objectives developed for the plan; however, it will be comparable in details to the NMED MAS data quality protocols and methods.

9.0 COST ESTIMATES FOR POTENTIAL BMPS

As a guide to implementing watershed-based water quality plans, US EPA requires that costs and funding sources be projected for the planning period used. It is difficult sometimes to anticipate what levels of funding will be available in the future. Therefore, this part of the plan will be incompletely known at the time of adoption. Nevertheless, it is important to understand realistic resources that are presently and may be available in the future and to base the plan on pragmatic goals, objective and implementation milestones.

9.1 ESTIMATES FOR RANGELAND BMPS

The discipline of sustainable rangeland management is not new. Although recent improvements in communicating practices have been achieved, maintaining grasslands while providing forage for livestock and wildlife may extend back to the dawn of human history. These practices, under economic and other pressures, have not always been followed. The disastrous results of allowing overgrazing to destroy soils, plan communities, ecological function and economic viability have been demonstrated repeatedly.

The BMPs suggested in this plan to reduce loading of waters of the US by plant nutrients, bacteria and sediment have costs associated that come from many years of grant implementation under USDA and EPA programs. In addition, the costs of self-funded actions by ranchers and land managers are available from these agencies, NMSU, Society for Range Management, Quivira Coalition and anecdotal information. All of these sources have been used for this plan.

9.2 ESTIMATES FOR URBAN BMPS

Urban runoff is a problem that receives a great deal of attention and funding by mostly government agencies (NRC 2010). Stormwater is frequently cited as the country's most intractable water quality problem, largely because many of the remaining pollutants emanate from both built and natural environments. Sediment, bacteria and plant nutrients are such pollutants.

Recently, the pollutant load from small cities, town, suburban, and exurban communities has also become a target for source control, as more of the problem comes under concern. Bacteria from pet waste and septic systems is a continuing problem. BMPs for both small and large urban systems have been developed under the EPA and state storm water discharge permit programs. A relatively new philosophy of control that uses landscaping runoff control (Green Infrastructure) and new construction methods (Low-Impact Development) has evolved as a set of BMPs that limit the contribution of pollution carrying runoff to jurisdictional waterbodies. Costs associated with these BMPs represent the most bourgeoning branch of this discipline.

Costs estimated in this section relied primarily upon past, EPA-approved watershed-based water quality plans, along with data from NRC (2009) and the International Stormwater Best Management Practices (BMP) Database (Leisenring 2012).

9.3 ESTIMATES FOR PUBLIC INVOLVEMENT/EDUCATION BMPS

Traditionally, the public involvement and education BMPs have been the most difficult elements of non-point source pollution plans to cost or assess. The obvious reason for this is the secondary nature of the results; people learn but they don't always act, or more often, act inefficiently to change behaviors of any kind. Despite this, changed attitudes about societal responsibility for the environment has been one of the more remarkable advancements of the last 50 years.

And with the implementation of education and public involvement programs there has been some improvement in the understanding of costs and efficiencies of these BMPs. Estimates of costs have primarily come from past, EPA-approved watershed-based water quality plans.

9.4 MONITORING COSTS

Although the Plan is focused on the protection of Ute Reservoir, the listed waters and other tributaries must be the first line of defense against degradation of the reservoir. Monitoring of the watershed is described in Section 9; however, there will be costs associated with sampling, analyzing and interpreting water quality data at Ute Reservoir.

For the past two years, the ENMWUA has conducted water quality monitoring at Ute Reservoir on its own initiative. A source water protection plan for the reservoir will be needed in order to compete for State of New Mexico Drinking Water State Revolving Funds. That plan could potentially be written to replace the current arrangement. The plan could require monitoring data on the water quality of the reservoir and watershed. It is anticipated that monitoring of the reservoir would cost about $19,000 per year, or $95,000 for the entire five-year planning period.

Sampling and analysis of the impaired reaches (Canadian River and Pajarito Creek) would also be required in order to gauge the effectiveness of the Plan at attaining the TMDL. Although delisting of the streams is a formal action that would be determined by NMED and EPA, achieving this goal is a major interest of the URWA.

Sampling ephemeral streams is not a simple task. It requires rapid mobilization by local staff well versed in sampling protocol and the analysis of the data often requires detail knowledge of the storm behavior. For this reason, it will fall to CRSWCD and the Watershed Plan Coordinator to implement the sampling of the impaired reaches. Based upon the costs associated with storm water sampling programs in other rural areas, the cost of this program is expected to be approximately $20,000 per year and $100,000 for the five-year planning period.

9.5 5-YEAR COSTS FOR WATERSHED PLAN

Five-year costs for the specific BMPs and potential sources of funding to cover those costs has been researched and accumulated (Table 4). The initial grant applications are expected to be directed by the Canadian River Soil & Water Conservation District and the Eastern New Mexico Water Utility Authority and will be initiated (depending upon application cycles) as soon as this Plan is formally adopted. That grant will fund, in part, a position with CRSWCD for a Watershed Plan Coordinator.

The Watershed Plan Coordinator would be responsible for facilitating meetings of the Ute Reservoir Watershed Alliance and any groups formed by URWA as part of the Plan, i.e. the public education and involvement program board. Additional responsibilities would include identifying funding sources, including NMED grants, targeting non-point source pollution and other 319(h) programs. This information would be rolled out to the URWA members and any interested stakeholder groups.

CWA 319(h) funding (along with necessary match money) is expected to support many of the activities described in the Plan. Over the five-year program, the Plan is expected to support 3.1 million dollars in external funding flowing to the agencies and organizations in the Ute Reservoir Watershed (Table 4). Of that, 1.3 million dollars would come from on-the-ground, 319(h) projects. 1.1 million dollars would come from USDA Rural Development funding and $460,000 from the USDA Grazing Lands Conservation Initiative. $260,000 would come from Water Trust Fund (State) contributions. To this would be added $190,000 in sampling costs (Section 8.4) for a grand total of 3.3 million dollars.

10.0 REFERENCES

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Tables

Table 1

TMDLs for Ute Reservoir watershed (NMED 2011)

TMDL (- margin of safety)	Estimated Load	Target Reduction
Canadian River (Ute Reservoir to Conchas Reservoir) E. coli, in cfu/day		
2.56×10^{9}	2.08×10^{10}	1.82×10^{10}, 88% of existing load
Pajarito Creek (Canadian River to headwaters) E. coli, in cfu/day		
4.92×10^{9}	3.12×10^{10}	2.63×10^{10}, 84% of existing load
Pajarito Creek (Canadian River to headwaters) Total nitrogen, in lbs/day		
0.258	26.6	26.3*, 99% of existing load
Pajarito Creek (Canadian River to headwaters) Total phosphorus, in lbs/day		
3.87	79.6	75.7*, 95% of existing load

*99% of this reduction to come from the Tucumcari WWTP

Table 2
Phase 1 effluent limitations for Tucumcari WWTP (NMED 2013)

	Discharge Limitations				Monitoring Requirements	
	Mass (lbs/day)		*Concentration*		*Frequency*	*Sample*
	30-Day Avg.	*7-Day Avg.*	*30-Day Avg.*	*Daily Max*		*Type*
E. coli Bacteria	**NA**	**NA**	**126 cfu**	**410 cfu**	**1/week**	**grab**
BOD	**230**	**345**	**30 mg/L**	**45 mg/L**	**1/week**	**6/hr Composite**

Table 3
12-digit HUC watersheds encompassed by the Ute Reservoir Watershed

HUC12	Name	Area	
		Acres	Sq Km
110800060101	Canon Bestias-La Cinta Creek	24084	97.5
110800060102	Burro Creek	28645	115.9
110800060103	Burro Draw-La Cinta Creek	20688	83.7
110800060104	Mule Creek	38737	156.8
110800060105	Mule Creek-La Cinta Creek	27898	112.9
110800060201	Bueyeros Creek	23157	93.7
110800060202	Seco Creek	23318	94.4
110800060203	Seco Creek-La Cinta Creek	36876	149.2
110800060204	Puertocito Creek-La Cinta Creek	24198	97.9
110800060205	Tulosa Creek-La Cinta Creek	21641	87.6
110800060301	Medio Creek-Atarque Creek	20874	84.5
110800060302	Alamosa Canyon	20516	83.0
110800060303	Alamosa Creek-Atarque Creek	20233	81.9
110800060304	Road Canyon	15654	63.3
110800060305	Road Canyon-Atarque Creek	17914	72.5
110800060306	Rattlesnake Creek-Atarque Creek	31841	128.9
110800060401	Headwaters La Manga Creek	27023	109.4
110800060402	Outlet La Manga Creek	19099	77.3
110800060403	Oso Creek	38333	155.1
110800060404	La Cinta Creek-Canadian River	20456	82.8
110800060405	Chical Creek	15459	62.6
110800060406	Alamosa Creek	14847	60.1
110800060407	Alamosa Creek-Canadian River	29028	117.5
110800060408	Road Draw	13638	55.2
110800060409	Road Draw-Canadian River	36595	148.1
110800060501	Harben Lake-Pajarito Lake	32298	130.7
110800060502	Mesa del Gato-Pajarito Creek	36399	147.3
110800060503	Caracita Creek	18490	74.8
110800060504	Bull Canyon Creek	35673	144.4
110800060505	Bull Canyon Creek-Pajarito Creek	25894	104.8
110800060601	Arroyo de Las Palomas	17786	72.0
110800060602	Vigil Canyon	29234	118.3
110800060603	Vigil Canyon-Pajarito Creek	27017	109.3
110800060604	Blanca Creek	27630	111.8
110800060605	Blanca Creek-Pajarito Creek	46781	189.3
110800060606	Tucumcari Lake-Canadian River	34810	140.9
110800060701	Pajarito Creek-Canadian River	24472	99.0
110800060702	Headwaters Carros Creek	16788	67.9
110800060703	Outlet Carros Creek	30777	124.6
110800060704	Romero Draw	14613	59.1
110800060705	Romero Draw-Canadian River	28750	116.3
110800060706	Ute Creek-Canadian River	14153	57.3
110800060801	Ute Reservoir	32050	129.7

Table 3
12-digit HUC watersheds encompassed by the Ute Reservoir Watershed

HUC12	Name	Area	
		Acres	Sq Km
110800070101	Joe Cabin Arroyo	17348	70.2
110800070102	Cart Canyon-Holken Creek	28300	114.5
110800070103	Lawrence Arroyo-Holken Creek	15794	63.9
110800070104	Headwaters Palo Blanco Creek	36647	148.3
110800070105	Outlet Palo Blanco Creek	10638	43.1
110800070106	110800070106	12412	50.2
110800070107	Turley Well	26198	106.0
110800070108	Headwaters Sand Arroyo	35136	142.2
110800070109	Outlet Sand Arroyo	27780	112.4
110800070110	Sand Arroyo-Ute Creek	25556	103.4
110800070201	110800070201	15406	62.3
110800070202	Romero Spring	15203	61.5
110800070203	Pasamonte Lake	29307	118.6
110800070204	Divine Lake	32264	130.6
110800070205	Divine Lake-Ute Creek	21277	86.1
110800070206	Garcia Creek	13241	53.6
110800070207	Garcia Creek-Ute Creek	19938	80.7
110800070208	1.108E+11	16331	66.1
110800070209	Headwaters Alamocita Creek	24620	99.6
110800070210	Outlet Alamocita Creek	21709	87.9
110800070211	Alamocita Creek-Ute Creek	38052	154.0
110800070301	Headwaters Del Muerto Creek	24252	98.1
110800070302	Salado Creek	15851	64.1
110800070303	Outlet Del Muerto Creek	17850	72.2
110800070304	Bueyeros Creek	30453	123.2
110800070305	Bueyeros Creek-Ute Creek	22348	90.4
110800070306	Circle Bar Ranch-Ute Creek	32364	131.0
110800070401	Upper Carrizo Creek	11246	45.5
110800070402	Spear Draw	19235	77.8
110800070403	Middle Carrizo Creek	30918	125.1
110800070404	Lower Carrizo Creek	35170	142.3
110800070501	Chicosa Lake	34188	138.4
110800070502	Reunion Draw	27979	113.2
110800070503	Kansas Valley Lake	19820	80.2
110800070504	Sabino Creek	14575	59.0
110800070505	Ladd Lake	28412	115.0
110800070506	Las Cuevas Canyon	11948	48.4
110800070507	Las Cuevas Canyon-Tequesquite Creek	31376	127.0
110800070601	Arroyo de La Cejita	37948	153.6
110800070602	Salt Lakes	24165	97.8
110800070603	Arroyo de LaCejita-Ute Creek	13370	54.1
110800070604	Lalo Canyon-Tequesquite Creek	11891	48.1
110800070605	Arroyo del Alamo	21670	87.7

Table 3
12-digit HUC watersheds encompassed by the Ute Reservoir Watershed

HUC12	Name	Area	
		Acres	Sq Km
110800070606	Arroyo del Alamo-Tequesquite Creek	29940	121.2
110800070607	Angosta Well-Tequesquite Creek	33480	135.5
110800070608	Tequesquite Creek-Ute Creek	32950	133.3
110800070701	Black Lake	21822	88.3
110800070702	Headwaters Mosquero Creek	36497	147.7
110800070703	Outlet Mosquero Creek	16566	67.0
110800070704	Rincon Creek-Ute Creek	26346	106.6
110800070705	Ramirez Draw-Ute Creek	39675	160.6
110800070801	House Well	27785	112.4
110800070802	Fuentes Well-Ute Creek	10155	41.1
110800070803	Montesito Creek-Ute Creek	35272	142.7
110800070804	Alamosa Creek-Ute Creek	18118	73.3
110800070805	Ute Reservoir-Ute Creek	31874	129.0

BMP #	BMP	Milestones	Load Reduction				2017	2018	2019	2020	2021
			E. coli	N	P	Sediment					
1	Reduce impairments to the listed waterbodies	Hire a watershed plan coordinator within the first six months of the plan.	indirect	indirect	indirect	indirect	x	x	x	x	x
2	Control TSS of inflow.	Provide runoff control for roads.	direct	none	none	direct			x	x	x
3	Manage Tucumcari WWTP for 100% effluent reuse.	Assist and support NMSU and the City in reaching 100% use of effluent within the Tucumcari WWTP NPDES permit timeline.	direct	direct	direct	none	x	x			
4	Assist the Village of Logan in acquiring funds to extend wastewater collection to south side of the reservoir.	Support Village in grant application to improve/expand Village sewer system.	direct	direct	direct	none	x				
5	Inspect and repair defective septic tanks.	Recondition 25% of watershed septic tanks.	direct	direct	direct	none			x	x	x
6	Limit sediment loading	Keep sedimentation rates equal or lower than historic values reported by the Canadian River Compact Commission by supporting sustainable ranching.	direct	direct	direct	direct	x	x	x	x	x
7	Control phreatophyte consumptive use	Treat 1% of the watershed in the first five years of plan (jointly w/CRRRP).	direct	direct	direct	direct	x	x	x	x	x
8	Control pinon-juniper encroachment	Treat 10% of the watershed in the first five years of plan (jointly w/CRRRP).	direct	direct	direct	direct	x	x	x	x	x
9	Protect ranch roads and stream crossings from excessive erosion	Provide regular opportunities for ranchers to learn ranch road and stream crossing design that promotes rangeland health	direct	direct	direct	direct		x		x	
10	Improve grasslands	Support NMSU-TAS staff in proposals to implement grassland improvement research.	indirect	indirect	indirect	indirect	x	x			
11	Protect agricultural land use of watershed.	Develop 2 non-point source management plans that are compatible with sustainable agricultural practices (jointly w/NMSU-TAS staff)	direct	direct	direct	direct			x		x
12	Provide an incentive for group work on watershed health.	Track opportunities for collaboration with other management efforts. Propose one collaboration in first three years of plan.	indirect	indirect	indirect	indirect			x		
13	Support and spread non-point source pollution awareness among community	Develop and fund a watershed education and outreach group to inform, engage and educate watershed residents.	indirect	indirect	indirect	indirect		x	x	x	x
14	Teach children to respect land and use good practices.	Work with local school districts to develop historical ranching stewardship lessons/presentations/field trips. Offer one field trip during first three years of plan.	indirect	indirect	indirect	indirect			x		
15	Teach students about historical watershed health practices.	A minimum of 50 percent of all school children (K-12) will be educated every two years on watershed pollution by providing the school districts in the jurisdiction of the City with materials, including videos, live brochures, and other media presentations.	indirect	indirect	indirect	indirect		x	x		
16	Promote rainwater harvesting.	Work with Statewide non-profit conservation groups to arrange for at least one rural rainwater harvesting workshop during the first five years of the plan.	indirect	indirect	indirect	indirect				x	
17	Keep habitat intact for birds and wildlife.	Identify useful wildlife habitat and secure funding to implement methods to protect its ecological function. Apply for one grant during first five years of plan (jointly w/CRRRP)	indirect	indirect	indirect	indirect				x	

BMP #	BMP	Milestones	Load Reduction				2017	2018	2019	2020	2021
			E. coli	N	P	Sediment					
18	Manage entire watershed for benefit of multiple uses.	Develop or adapt metrics for grassland habitat health that are compatible with sustainable grazing practices (jointly w/CRRRP).	direct	direct	direct	direct				x	x
19	Protect and enhance riparian habitat.	Develop or adapt metrics and techniques to protect riparian zones from overuse (jointly w/CRRRP).	direct	direct	direct	direct				x	x
20	Protect playa lake ecological function (habitat, recharge, etc.)	Work with other groups to identify and study playa lakes within the Ute Reservoir watershed.	indirect	indirect	indirect	indirect					x
21	Evaluate the possibilities and impact of reusing treated municipal effluent.	Go to full utilization of Tucumcari WWTP effluent by 20XX?	direct	direct	direct	none					x
22	Develop systems to restore rangeland/riparian health and disseminate best management practices.	Solicit funding for expansion of Tucumcari Agricultural Research Station as a center for rangeland/riparian health science.	indirect	indirect	indirect	indirect	x	x			
23	Integrate NMDOT goals for stormwater management.	Give regular feedback to NMDOT during permit renewals or other public input opportunities.	indirect	indirect	indirect	indirect	x	x	x	x	x
24	Support city/county/village goals for stormwater management.	At least once during the first three years of the plan, a representative of the watershed group will meet with each city council, county board of supervisor and village administrator to explain the progress of the plan.	indirect	indirect	indirect	indirect			x	x	x
25	Co-lead public awareness efforts of state and county in stormwater quality protection for the watershed.	Solicit funding within the first two years of the plan approval to sustain a watershed-based public awareness and education program that integrates state and county goals and concerns over water quality and watershed health.	indirect	indirect	indirect	indirect	x	x			
26	Assist Logan, Tucumcari, and Mosquero School District in developing watershed education programs.	Work with the local school districts to find and solicit external funding to support watershed science at the K-12 level.	indirect	indirect	indirect	indirect		x	x		
27	Promote rainwater harvesting and re-use in urban/suburban areas.	Work with Statewide non-profit conservation groups to arrange for at least one rainwater harvesting workshop in Tucumcari or other appropriate location during the first five years of the plan.	indirect	indirect	indirect	indirect				x	
28	Support runoff protection and NPS pollution control at Ute Lake State Park.	Work with NM State Parks Division to establish BMPs for the park consistent with good environmental stewardship.	indirect	indirect	indirect	indirect				x	
29	Support boat dock policies that protect water quality of Park.	Support NM State Parks Division boat dock policy and assist staff in informing the public about the importance of a well-managed boat dock program at Ute Reservoir.	indirect	indirect	indirect	indirect	x	x	x	x	x
30	Support and promote aquatic invasive species protection for Park.	Support NM State Parks Division and NM Game and Fish Department in their efforts to protect, control and eliminate invasive species at Ute Reservoir.	indirect	indirect	indirect	indirect	x	x	x	x	x
31	Promote low impact development and green infrastructure (LID/GI) for lakeside area.	With the assistance of NMED, hold a workshop in LID/GI and stormwater management during the first five years of the plan.	indirect	indirect	indirect	indirect				x	
32	Educate and involve developers/homeowners in eliminating excessive use of plant nutrient, herbicides and pesticides.	As part of the public education and participation program, annually distribute literature at County Fairs and other public events on the proper use of home chemicals such as to avoid polluting runoff.	indirect	indirect	indirect	indirect	x	x	x	x	x
33	Develop public participation and education programs in Logan on non-point source pollution.	Work with the Village Administrator to get the message out that polluted runoff damages the residents. One public presentation in first three years of plan.	indirect	indirect	indirect	indirect			x		
34	Encourage the perception that clean water builds property values.	Use the public education and participation group to directly link property value to clean water. One homeowners presentation in first three years of plan.	indirect	indirect	indirect	indirect				x	

BMP #	BMP	Benchmark	Costs Required Unit costs	Unit	Number of units	Total cost	External funding Source	Program
1	Reduce impairments to the listed waterbodies	Work with NMED to implement the management practices developed in Section 5.0.	$ 100	per meeting	5	$ 500	USEPA	CWA 319(h)
2	Control TSS of inflow.	Provide runoff control for roads.	$ 1,700	per mile	500	$ 850,000	USEPA	CWA 319(h)
3	Manage Tucumcari WWTP for 100% effluent reuse.	Assist and support NMSU and the City in reaching 100% use of effluent within the Tucumcari WWTP NPDES permit timeline.	$ 100	in-kind		$ -	Water Trust Board	Infrastructure
4	Assist the Village of Logan in acquiring funds to extend wastewater collection to south side of the reservoir.	Support Village in grant application to improve/expand Village sewer system.	$ 500	in-kind		$ -	Water Trust Board	Infrastructure
5	Inspect and repair defective septic tanks.	Recondition 25% of watershed septic tanks.	$ 1,800	per treatment	600	$ 1,080,000	USDA	Rural development funds
5	Limit sediment loading	Keep sedimentation rates equal or lower than historic values reported by the Canadian River Compact Commission by supporting sustainable ranching.	$ 100	per acre	1700	$ 170,000	USDA	Grazing Lands Conservation Initiative
6	Control phreatophyte consumptive use	Treat 1% of the watershed in the first five years of plan (jointly w/CRRRP).	$ 5,090	per mile	20	$ 101,800	Water Trust Board	Watershed restoration
7	Control pinon-juniper encroachment	Treat 10% of the watershed in the first five years of plan (jointly w/CRRRP).	$ 500	per acre	200	$ 100,000	Water Trust Board	Watershed restoration
8	Protect ranch roads and stream crossings from excessive erosion	Provide regular opportunities for ranchers to learn ranch road and stream crossing design that promotes rangeland health	$ 5,345	per mile	50	$267,261	USDA	Grazing Lands Conservation Initiative
9	Improve grasslands	Support NMSU-TAS staff in proposals to impliment grassland improvement research.	$ 100	per meeting	5	$500	USDA	Grazing Lands Conservation Initiative
10	Protect agricultural land use of watershed.	Develop 2 non-point source management plans that are compatible with sustainable agricultural practices (jointly w/NMSU-TAS staff)	$ 10,000	per study	2	$ 20,000	USDA	Grazing Lands Conservation Initiative
11	Provide an incentive for group work on watershed health.	Track opportunities for collaboration with other management efforts. Propose one collaboration in first three years of plan.	$ 500	per meeting	5	$ 2,500	USEPA	CWA 319(h)
12	Support and spread non-point source pollution awareness among community	Develop and fund a watershed education and outreach group to inform, engage and educate watershed residents.	$ 20,000	per activity	1	$20,000.00	USEPA	CWA 319(h)
13	Teach children to respect land and use good practices.	Work with local school districts to develop historical ranching stewardship lessons/presentations/field trips. Offer one field trip during first three years of plan.	$ 1,000	per event	1	$1,000.00	private	
14	Teach students about historical watershed health practices.	A minimum of 50 percent of all school children (K-12) will be educated every two years on watershed pollution by providing the school districts in the jurisdiction of the City with materials, including videos, live brochures, and other media presentations.	$ 5,000	per event	6	$ 30,000	USEPA	CWA 319(h)

BMP #	BMP	Benchmark	Costs Required				External funding	
			Unit costs	Unit	Number of units	Total cost	Source	Program
15	Promote rainwater harvesting.	Work with Statewide non-profit conservation groups to arrange for at least one rural rainwater harvesting workshop during the first five years of the plan.	$ 8,000	per workshop	1	$ 8,000	USEPA	CWA 319(h)
16	Keep habitat intact for birds and wildlife.	Identify useful wildlife habitat and secure funding to implement methods to protect its ecological function. Apply for one grant during first five years of plan (jointly w/CRRRP)	$ 10,000	per study	1	$ 10,000	Water Trust Board	watershed restoration
17	Manage entire watershed for benefit of multiple uses.	Develop or adapt metrics for grassland habitat health that are compatible with sustainable grazing practices (jointly w/CRRRP).	$ 10,000	per study	1	$ 10,000	Water Trust Board	watershed restoration
18	Protect and enhance riparian habitat.	Develop or adapt metrics and techniques to protect riparian zones from overuse (jointly w/CRRRP).	$ 8,000	per study	1	$ 8,000	Water Trust Board	watershed restoration
19	Protect playa lake ecological function (habitat, recharge, etc)	Work with other groups to identify and study playa lakes within the Ute Reservoir watershed.	$ 30,000	per study	1	$ 30,000	Water Trust Board	watershed restoration
20	Evaluate the possibilities and impact of reusing treated municipal effluent.	Go to full utilization of Tucumcari WWTP effluent by 20XX?					USDA	Rural development funds
21	Develop systems to restore rangeland/riparian health and disseminate best management practices.	Solicit funding for expansion of Tucumcari Agricultural Research Station as a center for rangeland/riparian health science.					NMSU	
22	Integrate NMDOT goals for stormwater management.	Provide a Watershed Coordinator who will give regular feedback to NMDOT during permit renewals or other public input opportunities.	$ 70,000	per year	5	$ 350,000	USEPA	CWA 319(h)
23	Support city/county/village goals for stormwater management.	At least once during the first three years of the plan, a representative of the watershed group will meet with each city council, county board of supervisor and village administrator to explain the progress of the plan.	$ 1,000	per meeting	1	$ 1,000	USEPA	CWA 319(h)
24	Co-lead public awareness efforts of state and county in stormwater quality protection for the watershed.	Solicit funding within the first two years of the plan approval to sustain a watershed-based public awareness and education program that integrates state and county goals and concerns over water quality and watershed health.	$ 10,000	per grant	1	$ 10,000	USEPA	CWA 319(h)
25	Assist Logan, Tucumcari, and Mosquero School District in developing watershed education programs.	Work with the local school districts to find and solicit external funding to support watershed science at the K-12 level.	$ 5,000	in kind		$ -	USEPA	CWA 319(h)
26	Promote rainwater harvesting and re-use in urban/suburban areas.	Work with Statewide non-profit conservation groups to arrange for at least one rainwater harvesting workshop in Tucumcari or other appropriate location during the first five years of the plan.	$ 10,100	per workshop	1	$ 10,100	USEPA	CWA 319(h)

BMP #	BMP	Benchmark	Costs Required				External funding	
			Unit costs	Unit	Number of units	Total cost	Source	Program
27	Support runoff protection and NPS pollution control at Ute Lake State Park.	Work with NM State Parks Division to establish BMPs for the park consistent with good environmental stewardship.	$ 3,000	in kind		$ -	NMSP	General fund
28	Support boat dock policies that protect water quality of Park.	Support NM State Parks Division boat dock policy and assist staff in informing the public about the importance of a well-managed boat dock program at Ute Reservoir.	$ 2,000	in kind		$ -	NMSP	General fund
29	Support and promote aquatic invasive species protection for Park.	Support NM State Parks Division and NM Game and Fish Department in their efforts to protect, control and eliminate invasive species at Ute Reservoir.	$ 500	in kind		$ -	NMSP	General fund
30	Promote low impact development and green infrastructure (LID/GI) for lakeside area.	With the assistance of NMED, hold a workshop in LID/GI and stormwater management during the first five years of the plan.	$ 10,100	per workshop	1	$ 10,100	USEPA	319(h)
31	Educate and involve developers/homeowners in eliminating excessive use of plant nutrient, herbicides and pesticides.	As part of the public education and participation program, annually distribute literature at County Fairs and other public events on the proper use of home chemicals such as to avoid polluting runoff.	$ 500	per event	5	$ 2,500	USEPA	319(h)
32	Develop public participation and education programs in Logan on non-point source pollution.	Work with the Village Administrator to get the message out that polluted runoff damages the residents. One public presentation in first three years of plan.	$ 200	per event	1	$ 200	USEPA	319(h)
33	Encourage the perception that clean water builds property values.	Use the public education and participation group to directly link property value to clean water. One homeowners presentation in first three years of plan.	$ 500	per event	1	$ 500	USEPA	319(h)
				TOTAL ESTIMATED		$ 3,097,961		

Figures

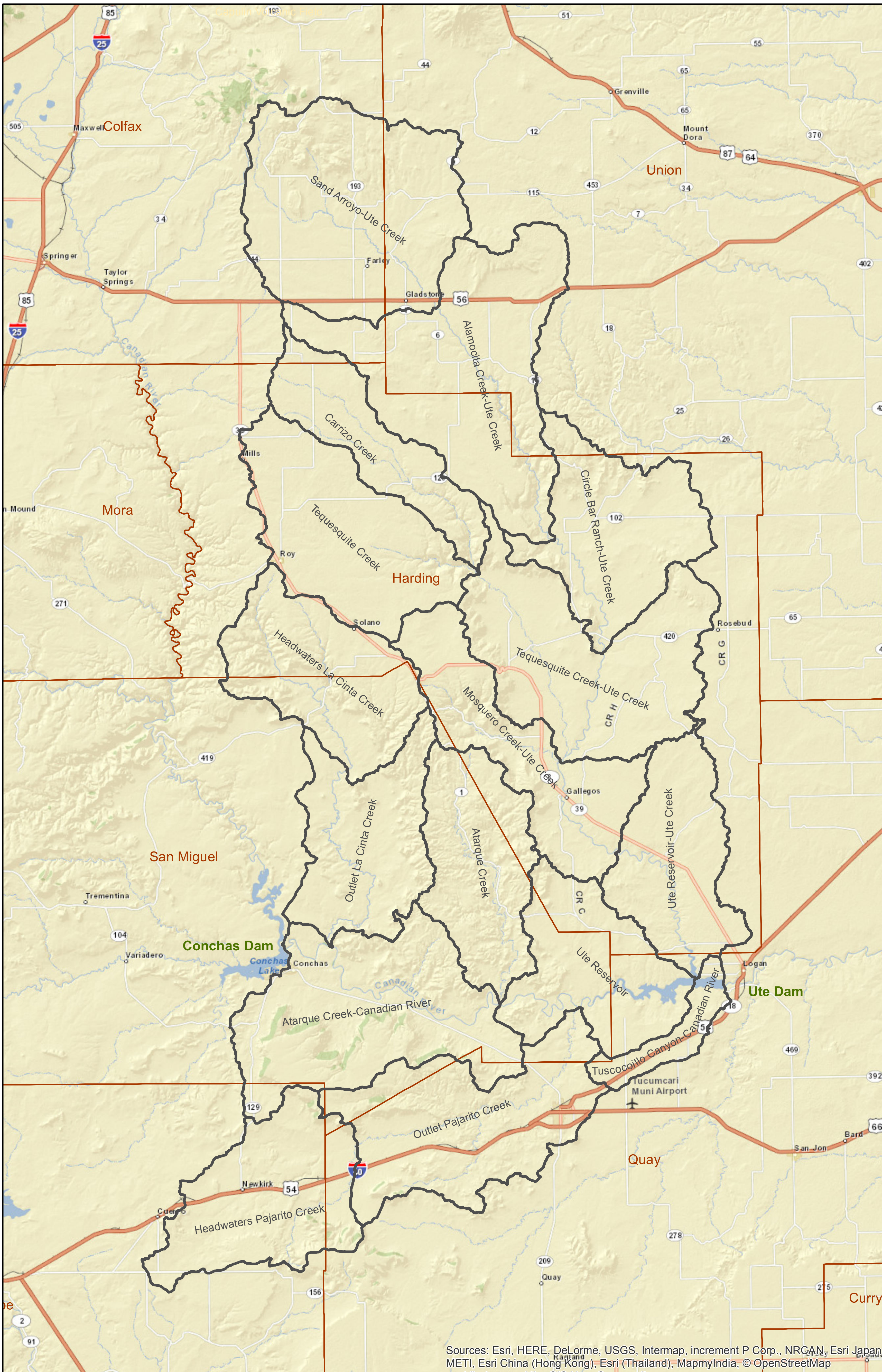

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Figure 1
Area map of Ute Reservoir region.

DATE: 2/16/2016 SCALE: 1:600,000

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APPENDIX A

WATERSHED VALUES

Ute Reservoir Watershed Alliance

Statement of values

The Ute Reservoir Watershed Alliance is the steering group of the Ute Reservoir Watershed-Based Water Quality Plan, funded by a US Environmental Protection Agency (EPA) Section 317 grant awarded to the Canadian River Soil & Water Conservation District (CRS&WCD) and administered by the New Mexico Environment Department, Surface Water Quality Bureau (SWB). In order to develop specific, measurable goals and objectives for the plan, the group has agreed upon common values that give purpose and unity to the plan.

Working with the natural ecosystems, a distinct ***quality of life*** has been achieved that is an overarching value of this watershed plan. ***Quality of life*** in the Ute Reservoir Watershed includes a sense of place in the American West, with the values, traditions and the economic structure to keep land in use while living close to nature. Accepting the often harsh climate and geography of the region, all of the human cultures of this place have worked hard to survive and thrive.

Specific values articulated by the group June 20 in a meeting at the Tucumcari Convention Center include:

1. ***Watershed yield.*** Increase flow in streams and delivery to reservoir by controlling or eradicating invasive phreatophytes (salt-cedar, primarily). Keep water level up.
2. ***Water quality of reservoir.*** Control salinity such that evaporation does not increase salinity of water and limit direct use of water. Manage discharge from WWTP to protect reservoir.
3. ***Wastewater Treatment Plan.*** Avoid future restrictions on permit by EPA, State.
4. ***Capacity of Reservoir.*** Limit sediment load and loss of volume behind dam.
5. ***Rangeland Health.*** Limit pinon-juniper expansion. Control erosion. Increase infiltration on rangeland. Protect ranch roads from excessive erosion and avoid damage to streams at road crossings.
6. ***Ranching/farming customs and culture.*** Protect agricultural land use of watershed. Quality of life.
7. ***Ecosystem services.*** Keep habitat intact for birds and wildlife. Manage entire watershed for benefit of multiple uses. Quality of life.
8. ***Tucumcari Agricultural Research Station (NMSU).*** Support research objectives. Use Tucumcari treated effluent for research on crop reuse. Support the assignment of faculty and students to station.
9. ***Forest health.*** Manage riparian and upland woodlands to be productive habitat.
10. ***Collaboration.*** Provide an incentive for group work.
11. ***Public road systems.*** Keep I40, state and county roads in top shape in order to protect waters from runoff impacts.
12. ***Cities, towns and villages.*** Protect urban/village investments that generate runoff from causing or receiving water quality impacts.

13. ***Recreation.*** Keep local and visitor use of Ute Lake State Park high. Protect opportunities for outdoor recreation. Quality of life.
14. ***Development/Property value.*** Encourage sustainable, benign land development where appropriate and within county objectives.
15. ***Cultural uses (similar to 6).*** Preserve ‘a sense of place.’ Historical importance. Quality of life.

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