Watershed Based Plan for the Mora River – Upper Canadian Plateau

Final Report

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ABBREVIATION	DEFINITION
ARMAS	Achieving in Research Math and Science – Internship program at NM Highlands University
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
CWA	Clean Water Act
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
HPWA	Hermit's Peak Watershed Alliance
LV	Las Vegas
MCWAL	Marginal Cold Water Aquatic Life
NM	New Mexico
NMED	New Mexico Environment Department
NMHU	New Mexico Highlands University
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
QAPP	Quality Assurance Project Plan
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WBPMR	Watershed Based Plan for the Mora River
WQCC	Water Quality Control Commission
WQ	Water Quality
WQS	Water Quality Standards

Executive Summary

Title of Project. Watershed Based Plan for the Mora River – Upper Canadian Plateau (WBPMR)

NPS Problem. According to the 2004-2006 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2004 Surface Water Assessment, the Mora River from the USGS gage east of Shoemaker to Hwy 434 does not support its designated standard for marginal coldwater aquatic life (NMED SWQB, 2004). This impairment was confirmed in the most recent 2014-2016 State of New Mexico CWA §303(d)/§305(b) Integrated List & Report Appendix A List of Assessed Surface Waters (NMED SWQB, 2014). Probable causes of impairment are identified in the Total Maximum Daily Load (TMDL) as: nutrient/eutrophication, biological indicators and dissolved oxygen. Probable sources of impairment are identified in the 2007 TMDL as: flow alterations from water diversions, municipal point source discharges and on-site treatment systems (septic systems and similar decentralized systems). The updated 2015 TMDL also adds the following probable sources: recreation pollution sources, silviculture harvesting, wildlife other than waterfowl, habitat modification, drought-related impacts, natural sources, and rangeland grazing.

WQ Goals and Objectives. The TMDL for nutrients approved by the EPA in 2007 states that the Mora River (USGS gage east of Shoemaker to Hwy 434) exceeded nutrient targets, specifically nitrogen and phosphorus, in multiple field tests conducted in 2002 by NMED SWQB (NMED SWQB., 2007). According to Procedures for Assessing Water Quality Standards Attainment For the State of New Mexico CWA §303(d)/§305(b) Integrated Report Assessment Protocol, Appendix D nutrient targets for transitional streams with marginal coldwater uses in the EPA Level III Ecoregion Southwestern Tablelands should not exceed 0.38 mg/L of nitrogen and 0.03 mg/L of phosphorus (NMED SWQB, 2015). However the TMDL lists the Mora River (USGS gage east of Shoemaker to Hwy 434) as having geometric mean of exceedence of 0.515 mg/L of nitrogen and 0.064 mg/L of phosphorus. The TMDL recommends a total load reduction of 34% for nitrogen and 58% for phosphorus. The TMDL lists a load of 0.154 lbs/day of Total Phosphorus and 1.946 lbs/day of Total Nitrogen that the stream could received and still meet its nutrient criterion at a critical low flow. The measured load (based on 2004 and 2006 data) was 0.328 lbs/day for Total Phosphorus and 2.637 lbs/day for Total Nitrogen. The difference (0.189 lbs/day for TP and 0.886 lbs/day for TN) is the overall load reduction goal for the stream published with the TMDL.

Original Timeframe. The work plan stated a goal of starting the grant in January 2014 and completing the WBPMR within two years. The work plan allowed for a degree of flexibility with those dates, providing the project was complete within 4 years of the start date. The actual timeframe was from late January 2014 to June 2016, two years and 6 months; this timeframe includes final EPA acceptance of the WBPMR.

Cooperators Involved.

- New Mexico Environment Department- Surface Water Quality Bureau
- Denver Zoo (in connection with the Rio Mora National Wildlife Refuge)
- U.S. Fish and Wildlife Service- Rio Mora National Wildlife Refuge
- NM Highlands University, Natural Resources Dept.
- Tierra Y Montes Soil and Water Conservation District

- High Plains Grassland Alliance
- Fort Union National Monument
- Geospatial Applications in Natural Resources (GAINS)
- Numerous private landowners

Funding. This planning project was funded entirely through EPA CWA Section 319(h) funds and was complemented by in-kind match of 54% of the total project budget, exceeding the required match by 14%.

Watershed Based Plan Highlights. This planning effort examined the current condition of the lower Mora River to identify specific causes and sources of degradation contributing to the water quality impairment and recommend efforts that can help restore healthy conditions. This plan focuses on management and restoration that reinstate watershed functions related to anchoring and rebuilding healthy soil ecosystems, encouraging soil and underground water infiltration, reestablishing riparian vegetation and buffer strips and purifying water in natural wetlands since these functions contribute most significantly to stream nutrient regulation, offer ecosystem services related to other important watershed values and are most controllable by human activities. This plan does not address point-source contributions (e.g. upstream municipal and industrial sources like the Mora Mutual Domestic Water and Sewerage Works Association, the Mora National Fish Hatchery and Technology Center, and the Mora Water Treatment facilities).

Nutrient impairments in the Mora River were substantiated with data collected in the summers of 2014 and 2015. Additionally, overall compromised stream conditions were identified with NMRAM, geomorphology and benthic macroinvertebrate surveys. GIS assessments and BASINS modeling identified and confirmed the scope and geographic range of Total Phosphorus and Total Nitrogen impairments. High nutrient loads and overall compromised stream conditions were identified to be caused by streambank erosion, stream channel incision, rangeland grazing, drought-related impacts, loss of riparian habitat, loss of wetlands, mass wasting and agriculture. Almost all of the impaired river in the Lower Mora is on private land with the exception of Rio Mora NWR. Activities that contribute to degradation of riparian vegetation and stream channels include livestock grazing, residential development, stream channel modifications, agricultural fields, roads and railroads. Social circumstances that contribute to the current impaired conditions of the Mora River are a lack of understanding about what constitutes a healthy stream and riparian area, a lack of community support to assist landowners in valuing and maintaining healthy stream conditions and inadequate financial support in our economically depressed area to implement sound land management measures. To remedy degraded conditions of the lower Mora River Watershed, both improved land management and restoration of degraded conditions are needed. This plan offers guidance, assistance and tools to landowners and land managers to develop watershed-sensitive land management practices and restoration activities for their rangeland, agricultural land, residential and riparian areas. A comprehensive suite of measures is presented that approaches watershed work from a holistic perspective, recognizing the interconnected nature of all watershed elements.

Restoration and management measures address root causes of watershed degradation that impact water quality and land health. All measures strive to reduce bare ground and reinstate abundant and diverse plant communities in upland and riparian areas with a focus on resilient native plants. They rebuild healthy soil ecosystems that enable the watershed's sponge to function and sequester and regulate nutrient movements by improving water infiltration and limiting erosion. They do this by providing carefully planned livestock management, coupled with specific tools like fencing, water development, herding and rangeland

improvements. Improvements to agricultural activities that maintain year-round plant cover like no-till and cover cropping systems and use regenerative farming practices are offered. Improved management benefits both landowners and watersheds.

Management and restoration measures also address impacts from existing infrastructures by ensuring adequate buffers between infrastructure and water courses. Roads that affect drainage systems and soil erosion are planned for redesign and reconstruction with watershed processes in mind. Restoring and supporting natural systems like wetlands and beaver communities that perform water purification and numerous watershed ecosystem services with little intervention are offered.

In order to offer the incentives and technical and financial support needed to act on these measures, conservation, planning and regulatory tools such as Conservation Easements, Wetland Mitigation Banks and financial assistance programs from various government agencies are recommended. The development of recommended riparian/stream buffers and best management practices would provide clear guidance for land use planning efforts. Work with County, State and Federal agencies to improve on regulatory or non-regulatory guidelines to support management and restoration measure are also complementary efforts. As a high priority, landowners need the tools to understand and implement efforts with educational opportunities that explain specific techniques that are practically implemented. Direct one-on-one work with landowners is likely to be most successful.

Sources of Information:

- Watershed Based Plan for the Mora River Upper Canadian Plateau Work Plan, 07/22/13
- Watershed Based Plan for the Mora River Upper Canadian Plateau, submitted to EPA 05/09/16, accepted by EPA 6/23/16
- NMED SWQB. (2007). USEPA-Approved Total Maximum Daily Load (TMDL) for the Canadian River Watershed – Part 1 (Mora River to the Colorado Border). Santa Fe, NM.
- NMED SWQB. (2004). 2004-2006 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2004 Surface Water Assessment. Santa Fe, NM.
- NMED SWQB. (2014). 2014-2016 State of New Mexico Clean Water Act §303(d) /§305(b) List of Assessed Waters. Santa Fe, NM.

Project Description and Chronology

Intro

The Mora Watershed – Upper Canadian Plateau project area is located within the Mora Watershed in northeastern New Mexico. The project area is within both Mora (60.5%) and San Miguel (39.5%) Counties. It is bounded by the Turkey Mountains and Black Mesa to the north, the creston to the west, the Great Plains to the south and canyon lands to the east. The villages of Sapello and Golondrinas are located near the southwest and west boundaries, respectively. The village of Watrous on I-25 is approximately in the center of the project area. The elevation descends from 8,500' on Black Mesa and the Turkey Mountains to 5,900' at the eastern downstream edge of the watershed. The project area begins approximately 50 miles downstream of the Mora River headwaters.

The watershed is mostly comprised of plains and rangeland with some piñon-juniper forest, canyon lands and agricultural valleys. Mostly intermittent streams and some perennial streams come from mountain sources to the north and west. Some flatter areas with small depressional wetlands or intermittent playas are scattered throughout the rangelands.

The project area is approximately 477 square miles (305,280 acres). It includes twelve 12-digit hydrologic unit codes: 110800040205, 110800040206, 110800040207, 110800040208, 110800040309, 110800040401, 110800040402, 110800040403, 110800040501, 110800040502, 110800040503 and 110800040505.

The Mora Watershed is a sub-basin in the Canadian Watershed. The Mora River starts in the Rincon Mountains north of Chacon (at about 10,000 ft.) and enters the Canadian River near the tri-county border of Mora, Harding and San Miguel Counties, a distance of 116 miles. The main tributaries feeding the lower Mora River in the Upper Canadian Plateau are the Sapello River (perennial), Wolf Creek, Tipton Creek and Dog Creek (all intermittent). The project area includes 36.6 miles of the main stem of the Mora River, which is listed as nutrient impaired, as well 130.1 miles of tributaries.

Table 1- Hydrologic Unit Codes (HUCs) and impaired river in the Mora WBP Project Area

HUC Name	HUC 12	HUC Size (mi^2)	Length of Impaired Mora River (mi)	Length of Tributaries (mi)
Arroyo de La Jara	110800040205	42.13		16.57
Sanguijuela Arroyo-Sapello River	110800040206	49.151		24.95
Lewis Ranch	110800040207	48.30		
Phoenix Lake-Sapello River	110800040208	23.19		11.22
Sapello River-Mora River	110800040309	53.43	19.35	
Headwaters Wolf Creek	110800040401	46.71		10.06
Arroyo Needam	110800040402	19.01		18.02
Outlet Wolf Creek	110800040403	55.40		22.95
Tiptun Creek-Mora River	110800040501	49.24	6.45	16.34
Dog Creek	110800040502	17.62		9.99
Cherry Valley Lake	110800040503	17.57		
Arroyo Tierra Blanca-Mora River	110800040505	55.27	10.8	
Total	**110080004**	**477.02**	**36.6**	**130.1**

Over 97% of lands in the foothills and Great Plains portions of the watershed are privately owned. Private ownership is a mixture of large ranches (including at least two over 75,000 acres) as well as many smaller ranches in the range of 100s to 1,000s of acres. The average parcel size in the project area is 780 acres.

While a significant portion of the current population in the lower Mora consists of year-round and long-term residents, probably the largest land base is owned and operated by absentee landowners. These large ranches are typically managed by a resident ranch manager. Residents of the area most typically obtain their income outside the area with the exception of a few ranches/farms that acquire most of their income from the land.

Public lands in the lower Mora Watershed consist of the Fort Union National Monument administered by the National Park Service (718 acres) and the Rio Mora National Wildlife Refuge (4,443 acres) administered by the US Fish and Wildlife Service, both under the U.S. Department of Interior. A small amount land in the far eastern edge is managed by the Bureau of Land Management (376 acres) and by the State of New Mexico (1,980 acres). Overall, Mora County is currently very sparsely populated with 2.5 people/sq. mi. (U.S. Census Bureau, 2015) over an area of 1,934 square miles. The county seat, the town of Mora in the western portion of the county, is the largest populated place in the county with 656 residents. 135 people reside in Watrous (2010 Census). The total population of the lower Mora Watershed Based Plan project area is 591 according to the 2010 census. Approximately 32 families live in Watrous and there are 10 – 15 ranches in the surrounding area (according to the Watrous Fire Department). The remainder of the population is dispersed throughout the area in the small villages of Sapello, Tiptonville, and Shoemaker or on private ranches. The population estimate for 2014 was 4,592 for the entirety of Mora County in contrast to the 4,881 people in 2010. Mora County has experienced large population declines of 11.3 percent over the past 15 years. Population declines have been largely attributed to recent drought conditions, reducing the number of available agricultural jobs (NM Office of the State Engineer/Interstate Stream Commisssion, 2016). Livestock numbers during recent drought years have also declined, as have the area of irrigated croplands.

The population of the county is 81% Hispanic, 17.7% Caucasian and 1.3% Native American. The median household income in Mora County is $24,425 with 24.2% of the population living in poverty (U.S. Census Bureau, 2015).

Within the watershed, ranching is the dominant land use, occurring in many undeveloped forest, shrub and grassland areas. There are small areas with irrigated hay fields or crops in the Mora River and Sapello River valleys. Outdoor recreation such as hunting, fishing and hiking are popular in the area with local residents on their private lands, as well as with citizens from outside of the local area, primarily on the two USDI public lands.

Development on the land within the Project Area makes up only 0.41% of the landscape. Land in this area is primarily divided into large ranches. These ranches are set up with headquarters in one area and undeveloped (grazing) land surrounding them. For this reason, land within the Project Area is primarily grassland (80.69%), used for cattle/livestock grazing. 10.84% of the land is evergreen forest, uses for which include logging and timber management and 5.57% of the land is shrub or scrub. Other minor land uses include open water, cultivated crops, hay, gravel or rock extraction pits and wetlands (U.S. EPA, 2010).

Along the Mora and Sapello Rivers, water is diverted from the river to irrigate land for hay production and other agricultural uses. Approximately 47 acequias, or community operated irrigation ditches, occur on the

Mora River and its tributaries throughout the watershed (Thompson, 2009). Acequias are part of a strong cultural heritage of cooperative land management in the local communities and throughout New Mexico (NM Office of the State Engineer/Interstate Stream Commisssion, 2016). In the Mora, where other social organizations are scant, acequia members remain connected by traditional sharing of water resources.

Figure 1- Mora River near Watrous, NM

The New Mexico Standards for Interstate and Intrastate Surface Waters designates use of water in the Mora River (USGS gage east of Shoemaker to HWY 434) as irrigation, livestock watering, marginal coldwater fishery, primary contact (swimming or other direct human contact with water), warmwater fishery and wildlife habitat.

According to the 2004-2006 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2004 Surface Water Assessment, the Mora River from the USGS gage east of Shoemaker to Hwy 434 does not support its designated standard for marginal coldwater aquatic life (NMED SWQB, 2004). This impairment was confirmed in the most recent 2014-2016 State of New Mexico CWA §303(d)/§305(b) Integrated List & Report Appendix A List of Assessed Surface Waters (NMED SWQB, 2014).

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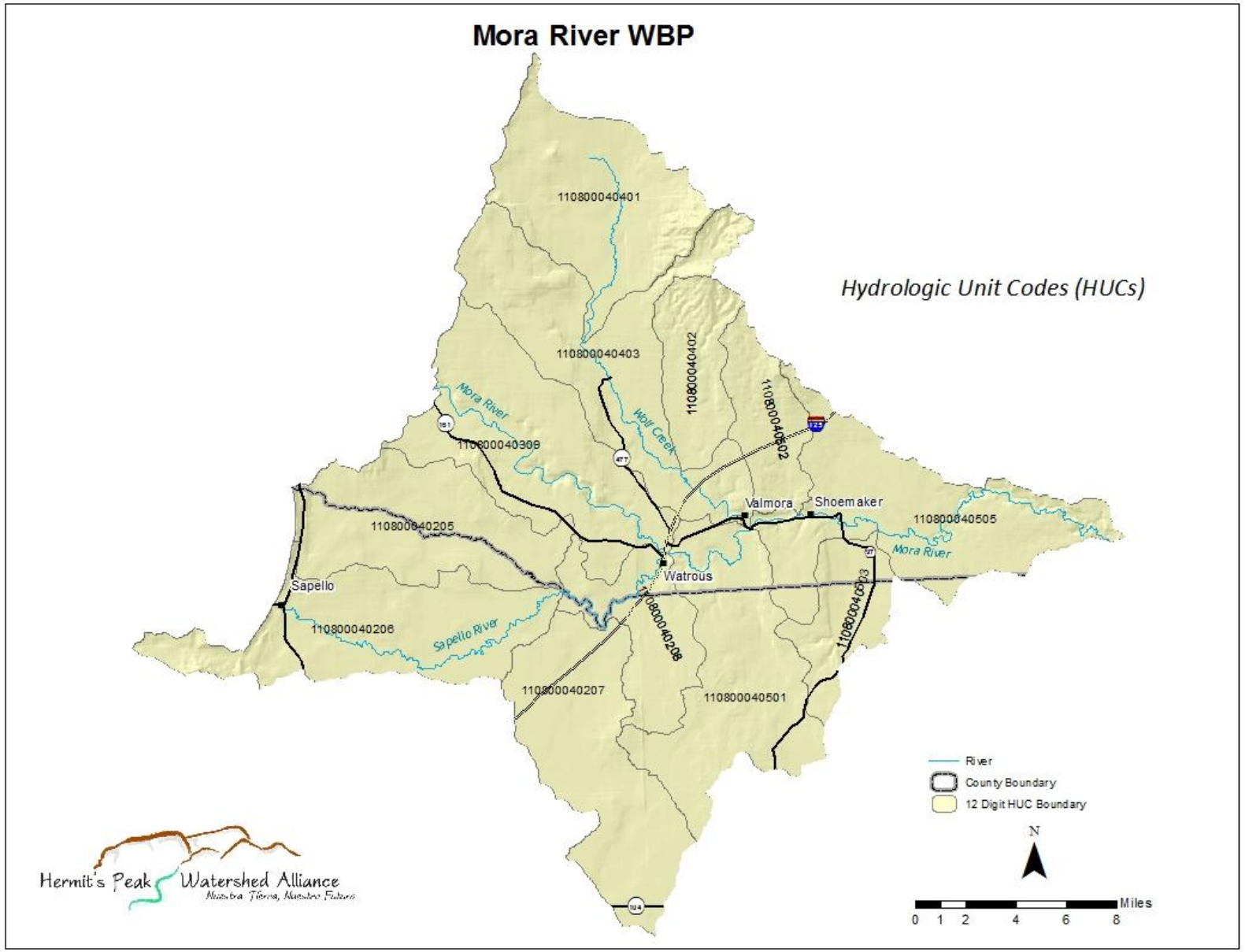
The TMDL for plant nutrients is:

$$Total\ Phosphorus: WLA\ (0.135)\ +\ LA\ (0.004)\ +\ MOS\ (0.015)\ =\ 0.154\ lbs/day$$

$$Total\ Nitrogen: WLA\ (1.705)\ +\ LA\ (0.046)\ +\ MOS\ (0.195)\ =\ 1.946\ lbs/day$$

The TMDL recommends a total load reduction of 34% for nitrogen and 58% for phosphorus. The pollutant source summary for the Mora River (USGS gage east of Shoemaker to Hwy 434) identifies 54% of the total phosphorus and 62% of the total nitrogen as point source (from municipal and industrial source discharge). The Mora Mutual Domestic Water and Sewerage Works Association (NM0024996) and the Mora National Fish Hatchery and Technology Center (NM0030031) have the only two individual National Pollutant Discharge Elimination System (NPDES) permits in the assessment unit. While the point source pollution was taken into account while calculating loading rates and load reductions, this plan primarily addresses nonpoint sources of pollution as per the purpose of 319(h) Watershed Based Plans.



Map 1-Mora WBP Hydrologic Unit Code (HUC) boundaries

This WBP is based on a scientific watershed condition assessment, informal discussions with residents and stakeholders, consultations with watershed restoration specialists and a review of literature. This base of information was then used to document and substantiate causes and sources of the water quality impairment.

In order to establish a clear understanding of the specific ecological factors affecting the nutrient impairment and the overall stream condition, HPWA conducted a variety of studies during 2014 and 2015. These studies examined numerous aspects of stream condition including:

- Nutrient Assessment Level 1 and 2 including collecting river samples for nitrogen and phosphorus analysis, collecting periphyton for chlorophyll a analysis and collecting sonde data;
- Riparian and instream condition using the NM Rapid Assessment Method (NMRAM) for Montane Riverine Wetlands, ver. 2.0;
- Geomorphology using a Rosgen Level II assessment;
- Macroinvertebrates survey as additional water quality indicators;
- River Visual Assessment;
- Watershed modeling – Bare ground, Hydrologic, Sediment and Nutrient.

Social perceptions, interests, impediments and resources were then examined by interviewing and meeting with riverfront private landowners, and other public and private stakeholders in the area (Hermit's Peak Watershed Alliance, 2016). Results of these ecological and social studies are contained in ancillary reports (available from the Hermit's Peak Watershed Alliance upon request) and provide the basis for the Watershed Based Plan.

Planned and Actual Milestones

Below is a description of project tasks that were planned and accomplished. It includes specific discussions of work completed and challenges encountered for each task. See the Lessons Learned section for more general comments.

Task 1: Engage Stakeholders

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
Identify Stakeholders	List of Stakeholders	In WBP and Final Report	Feb. 2014 -June 2014	Feb. 2014 -June 2014	Developed a list of 81 landowners
Landowner Interviews	interview report	Results in WBP	March 2014 - March 2015	July 2014 – Nov. 2015	Completed 23 interviews and received 2 completed questionnaires
3 Public Meetings	Report of meetings	In WBP and Final Report	March 2014, Nov 2014, Aug. 2015	October 2014, November 2015	Held two public meetings – see explanation below
HPWA Steering Committee	steering committee minutes	BOD and steering committee meeting minutes available upon request	monthly	Quarterly Board of Director meetings, 2 steering committee meeting (April 8, May 30, 2014)	Most members of the steering committee were also on our Board – so BOD meetings were also considered Steering committee meetings
Stakeholder meetings	review of public meetings and list of participants	See WBP and comments below	monthly	See Landowner interviews and education and outreach	This sub-task was synonymous with the Landowner interviews. Met with stakeholders individually (e.g. High Plains Grassland Alliance) – no formal stakeholder meetings beyond the 3 public meetings occurred. A tour was conducted with EPA Region 6 staff on May 11, 2016.
Include community members in data collection	none	In WBP and final report	As appropriate	Did not occur	No community members were interested in helping with data collection – work was done by interns and staff

Comments:

In addition to the tasks listed, HPWA engaged local non-landowner stakeholders such as government agencies and other organizations and engaged the general Las Vegas community via numerous PR and educational efforts (see Task 5).

Stakeholders in Mora:

At the beginning of the project, the Project Coordinator acquired maps from the county assessor's office which contained mailing addresses for all property parcels in the project area. After digitizing and organizing the databases, HPWA was able to compile a list of most of landowners and their contact information and able to target specific landowners by location (property on the river for example). Other landowners were identified by asking neighbors and other contacts. With this information HPWA notified Mora River landowners of our 319 project and requested community participation through personal letters. Additionally the Project Manager and Project Coordinator met with various landowners to explain the project and obtain permission to collect data on their property.

The first public meeting of residents in Mora was held on October 18th, 2014. This meeting was held collaboratively with the US Fish and Wildlife Service and Denver Zoo at the Rio Mora National Wildlife Refuge. The meeting was designed to introduce residents to our organization and the 319 project, get to know them personally and begin establishing a common ground of "caring for our watershed". Only two local landowners came to the public meeting. This meeting included a landowner workshop at a private in-holding property in the refuge. Steve Reichert

Figure 2 - Erosion control structure built during first public meeting October 2014

(Tierra y Montes SWCD) assisted with the erosion control workshop which involved 14 volunteers and constructed 2 large Zuni Bowls, 5 one-rock dams, and 2 rolling dips on an eroding road. The landowner provided match.

Figure 3- The Project Manager speaks with Mora landowners at an informal Open House at the Watrous Fire Station.

Our second public meeting was held on November 14th, 2015 in Watrous at the Fire Station. The open house was planned to discuss the project with locals and solicit their input. Only three people attended so it was a very informal meet and greet.

The residents in the area are not organized into community groups, many are absentee landowners and all are typically a very independent group. Public meetings appear to be a questionable strategy for meeting and talking with people in this area. Due to the fact that both public meetings had such low

attendance, HPWA determined that the best way to engage stakeholders were through personal one-on- one meetings.

A far more effective way of meeting stakeholders was to hold personal interviews. The Project Manager and Project Coordinator drafted a procedure for interviewing Mora residents. These interviews were conducted to specifically address: land uses, land use challenges that pertain to watershed and river ecosystem health, willingness to participate in field data collection, interest in restoration projects, and feasibility of restoration projects. The Project Manager then conducted private interviews with Mora River landowners to determine their interest in river restoration projects and collect general background information on land use along the Mora River. The goal of the interview project was to conduct interviews with as many local landowners who own property on the river as possible. HPWA sent out mail questionnaires to 55 landowners and created a web questionnaire for all out of town landowners. Ultimately, we were able to personally interview 23 landowners and received only 2 completed web or mail questionnaires from landowners who were unable to meet in person. In spite of the seemingly low numbers of landowners that were interviewed, good relationships were forged with those meetings and excellent project prospects were discussed. In this sparsely populated area word-of-mouth is slow and it is expected to take a number of years to become well known and trusted.

HPWA also attended a number of other events to inform the community about the project. In May 2014 HPWA attended a landowner workshop day at Pritzlaff Ranch hosted by US Fish and Wildlife Service to inform landowners in the Sapello and Mora watersheds about our watershed planning project. In September 2014 we attended a Watrous 4-H meeting to inform members and their parents of the WBP project and invited them to volunteer and participate in upcoming workshops. We also attended a number of meetings of the High Plains Grassland Alliance and have formed a strong working relationship with that future collaborator.

Finally, HPWA organized a number of landowner workshops in order to engage landowners and demonstrate some of the restoration work we do. Along with the abovementioned erosion control workshop, HPWA also conducted a Land Stewardship Series workshop titled: Beavers: Watershed Engineers held at the Pritzlaff Ranch in Sapello in November 2014. David Blagg presented and eighteen people attended. Another Land Stewardship Series was held in 2015. It was a hands-on erosion control workshop that was held at the King Ranch in Watrous in October; 12 people attended. The workshop was led by Reineke Construction, a local contractor with experience in erosion control structures. A Zuni Bowl was constructed on a gully headcut, construction of another Zuni Bowl was prepared. Match was contributed by both the landowner and contractor. See Table 5 for a complete list of workshops and events.

<u>Stakeholders from Agencies and Other Organizations:</u>

At the beginning of the planning project the Project Manager and Project Coordinator developed a list of non-landowner stakeholders (agencies and other organizations with interest in the Mora) in the general community. A letter was mailed to them explaining the 319 project. As a follow up, the Project Manager

and Project Coordinator held personal meetings with as many of these individuals/organizations as possible. These meetings were largely designed to better understand the role and interest of respective organizations in the Mora Watershed, inform them of our work and explore potential collaboration. Through these meetings, strong working relationships were built and our organization gained significant recognition.

The following table lists the non-landowner stakeholders that we interviewed or worked with over the course of this project.

Table 2- List of stakeholders and collaborators

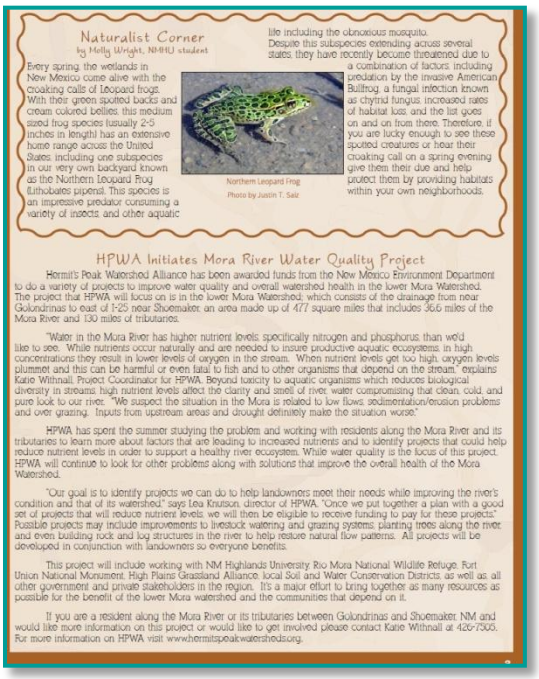
Organization	Representative
FEDERAL AGENCIES	
Fort Union National Monument	Charles Strickfaden
NRCS	Kenneth Alcon
Environmental Protection Agency	Brian Fontenot – Region 6
USFWS – Rio Mora National Wildlife Refuge	Rob Larranaga, Phillip Garcia, Debbie Pike
STATE AGENCIES	
New Mexico Acequia Association	Paula Garcia
NM Environment Department	Neal Schaeffer
NM Highlands University	Edward Martinez, Craig Conely
NMHU ARMAS	Monique Esquibel
NM Office of the State Engineer	
Tierra Y Montes SWCD	Frances Martinez
NON-GOVERNMENT ORGANIZATIONS	
Denver Zoo	Brian Miller, Shantini Ramakrishnan
Playa Lakes Joint Venture	Christopher Rustay
High Plains Grassland Alliance	Katie Meiklejohn, Michael Bain
Quivira Coalition	Mollie Walton
Friends of the Las Vegas Wildlife Refuge	Sonya Berg
New Mexico Land Conservancy	Scott Wilbur, Beth Mills
Mora Watershed Alliance	John Olivas - No longer an active organization
United World College – USA	Ben Gillock
Zeedyk Ecological Consulting	Bill Zeedyk
Watershed Artisans, Inc.	Craig Sponholtz

Figure 4- EPA and NMED staff take a tour of erosion control projects at Rio Mora National Wildlife Refuge

A tour of the Mora Watershed occurred with EPA Region 6 staff near the end of the project (May 11, 2016). The tour was organized by NMED staff. It offered Brian Fontenot (EPA's WBP reviewer) an excellent first-hand feel for the landscape covered in the plan.

PR Efforts:

At the beginning of the project HPWA pursued a number of PR efforts. The Project Coordinator regularly updated the website with information and event notifications. HPWA created and refined an email and mail distribution list specific to Mora stakeholders. A number of MRWBP documents were created, including a fact sheet, power point presentation and maps to inform the public about our organization as well as to provide information about land stewardship, the Mora nutrient impairment and many other issues.



Naturalist Corner

by Molly Wright, NMHU student

Every spring, the wetlands in New Mexico come alive with the croaking calls of Leopard frogs. With their green spotted backs and cream colored bellies, this medium sized frog species (usually 2-5 inches in length) has an extensive home range across the United States, including one subspecies in our very own backyard known as the Northern Leopard Frog (Lithobates pipiens). This species is an impressive predator consuming a variety of insects and other aquatic life including the obnoxious mosquito. Despite this subspecies extending across several states, they have recently become threatened due to a combination of factors including predation by the invasive American Bullfrog, a fungal infection known as chytrid fungus, increased rates of habitat loss, and the list goes on and on from there. Therefore, if you are lucky enough to see these spotted creatures or hear their croaking call on a spring evening give them their due and help protect them by providing habitats within your own neighborhoods.

Northern Leopard Frog

Photo by Justin T. Saiz

HPWA Initiates Mora River Water Quality Project

Hermit's Peak Watershed Alliance has been awarded funds from the New Mexico Environment Department to do a variety of projects to improve water quality and overall watershed health in the lower Mora Watershed. The project that HPWA will focus on is in the lower Mora Watershed; which consists of the drainage from near Golondrinas to east of I-25 near Shoemaker, an area made up of 477 square miles that includes 366 miles of the Mora River and 130 miles of tributaries.

"Water in the Mora River has higher nutrient levels specifically nitrogen and phosphorus than we'd like to see. While nutrients occur naturally and are needed to insure productive aquatic ecosystems in high concentrations they result in lower levels of oxygen in the stream. When nutrient levels get too high, oxygen levels plummet and this can be harmful or even fatal to fish and to other organisms that depend on the stream," explains Katie Withnall, Project Coordinator for HPWA. Beyond toxicity to aquatic organisms which reduces biological diversity in streams, high nutrient levels affect the clarity and smell of river water compromising that clean, cold, and pure look to our river. "We suspect the situation in the Mora is related to low flows, sedimentation/erosion problems and over grazing. Inputs from upstream areas and drought definitely make the situation worse."

HPWA has spent the summer studying the problem and working with residents along the Mora River and its tributaries to learn more about factors that are leading to increased nutrients and to identify projects that could help reduce nutrient levels in order to support a healthy river ecosystem. While water quality is the focus of this project, HPWA will continue to look for other problems along with solutions that improve the overall health of the Mora Watershed.

"Our goal is to identify projects we can do to help landowners meet their needs while improving the river's condition and that of its watershed," says Lea Knutson, director of HPWA. "Once we put together a plan with a good set of projects that will reduce nutrient levels, we will then be eligible to receive funding to pay for these projects." Possible projects may include improvements to livestock watering and grazing systems, planting trees along the river, and even building rock and log structures in the river to help restore natural flow patterns. All projects will be developed in conjunction with landowners so everyone benefits.

This project will include working with NM Highlands University Rio Mora National Wildlife Refuge, Fort Union National Monument, High Plains Grassland Alliance, local Soil and Water Conservation Districts, as well as all other government and private stakeholders in the region. It's a major effort to bring together as many resources as possible for the benefit of the lower Mora watershed and the communities that depend on it.

If you are a resident along the Mora River or its tributaries between Golondrinas and Shoemaker, NM and would like more information on this project or would like to get involved please contact Katie Withnall at 426-7505. For more information on HPWA visit www.hermitspeakwatershed.org.

Figure 5- HPWA newsletter summer 2014

A number of PR efforts have also taken place via radio and newspaper. At the beginning of the project articles were submitted to the Las Vegas Optic and La Voz de Mora to explain the project and solicit community participation. HPWA also spoke about this project a number of times on the local radio station KLVF. HPWA also published an annual newsletter, Ridge to River which included updates on the Mora Plan.

HPWA has participated in as many local fairs and events as possible. We have had a booth at the People's Faire and Synergy Fest with information on this project and fun/educational activities like microscopes to view benthic macroinvertebrates.

Challenges:

As HPWA was new to working in the Mora River – UCP area, it took some time and effort to find out who landowners are and how to get in contact with them. The project area is far from any cities or

towns and it was been a challenge to determine how best to target PR efforts, as newspapers and radio in Las Vegas and Mora may or may not reach the community in the project area.

The residents in the area are not organized into community groups, many are absentee landowners and all are typically a very independent and private group. Some of the landowners that we do not know personally have been somewhat hesitant to meet with us. Some of them appear to be more protective of information regarding how they are managing their lands. This hesitation caused us to rethink our approach in interviewing landowners. Furthermore, during the summer and fall it was very difficult to arrange time to meet with landowners who were busy with ranch management efforts.

The Open House, in spite of being held at the local Fire Department in Watrous and was publicized widely was not well attended as was also the case with a public meeting that was held the previous year. Public meetings also appear to be a questionable strategy for meeting and talking with people. For that reason we did not hold the third planned public meeting. While the Gallinas Watershed community is close knit and best approached personally, the best way to connect with stakeholders in the Mora area is likely through the internet.

Task 2: Project Administration

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
QAPP preparation	EPA approved QAPP	NMED records, HPWA files – available upon request	March 2014	QAPP prepared March 2014	EPA accepted May 2014
Quarterly progress reports and invoices	Reports and invoices	NMED records, HPWA files – available upon request	Quarterly: Jan. 2014-Jan 2016; invoices as needed	Semiannual reports: June 2014, Jan. 2015, June 2015, January 2016; 20 invoices were submitted and paid by NMED	NMED asked that progress reports only occur semi-annually
Final progress report	Final Report	NMED records, HPWA files – available upon request	upon completion (before Jan 2016)	June 2016	6 month project extension from Jan. to June was requested and approved

Comments:

Project Administration included project oversight, coordinating activities, organizing project initiatives, keeping and maintaining proper records, submitting required reports, and development and enforcement of a QAPP

Keeping and Maintaining Proper Records:

At the start of the project the Project Manager met with the contracted Accountant, Project Coordinator and HPWA Treasurer to set up bookkeeping system. The Project Manager developed record keeping forms and procedures (e.g. timesheets, match documentation) and established billing, account payable and payroll procedures. Invoices were submitted to NMED on a regular basis (20 invoices were submitted over the 2.5 year period). The Project Manager reviewed financials and billing and accounting procedures with Accountant and HPWA treasurer quarterly. Additionally the Project Manager completed all year-end financial review and reports. The day-to-day bookkeeping was done by the Project Manager rather than the contractor.

Project Oversight/Coordinating Activities/Organizing Project Initiatives:

Board of Directors meetings were held quarterly to conduct general HPWA business and update the Board on the status of the 319 project.

The Project Manager and Project Coordinator established a 319 Steering Committee to hold monthly meetings at the beginning of the project. The Steering Committee consisted of the Project Manager, the Project Coordinator, Dr. Brian Miller of Denver Zoo, Phillip Garcia and Debbie Pike of USFWS, Joe Zebrowski of GAINS lab and Dr. Edward Martinez of NMHU. These steering committee meetings were held only two times during the initial phase of the planning project in order to plan our approach to engaging stakeholders and planning educational and outreach events. During the remainder of the project steering committee members were frequently consulted on an individual, as-needed basis and quarterly Board of Director meetings occurred to obtain other guidance.

The Project Manager and Project Coordinator met regularly with all contractors (KI Bar Consulting, Watershed Artisans, Inc., the NMHU Water Chemistry Lab and Ernesto Sandoval) as well as with all OSM/VISTA and NMHU Interns to review and guide their work.

Submitting Required Reports/Development of a QAPP:

The Project Coordinator completed and submitted 4 semiannual reports during the duration of the project: June 2014, January 2015, June 2015 and January 2016. She also completed the QAPP on March 13, 2014 to guide data collection and obtained approval of it from EPA on May 12, 2014. The Project Coordinator ensured that the QAPP was followed by all staff, contractors and interns involved in data collection.

Other Project Administration Tasks:

HPWA interviewed and hired three contractors and one intern in the summer of 2014 to conduct field monitoring work and assist with landowner interviews. One contractor was a NMHU student who specialized in benthic macroinvertebrates, he was hired to conduct the macroinvertebrate survey with guidance from Dr. Edward Martinez. Two contractors were former ARMAS interns who had the experience and expertise to conduct geomorphology and NMRAM monitoring. The one intern, provided to us through the NMHU ARMAS program assisted with the field monitoring.

During the course of the project HPWA sponsored two OSM/VISTA volunteers through the Western Hardrock Watershed Team. They worked on numerous PR efforts, education and outreach events, and put together a Watershed Trunk with educational curriculum which was distributed to local schools.

The Project Coordinator, field crew and OSM/VISTA participated in NMRAM training put on by NMED to ensure a consistent approach to employing NMRAM protocol.

Challenges:

No specific administrative challenges were experienced through the course of this project. HPWA administrative processes are well formed and efficiently executed at this point. Our three year participation in the OSM/VISTA program was concluded in April 2015. With the loss of that education and outreach staff our abilities to conduct those tasks has declined.

Task 3: Assemble and Review Available Data

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
Assemble existing information	List and review of existing and historical data	In WBP	January-February 2014	Feb-March 2014,	
	series of maps summarizing watershed attributes from existing data,	In WBP	Jan.- June 2014	Feb-July 2014	
	list of previously published research for the project area.	In WBP	Jan.-June 2014	Feb 2014-January 2016 (ongoing throughout project)	

Comments:

Accomplishments: HPWA assembled, reviewed, and backed up numerous forms of available data pertaining to the lower Mora Watershed. Most data are summarized in the WBP.

Geospatial Data:

HPWA purchased landowner maps from the local county assessor's office and developed landownership data layer in GIS. This landownership data includes parcel boundaries and ownership information. The Project Coordinator also assembled GIS data listed in Table 4.

Table 3- List of acquired GIS data

Data Type	Data Files	Source
Hydrography	National Hydrography Dataset	USGS
Wetlands and Playas	National Wetlands Inventory, Playas	Playa Lakes Joint Venture, U.S. Fish and Wildlife Service
Demographics	2010 Census Data	Census Bureau
Vegetation	Landfire Vegetation Type, Vegetation Cover, SWReGAP land cover, National Landcover Dataset	Landfire, SWReGAP, NLD
Soils	NRCS Soil Survey	USDA NRCS
Parcel Ownership	Parcel boundaries, E911 addresses	San Miguel County
Background and Boundary	DOQQs, DEMs, Topo, County Boundaries, Roads, railroads, Cities, land ownership, EPA Ecoregions	USDA, USGS, Census 2010, USFS
Monitoring	Temperature, Geomorphology, Canopy and Width to Depth, Greenline, EMAP, beaver	HPWA
Bare Ground	Identified using Landsat Imagery	HPWA
Identified Restoration Projects	Created with input from local landowners, community mapping exercise, watershed restoration consultants, and HPWA staff	HPWA

Other Information:

The Project Manager and Project Coordinator assembled and reviewed information and reports on previous projects, studies and restoration efforts in the Lower Mora. Additionally previous watershed related field research was assembled and reviewed. All field data collected by HPWA for the 319 planning grant was organized and backed up.

Challenges:

Land ownership information was difficult to come by for some properties. While we did identify the majority of landowners in the project area, we were unable to identify a few of them, even with the aid of county assessor documents. Without a strong social network in the area, finding contact information for landowners was challenging.

Task 4: Assess Current Field Conditions

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
Field monitoring	Reports including methodology, results and analysis of field assessments, results of models and GIS	In WBP and ancillary reports	April – Sept. 2014 and April – Sept. 2015	April – Oct. 2014 and April – Oct. 2015	
Spatial modeling	Reports including methodology, results and analysis of field assessments, results of models and GIS	In WBP	Sept. 2014-Feb. 2015	January 2015-December 2015	Spatial modeling took much longer than anticipated to complete.

Comments:

Accomplishments: HPWA conducted field studies, and analyzed collected data for stream nutrients, stream geomorphology, riparian habitat, and benthic macroinvertebrates. GIS analysis and BASINS modeling of the entire watershed was also conducted. Finally, a visual assessment of the lower section of the project area (from Watrous downstream) was carried out by the watershed restoration consultant.

Methods/ Sampling/ Logistics:

During the development of the work plan field monitoring methods were determined including NMRAM, Rosgen II, NMED SOP's for nutrient assessment and macroinvertebrate surveys. Models were

researched included AQUATOX, SPARROW, BASINS, Pacific Southwest Interagency Model, SWAT and STEPL. After conducting research on the above models it was decided to use BASINS and STEPL.

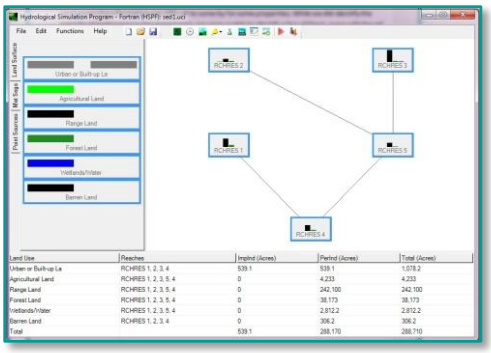


Figure 6- BASINS/ HPSF model for the Mora River

Monitoring sites were then identified, sites were chosen based on reach, access, and other inputs such as above or below tributaries. Equipment (sonde) and supplies were ordered and assembled. A timeline and schedule was developed for the field work. Landowner monitoring agreements were developed and a permit was submitted to conduct monitoring on the Rio Mora National Wildlife Refuge.

Three contractors and one ARMAS intern were hired to conduct the NMRAM, Rosgen II, and macroinvertebrate surveys in the summer of 2014. The Project Coordinator conducted the nutrient surveys in 2014 and 2015. Nutrient analysis was completed at the NMHU Water Chemistry Lab in 2014; the analysis was moved to the NM State Laboratory Division in 2015 due to instrument errors at the NMHU Lab.

Field Work

Figure 7- Collecting macroinvertebrates, March 2014

In late March and mid October of 2014 benthic macroinvertebrates were collected at four sites on the Mora River. These were sorted and identified during the summer and fall of 2014.

In early June 2014, the field crew attended a three day NMRAM workshop in Santa Fe, NM.

During the month of June 2014, NMRAM, geomorph and Nutrient Level 1 surveys were completed at 8 sites along the river.

Nutrient Level 2 surveys were conducted in October 2014, including deploying the sonde for 72 hours at each site.

Nutrient Level 1 and 2 surveys were repeated in 2015 in June and October, respectively.

Data Analysis

At the end of the 2014 field season, the Field Coordinator conducted data analysis for the geomorphology and NMRAM sites monitored. She presented findings of the field assessments to the Project Manager and Project Coordinator. Additionally, the Field Coordinator completed a report of the findings "*Watershed Condition Assessment of the Lower Mora River*". The Field Coordinator was also

contracted to research and write a literature review concentrating on the efficacy of BMPs in reducing Total Nitrogen and Total Phosphorus from streams. It was completed in 2015.

The contractor who conducted the benthic macroinvertebrate survey spend the summer and winter of 2014 sorting and identifying the samples he collected in the spring and fall of 2014. He provided a report entitled "*Benthic Macroinvertebrate Bioassessment of the Lower Mora River*" which outlined the results of the surveys.

Figure 8- Field crew conducting a geomorphology survey, June 2014

The Project Coordinator began analysis of nutrient data after the Nutrient Level 2 Assessment was complete each year. She began BASINS modeling in early 2015. As she was not familiar with the model, it took some time and trial and error to learn BASINS and HSPF using online EPA tutorials and forums for guidance. The Mora Watershed was broken down into 5 subwatersheds for which she was able to calculate total nitrogen and total phosphorus loading rates over a 9 year period. The results of the modeling are contained in the report "*Hydrologic Analysis of Management and Restoration Measures for Nutrient Control in the Lower Mora River."* With that information STEPL was used to determine load reductions.

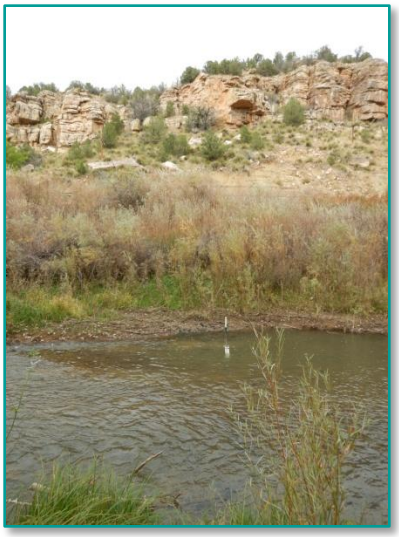


Figure 9- Sonde deployed at Cherry Valley near the downstream end of the project area

<u>Challenges:</u>

Instrument problems at the NMHU Water Chemistry Lab resulted in no data for TKN analysis for the Level II Nutrient Survey collected in fall 2014. As a result of this missing data HPWA moved water chemistry analysis to the NM DOH State Laboratory.

Landowners at the farthest upstream monitoring site requested that we no longer monitor on their property in the spring of 2015. This was not due to any issue they had with HPWA, but their personal preference to not allow access to outside organizations. We did not replace the monitoring site as that property is the only property within the project area that is upstream of Rio Mora (the monitoring site directly downstream).

BASINS modeling took some considerable time as the Project Coordinator self-taught herself the program using online tutorials and forums; no assistance was available from EPA or NMED. This took quite a bit of trial and error but ultimately was a successful effort.

Task 5: Community Education on Watershed Health and Restoration

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
4 landowner workshops	list of all landowners and students participating in trainings/worksh ops/classes	HPWA records	May 2014, August 2014, May 2015, August 2015	See Table 5 below	11 landowner workshops and 8 other educational events were held
4 field trips for K-12 students	K-12 education report. Various educational events conducted by Denver Zoo at Rio Mora National Wildlife Refuge	List of events in match reports and quarterly reports	2014-2015 school calendar year	March 22, 2014 April 22, 2014 July 9, 2014 July 16, 2015 Oct. 14, 2015	1. Student riparian planting day – Rio Mora (10 students) 2. River Health field day (32 students) 3. Outdoor recreation day 4. Restoration workshop (48 students) 5. Restoration workday and tour (Rocky Mtn. Youth Corps)
Develop and distribute educational materials (brochures, posters)	brochure series	HPWA files	ongoing	ongoing	Brochure series and poster were not developed. Handouts for workshops were produced and distributed to participants.
Develop traveling watershed trunk curriculum for schools	traveling watershed trunk	HPWA files – available upon request	Dec. 2014	October 2015	Collection of 5 watershed lessons tied to Standards and Benchmarks provided to 2 local high schools
Hold a watershed conference	watershed conference report	Conference was not held, see landowner workshops and descriptions of the Land Stewardship Series	June 2015	See Table 5 for list of events	The Land Stewardship Series was substituted for the Watershed Conference. Consisted of 19 educational events.

Comments:

Accomplishments:

In addition to identifying landowners and stakeholders in the lower Mora Watershed with public records and "word-of-mouth" information, mailing them information about the project along with a questionnaire and then interviewing many of them, 19 educational events were held to inform locals of our work and solicit their ideas and knowledge (see Table 4).

These events were part of the Land Stewardship Series (LSS) hosted by HPWA which began in 2013. This series provides a variety of educational presentations to the public about topics relevant to both land stewardship and watershed health. Landowners and managers are the target audience but others benefit as well. This series of continued, small and usually simple educational programs seems to be a very cost-effective means of providing landowner support and education, with approximately 319 participants.

Figure 10- LSS Weed Identification Workshop at LVNWR

LSS events are a combination of lecture presentations, on-the-ground tours and hands-on workshops. Topics have included: soil health, erosion control, weed management, managing horses on small properties, a farm tour and talk and grazing and rangeland health among many others. Some topics were particularly popular, like weed management and the farm tour, while others were not well attended, such as conservation easements and a water catchment construction day.

The Land Stewardship Series was a substitute for the planned Watershed Conference (in original proposal and work plan) because the Steering Committee and HPWA Board of Directors and staff believed that it was a more effective means of delivering ongoing information and support for watershed stewardship than a one-time Watershed Conference event. LSS events are relatively small, inexpensive (most of the promotion, locations, and instructors are donations) and easy to arrange unlike a large conference that can be very costly and time consuming with only a one-time benefit.

Figure 11- LSS event Harvesting and Conserving Water from Rural Roads

In addition to HPWA events, numerous events were held at the Rio Mora National Wildlife Refuge to engage volunteers in land stewardship, many of them focusing on weed treatments and construction of erosion control structures. These volunteer events were organized by the USFWS staff

and the Friends of the Las Vegas National Wildlife Refuge and all complemented HPWA work by increasing local watershed involvement.

Two specific public meetings were held for Mora-area residents to provide information about the WBP project and get to know residents. One was held collaboratively with the USFWS Rio Mora National Wildlife Refuge as part of their landowner day and one was held independently. The first entailed a hands-on workshop which HPWA conducted to build arroyo erosion control structures (Zuni Bowl and one-rock dams) on private property adjacent to refuge. The workshop was conducted concurrently with a presentation by USFWS and HPWA with information tables. Both public meetings were not well attended; the first had two landowners participate in the inside presentation portion (12 students attended the erosion control workshop portion), the second had three. This lack of attendance indicates the challenges related to bringing people together in this rural area, especially if the topic is not already familiar or individually compelling. Landowners appear to be much more interested in educational events that pertain to something they can specifically apply on their land, like weed management.

Denver Zoo, working with and at the Rio Mora National Wildlife Refuge, held over eleven educational events in conjunction with this project to provide land health education to local and distant youth; over 300 students participated in these events. Events included numerous hands-on workshops involving erosion control and weed management, general watershed health, water quality monitoring and general natural history. While they did not target landowners in the lower Mora area, they contributed to overall education of the next generation of landowners.

A further contribution to youth education that was part of this project entailed the creation and presentation of a curriculum of watershed activities for high school students. The curriculum that was developed consisted of a series of five activities including teacher instructions and background information that was provided to the West Las Vegas and Robertson High Schools in Las Vegas. Activities included:

- What is a Watershed?
- The Life In and Around a River Bosque
- Soil Texture and Permeability and How it Relates to Watershed Health
- River Discharge and Use
- Water Quality Testing

No schools exist in the villages of the lower Mora Watershed and most resident students attend schools in Las Vegas, hence its presentation to Las Vegas schools. Contact HPWA to obtain a copy of this curriculum (hpwa@hermitspeakwatersheds.org).

Table 4- Educational Events Held During the Project Period as Part of the HPWA Land Stewardship Series

Date	Topic	Presenters	# of Attendees
2014			
Feb. 19	Working on Roads and their Land Relationship	Bill Zeedyk	18
March 22	Riparian Planting work day in the Gallinas Watershed	HPWA	17
April 23	Leaving a Land Legacy: Conservation Easements	Charlie O'Leary, Santa Fe Conservation Trust and Beth Mills, NM Land Conservancy	6
June 6, 7	Managing Horses on Small Properties - a two day workshop	Cooperatively organized with Quivira Coalition	12
June 28	Water Catchment for Livestock work day	Kathryn Mahan and Ikhzaan Saleem, KI Bar Consulting	1
July 30	Weed Doctors: Identification and Treatment of Weeds	Lydia Ulibarri, Tierra Y Montes Soil and Water Conservation District and Mollie Walton, Quivira Coalition	30
Sept. 9	Watrous 4-H: Caring for you Watershed	HPWA	20
October 18	Landowner Workshop at Rio Mora National Wildlife Refuge and adjacent private land: Hands on Erosion Control at Larry Humphreys and Anne Farrell property and presentation of Mora Watershed Based Planning effort	USFWS, Tierra y Montes Soil and Water Conservation District	2 landowners 12 United World College students
October 29	Grazing and Grassland Health	Kirk Gadzia, collaboration with Denver Zoo	25
Nov. 15	Beaver: Watershed Engineers	David Blagg	18
2015			
March 14	Get Ready for Gardening Season – a farm tour of UWC Agroecology Research Center	Ben Gillock, UWC	42
March 28	La Milpa Community Garden – gardening techniques	Collaboration with USFWS and Friends of the Las Vegas Wildlife Refuge	27
June 20	Fly fishing Clinic	Aaron Juarros, Zia Fly (Taos, NM)	10
July 30	Understanding and Managing Weeds	Mollie Walton, Quivira Coalition and Craig Conley, NMHU	45
August 4	Rotary Club presentation on HPWA activities	HPWA	14
August 29	People's Faire	HPWA - booth	hundreds
Oct 17	Erosion Control Work Day	Mark Reineke, Reineke Construction, King Ranch	12
Nov 7	WBP Open House	HPWA, Watrous	3
Nov. 5	Soil Health and Carbon Sequestration	Craig Conley	25

Challenges:

A continuing challenge is developing an education and outreach strategy and system of support that is both effective and sustainable. The question of effectiveness must be addressed with the local setting first in mind but then must be adaptable to accommodate realities of a situation. The lower Mora area is distinctly different from the Gallinas (where we have worked in the past) so needed a unique approach. We are pleased with the decision to forego a large Watershed Conference in favor of more regular, small events that are held close to home and require relatively little time to organize and participate in. The Land Stewardship Series met these requirements.

Having adequate personnel to carry out education and outreach activities is also a constant challenge. During the first 18 months of this Mora WBP project, we had an enthusiastic OSM/VISTA staff person who effectively did that work. When that program was completed (mid 2015) that work was added to the Project Manager and Coordinator tasks. Finding reliable volunteers to help our organization has proven to be a time consuming and questionable endeavor.

Task 7: Prepare Draft Watershed Based Plan

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
Develop draft plan	Draft plan	HPWA files	June-Aug. 2015	Jan- March 2016	A project extension request was submitted and approved
Review plan by NMED, Board, stakeholders, experts, public with a public meeting	Draft plan and community review comments	HPWA files	Aug.- Oct. 2015	April- May 2016	Detailed review occurred by 7 reviewers plus NMED. No public meeting occurred to present draft plan since attendance in the past was extremely poor.

Comments:

HPWA began work to develop the plan by reviewing the EPA WBP Handbook and other completed plans, drafting an outline and assigning tasks to team members. We developed the Draft Watershed Based Plan and sent it out to 37 people and received review from our Project Officer, Steering Committee, Board of Directors, selected individuals and the general public in the Mora in early April 2016. Because data analysis and reporting took longer than expected (because of larger volumes of data and analysis challenges), drafting the plan occurred later than expected. The review period for the plan

was consequently shortened to 3 weeks. This did not appear to affect the thoroughness of the review period. We received in-depth comments from 7 stakeholders as well as from NMED. Those comments were incorporated into the plan and it was then submitted to EPA on May 9th, 2016 for review.

Challenges:

While in the process of drafting the Watershed Based Plan the following issue arose:

HPWA was contracted to develop this WBP in January 2014. In late July of 2015, NMED-SWQB revised the 2007 TMDL for this reach. This changed the TMDL from:

WLA[1] (lbs/day) + LA[2] (lbs/day) + MOS[3] (10%) = TMDL (lbs/day)

Equation 1- 2007 Nutrient TMDL (NMED SWQB., 2007)

Total Phosphorus	0.135	+	0.004	+	0.015	= 0.154
Total Nitrogen	1.705	+	0.046	+	0.195	= 1.946

to:

WLA (lbs/day) + LA (lbs/day) + MOS (10%) = TMDL (lbs/day)

Equation 2- 2015 Nutrient TMDL for Summer (NMED SWQB, 2015)

Summer (May to September)

Total Phosphorus	1.16	+	1.31	+	0.27	= 2.75
Total Nitrogen	9.41	+	21.9	+	3.48	= 34.80

Equation 3- 2015 Nutrient TMDL for Winter (NMED SWQB, 2015)

Winter (October to April)

Total Phosphorus	0.38	+	0.34	+	0.08	= 0.79
Total Nitrogen	3.18	+	5.84	+	1.00	= 10.03

This substantial change was derived primarily from determining a different critical flow and, to a lesser extent, reducing measured load results by using an arithmetic mean rather than a geometric mean of exceedences of TN and TP concentrations from water quality surveys. The TMDL does not explain a rationale for the different mean calculation. Regarding critical flow, the 2007 TMDL used the low flow (0.87 cfs) because of the negative effect decreasing flows have on nutrient concentrations and algal growth. However, the revised 2015 TMDL used the median flow, which was substantially greater (17 cfs in the summer and 4.9 cfs in the winter).

[1] Waste Load Allocation (point sources)
[2] Load Allocation (nonpoint sources)
[3] Margin of Safety

The revised TMDL explains:

> "The summer and winter median flows were calculated using gage data from 2004-2014. This period was selected because it represents the most recent hydrologic conditions but also is representative of long term precipitation based on tree ring data from AD 1000 – 2000 (Gutzler 2007). In addition, the median gaged flow from the period of record (considered to be 1998 to present because the Mora Fish Hatchery came online in 1998) was calculated to be 5.3 cfs and the last decade median flow value was 4.9 cfs. Thus, using the full period of record may overpredict current flow conditions in the Mora River. Summer (May to September) and winter (October to April) median flows, based on daily flows from the USGS gage at La Cueva and corrected for diversions, are listed in Table 1.4." (NMED SWQB, 2015)

In New Mexico, using the median flow appears to be unique to this revised TMDL. The conceptual effect of this new TMDL is to render the Mora River bigger than it is. In particular, the new load allocations increased by a couple orders of magnitude; however, the watershed remains the same size. In contrast, other nutrient TMDLs (apparently based on low flows rather than median flows) list the following load allocations:

Equation 4- Nutrient TMDLs for various rivers throughout New Mexico

Oak Creek (tributary to the Dry Cimarron River), 2009 (NMED SWQB, 2009):

	WLA (lbs/day)	+ **LA (lbs/day)**	+ **MOS (10%)**	= **TMDL (lbs/day)**
Total Phosphorus	0	+ 0.062	+ 0.016	= 0.078
Total Nitrogen	0	+ 0.779	+ 0.195	= 0.974

Canadian River (Cimarron River to Colorado Border), 2011 (NMED SWQB, 2011):

	WLA (lbs/day)	+ **LA (lbs/day)**	+ **MOS (10%)**	= **TMDL (lbs/day)**
Total Phosphorus	0	+ 0.098	+ 0.017	= 0.115
Total Nitrogen	0	+ 1.47	+ 0.260	= 1.73

Pajarito Creek (Canadian River to Headwaters), 2011 (NMED SWQB, 2011):

	WLA (lbs/day)	+ **LA (lbs/day)**	+ **MOS (10%)**	= **TMDL (lbs/day)**
Total Phosphorus	0.230	+ 0.028	+ 0.005	= 0.263
Total Nitrogen	3.45	+ 0.416	+ 0.074	= 3.94

Uña De Gato Creek (Chicorica Creek to Highway 64), 2011 (NMED SWQB, 2011):

	WLA (lbs/day)	+ **LA (lbs/day)**	+ **MOS (10%)**	= **TMDL (lbs/day)**
Total Phosphorus	0	+ 0.041	+ 0.007	= 0.048
Total Nitrogen	0	+ 0.606	+ 0.107	= 0.713

The first step to address non-point source load reduction planning is to determine the load reduction required. This is the measured load minus the target load, and it is expressed as a negative number (a

"reduction"). The measured load derives from the concentration of the pollutant and the flow on the day is was collected. However, under the revised TMDL, the target load is much larger. As a result, the non-point source load reduction required is likewise much larger.

In fact, for this reach of the Mora River, HPWA does not believe that the load allocation in the revised TMDL is attainable. HPWA modeling conducted in 2015 identified loading rates for TN and TP based on land use. In order to meet load reductions based on the updated TMDL it would require restoration work on approximately 112,000 acres of land in the watershed. That translates to 38% of the entire watershed which is clearly unattainable. Not only would this work cost more than $350 million to accomplish but the practicality, logistics and time required to complete this work make it nearly impossible. Finally, TN and TP loading rates and BMP efficiencies are calculated on a yearly basis. There is no clear means to separate these efficiencies and loading rates by season to calculate load reductions for the updated TMDL.

Field samples collected during the 2014 and 2015 seasons show that 66% of TN and TP samples that exceeded nutrient standards were collected during flows below the median identified in the updated TMDL (17cfs). Additionally, modeling completed by HPWA show that the original critical low flow is much more representative of effects on nutrient concentrations than the updated TMDL. Modeling results show that at flows of 0.87 cfs and below 100% of TP concentrations exceed nutrient standards and 87% of TN concentrations exceed standards. On the other hand, at flows of 17 cfs and below, only 21% of TN concentrations and 61% of TP concentrations exceed standards.

Finally, the updated TMDL arguably has a WLA which is too high but HPWA is not equipped to recommend ways to alleviate discharge from the Mora WWTP and National Fish Hatchery. However, an engineered and aggressively managed riparian zone could be managed to attenuate nutrients below their outfalls.

HPWA identifies this apparent problem with the revised TMDL as a data gap. The observed pollutant concentrations and the permitted point sources seem to lead to excessive nutrient concentrations that cannot be ameliorated with non-point source controls. HPWA doesn't know whether this can be resolved through greater control over the point sources.

As a result of the above listed problematic issues with the revised TMDL, this Mora WBP is using the original 2007 TMDL as a basis for calculating loads and load reductions. With the original TMDL this WBP contemplates reasonable load reductions. This planning could achieve the load allocation in the previous TMDL, but (as explained above) not the revised TMDL. All further references to load reductions in this plan will refer to the original 2007 TMDL.

Upon acceptance of the Watershed Based Plan by the EPA in June of 2016, EPA stated that they would look further into this TMDL issue, and that in the future either the new 2015 TMDL or our WBP would need to be updated depending on the outcome of the investigation into the TMDL.

Task 8: Preparation of a Final Watershed Based Plan

The below table summarizes task completion.

Implementation Plan	Deliverable	Location of Deliverable	Planned Schedule	Actual Schedule	Comments
Resolve issues from review, publish plan and distribute – printed & digital.	Final Watershed Based Plan including all above mentioned reports.	HPWA Website, NMED Website, emailed to all project stakeholders, copies available upon request	November 2015-Jan. 2016	Final Watershed Plan approved by EPA June 2016	The TMDL challenge discussed above will be resolved in subsequent updates to the WBP.

Comments:

The Watershed Based Plan for the Mora River Upper Canadian Plateau was accepted by EPA on June 23, 2016. EPA did not require any revisions or changes.

Challenges: None

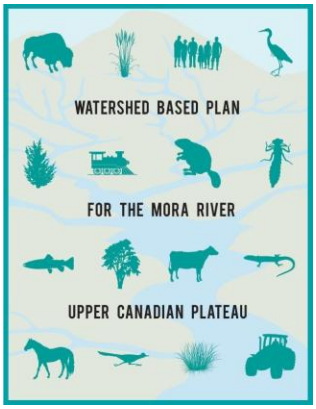


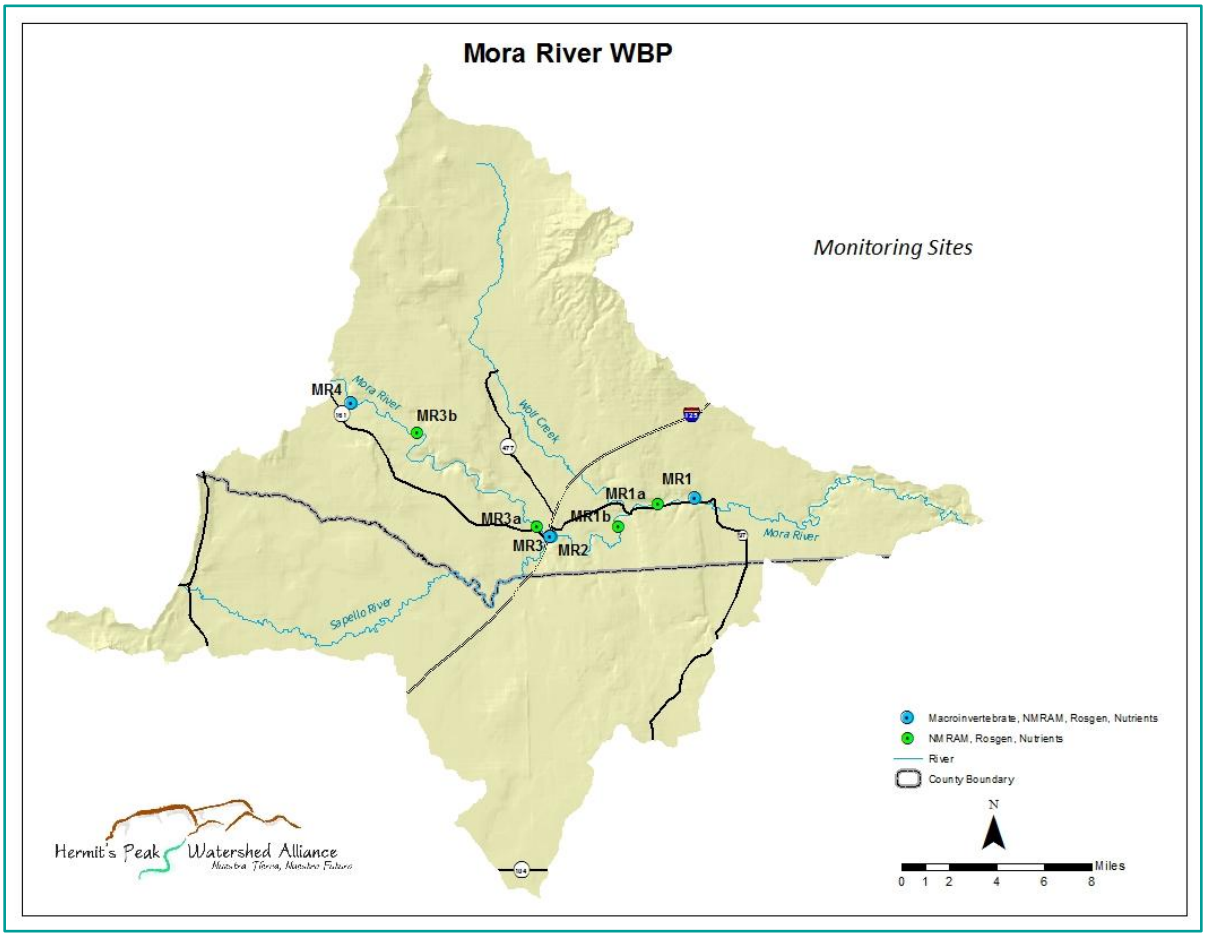
Figure 12- Mora WBP

Monitoring DOQs

For a summary of monitoring methods and models see Planned and Actual Milestones – Task 4: Assess Current Field Conditions. For detailed analysis and summary of data collected please see reports Watershed Condition Assessment of the Lower Mora River (2014), Benthic Macroinvertebrate Bioassessment of the Lower Mora River (2015) and Hydrologic Analysis of Management and Restoration Measures for Nutrient Control in the Lower Mora River (2016). These documents are available on the HPWA website. All monitoring conducted was in accordance with the EPA approved Quality Assurance Project Plan (QAPP, 2014).

The nutrient data collected confirmed the nutrient impairment on the Mora, as Total Nitrogen and Total Phosphorus results far exceeded standards for a Marginal Coldwater Fishery, though response variables exceeded at only two sites. NMRAM, geomorphology, macroinvertebrate and visual assessment data

identified numerous sites with potential for restoration due to degraded conditions. Load reductions were calculated for these potential projects and use to prioritize projects using simulated TN and TP data modeled through BASINS.



Map 2- Monitoring Sites 2014-2015

Table 5- Summary of Nutrient Impairment Assessment from data collected in 2014 and 2015

Causal Variables							Response Variables				Assessment Conclusion
Site Upstream to downstream	Total Nitrogen		Total Phosphorus		Dissolved Oxygen		pH		Chlorophyll *a*		One causal variable and one response variable must exceed in order to be considered "Not Supporting"
Threshold	>0.38 mg/L		>0.03 mg/L		<6.0 mg/L		6.6-9.0		8.2-14.0 µg/cm^2		
	Max (mg/L)	Determination	Max (mg/L)	Determination	Min (mg/L)	Determination	Range	Determination	Max (µg/cm^2)	Determination	
MR4	2.16	Exceeded	1.206	Exceeded	7.38	In range	8.49-8.75	In range	1.2	In range	Fully Supporting
MR3b	2.4	Exceeded	0.981	Exceeded	6.57	In range	8.41-8.67	In range	4.08	In range	Fully Supporting
MR3a	2.05	Exceeded	0.843	Exceeded	6.96	In range	8.25-8.53	In range	0.487	In range	Fully Supporting
MR3	2.66	Exceeded	0.918	Exceeded	7.87	In range	8.16-8.32	In range	0.578	In range	Fully Supporting
MR2	3.58	Exceeded	0.759	Exceeded	8.06	In range	8.14-8.29	In range	0.314	In range	Fully Supporting
MR1b	2.9	Exceeded	1.28	Exceeded	7.52	In range	8.13-8.31	In range	0.337	In range	Fully Supporting
MR1a	2.68	Exceeded	1.281	Exceeded	3.35	Exceeded	7.59-7.80	In range	1.7	In range	Not Supporting
MR1	5.99	Exceeded	0.073	Exceeded	5.71	Exceeded	7.59-7.9	In range	2.2	In range	Not Supporting

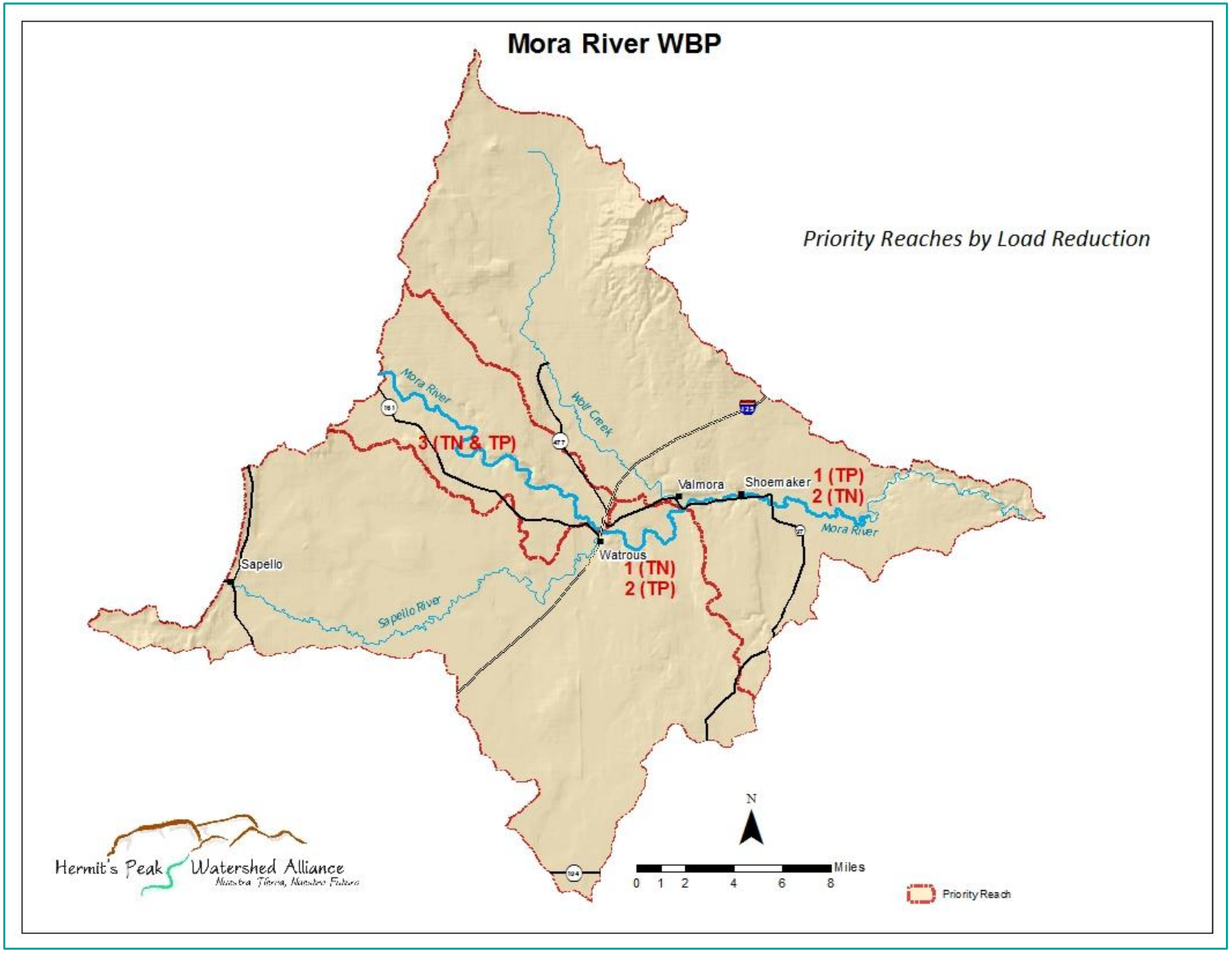
Total Phosphorus and Total Nitrogen load was calculated on three reaches of the lower Mora River; Reach 2: the section of river from the upstream end of the project area (near Golondrinas, NM) to the confluence with the Sapello River, Reach 5: the section from the confluence of the Sapello to the confluence with Wolf Creek and Reach 4: the section of river from the confluence of Wolf Creek to the downstream end of the project area. These loads were calculated in BASINS using the geometric mean of exceedences of daily TN and TP concentrations for the 9 year modeling period.

The following segments in **Error! Reference source not found.** are prioritized based on total load reduction in lbs/day from the highest reduction to the lowest. Loads for the Sapello River, a significant tributary to the Mora River and Wolf Creek, an intermittent tributary to the Mora River, were not calculated individually as neither river has a USGS gage and nutrient samples were not collected there. As a result of this data gap, BASINS could not model those streams individually; hence those subwatersheds have been included in the priority listing with the reaches that they directly drain into. Collecting data on these key tributaries will be added during subsequent funding requests and phases of work. Because of their significance, restoration and improved land management work will be pursued along with the above priority reaches.

Table 6-Prioritized Nutrient Load Reductions required (lbs/day)

Priority	Reach ID	BASINS TN Load (lbs/day)	TN Load Reduction Required (lbs/day)	BASINS TP Load (lbs/day)	TP Load Reduction Required (lbs/day)
1 (TP) & 2 (TN)	Reach 4 (Mora below confluence with Wolf Creek including Wolf Creek subwatershed)	3.175	1.424	0.348	0.209
1 (TN) & 2 (TP)	Reach 5 (Mora below confluence with Sapello, above Wolf Creek including Sapello subwatershed)	3.211	1.460	0.307	0.168
3 (TN & TP)	Reach 2 (above confluence of Sapello)	2.919	1.168	0.271	0.132

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) was used to calculate load reductions. After loading rates were determined by land use type in BASINS, STEPL was used to calculate load reductions expected for each Management and Restoration Measure (MRM) and land use type.



Map 3- Priority Segments for Implementation

Measures of Success

As this was a 319 Watershed Based Planning project, no NPS pollution goals were implemented. The project's goal- to research and write a Watershed Based Plan for the Mora River Upper Canadian Plateau was accomplished in June 2016. The WBPMR was written with the intent to plan implementation projects to control NPS pollution as part of an integrated, watershed-wide approach.

Describe major project highlights not described above

This project entailed gaining significant experience with employing BASINS and STEPL modeling tools. We found that little assistance is available to assist in this endeavor. This experience will increase the future efficiency of HPWA to apply these models and potentially offer advice or guidance to other entities attempting such a feat.

Because of the large size of the lower Mora Watershed and the significant number of potential projects and willing landowners, this WBP highlighted the need to develop new techniques for prioritizing projects. Prioritization schemes employed were largely based on obtaining the greatest load reductions but did not take into account the entire watershed context that might guide project selection based on critical locations based on watershed functions and areas with the greatest potential for response to restoration efforts. Toward this effort, HPWA and Watershed Artisans, Inc. began exploration of using an approach developed in Australia called River Styles. We did early investigation into this approach and Watershed Artisans completed training by the authors of River Styles. Watershed Artisans, with help from the GAINS lab at NMHU developed a simplified version of River Styles now referred to as River Behavior and Recovery Assessment as an alternative means of assessing watershed-wide geomorphic related conditions and identifying priority areas for restoration on that basis. This will be further explored in future WBP proposals by HPWA.

To augment site specific condition assessments, HPWA used a new approach to find potential projects over a broad area. A walking, visual assessment along the river course by trained restoration specialist was used in the highest priority area to locate specific project sites. While this effort might seem too simple, it offered the most direct means of finding specific locations of degraded conditions over many miles of river course fairly quickly. It is an exercise that we plan to repeat.

Works Cited

Hermit's Peak Watershed Alliance. (2016). *Watershed Based Plan for the Mora River Upper Canadian Plateau.* Hermit's Peak Watershed Alliance. Retrieved from www.hermitspeakwatersheds.org/WBPMR

NM Office of the State Engineer/Interstate Stream Commisssion. (2016). *DRAFT Mora-San Miguel-Guadalupe Regional Water Plan.* NMOSE.

NMED SWQB. (2004). 2004-2006 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2004 Surface Water Assessment. Santa Fe, NM. Retrieved from https://www.env.nm.gov/wqcc/303d-305b/2004/AppendixB/Part01.pdf

NMED SWQB. (2009). *US EPA- Approved Total Maximum Daily Load (TMDL) For the Dry Cimarron River Watershed.* Santa Fe, NM: NMED.

NMED SWQB. (2011). *US EPA- Approved Total Maximum Daily Load (TMDL) for the Mainstem of the Canadian River (from Texas to Colorado) and Select Tributaries.* Santa Fe, NM: NMED.

NMED SWQB. (2014). 2014-2016 State of New Mexico Clean Water Act §303(d) /§305(b) List of Assessed Waters. Santa Fe, NM. Retrieved from https://www.env.nm.gov/swqb/303d-305b/2014-206/index.html

NMED SWQB. (2015). Procedures for Assessign Water Quality Standards Attainment for the State of New Mexico CWA §303(d) /§305(b) Integrated Report: Assessment Protocol. Santa Fe, NM. Retrieved from https://www.env.nm.gov/swqb/protocols/documents/2016_FINAL_AP_062215.pdf

NMED SWQB. (2015). *UPDATE USEPA Approved Total Maximum Daily Load (TMDL) for the Mora River (USGS Gage East of SHowmaker to Hwy 434).* Santa Fe, NM: NMED. Retrieved from https://www.env.nm.gov/swqb/Mora/Nutrients/MoraRiver-NutrientTMDL_EPAapproved.pdf

NMED SWQB. (2007). USEPA-Approved Total Maximum Daily Load (TMDL) for the Canadian River Watershed – Part 1 (Mora River to the Colorado Border). . Santa Fe, NM. Retrieved 2015, from https://www.env.nm.gov/swqb/documents/swqbdocs/MAS/TMDLs/Canadian/Pt1/CanadianTMDL-Pt1.pdf.

Thompson, B. a. (2009). *Water Resources Assessment of the Mora River.* Water Resources Program University of New Mexico.

U.S. Census Bureau. (2015). QuickFacts Mora County, NM. Retrieved from http://www.census.gov/quickfacts/table/PST045215/35033

U.S. EPA. (2010). *Multi-Resolution Land Characteristics Consortium: 2001 National Land Cover Data (NLCD)*. Retrieved 2016, from Environmental Protection Agency: http://www.epa.gov/mrlc/nlcd-2001.html

Lessons Learned

What made our project a success?

1. **A Foundation in Science and Watershed Ecology** – We began our planning process with a strong, watershed-wide baseline data collection effort. Past studies were not adequate to guide future watershed management and restoration efforts and priorities. These baseline data also provide a strong foundation for tracking long-term change. While public opinion and landowner objectives are important, we also based our planning effort on principles of Watershed Ecology rather than public desires. We found that public knowledge of watershed health was not always founded in the best available ecological understanding, so, soliciting public opinion about what was needed to improve watershed condition was not the basis of our plan. Public opinion and desires were incorporated in the planned means and locations of watershed management and restoration implementation.
2. **Building Personal Relationships a Priority** – Rather than relying on a series of formal public meetings that were largely unsuccessful in this area to solicit stakeholder input, we focused on building personal relationships with local residents and other stakeholders. While this effort is very time consuming, it was a key aspect of setting the stage for future implementation and land stewardship. Building personal relationships began with learning about the perspectives, interests, and knowledge of each individual. Then slowly and respectfully, we pursued more in depth work and discussions with people that were interested in our work.
3. **Built Community Support on the Basis of a Common Ground** – We first worked to find and establish a common ground with individuals and organizations. That common ground is based on our mutual need for water and the critical role that land stewardship plays in providing that resource. In the arid lower Mora Watershed, preparing for and coping with drought was the common ground that linked all landowners. We focused on identifying and communicating means of improving watershed health and resilience while retaining usable water to grow forage and crops in this largely working landscape.
4. **Going Beyond 319 –** 319 funds were used in this project to not only address the local nutrient impairment but were also leveraged to go beyond 319. HPWA used them as an opportunity to further our capacity to improve on Watershed Based Planning approaches using modeling tools. The large size of the Mora Watershed made complete coverage difficult, so GIS and modeling tools supplemented in the field knowledge. Furthermore, HPWA, with the help of Watershed Artisans, Inc. used this project to pursue new means of understanding watershed wide processes and functions to better prioritize restoration work. While this effort was only just begun during this project, the ground work was laid to improve on the Watershed Based Planning approach for future efforts.
5. **The Land Stewardship Series** – Instead of holding an expensive, time consuming, one-time Watershed Conference, we opted to have smaller, regular educational and community building events. These were easier to organize, very inexpensive to put on, and required significantly less time to participate in for a community of hard working, busy people. The events were easily adjusted to meet relevant issues that landowners were dealing with at the time, making them

generally well attended. Events also can be located on-the-ground in backyards, helping to connect neighbors.

6. **Collaborative Efforts Really Pay Off** – Collaborative relationships were built and strengthened with the staff at the Rio Mora National Wildlife Refuge, the High Plains Grassland Alliance, and Tierra y Montes Soil and Water Conservation District during this project. Those alliances will help to sustain future coordinated work in the area.

What was not successful?

1. Our ability to address landowner hesitation we observed was only marginally successful. Large, often absentee landowners/ranchers are very difficult to connect with, especially since we are not personally connected in that community. Those landowners are private about their affairs and reluctant to even take the time to meet with unknown entities. From this we concluded that it is important to just start doing valuable work on-the-ground to demonstrate the benefits and slowly, one landowner at a time, build momentum of watershed related land stewardship. We currently have more than enough interested landowners to begin that process. Furthermore, we will use our connections with the High Plains Grassland Alliance, Quivira Coalition, and consultants to get introductions to some of those reluctant landowners.
2. The educational events offered by the Denver Zoo were largely successful but many targeted audiences from outside the area. While this helps foster watershed awareness in a broader area, local landowners and students need more watershed education opportunities.
3. While the Watershed Trunk/Curriculum was well received among teachers at both Las Vegas high schools, we did not plan adequate resources to follow-up and provide future support to those teachers. A concerted effort is needed to provide continued support and materials for area teachers to really have an impact.
4. Public meetings we held did not appeal to local residents. PR is difficult in this area necessitating direct email communication with locals and that requires having good contact information. Also, working people do not want to spend their time at another meeting to just talk. Working educational events where real skills are taught offer a more potentially beneficial forum.
5. Our interest and that of Watershed Artisans, Inc. to pursue a better means of assessing watershed wide conditions and targeting restoration work (similar to River Styles) was only a very simple beginning and did not advance as far as we would have liked. Without a specific, well thought-out set of goals and objectives and a budget to back it up little progress was made on the front, especially since it relied on consultant services provided on a gratis basis. Watershed Artisans, Inc. did develop a beginning framework for what was called River Behavior and Recovery Assessment but little progress was made beyond that without a budget to support it.

What would we do different?

1. One purpose of requesting a project extension was to pursue the first steps of a River Behavior and Recovery Assessment (similar to River Styles) in order to improve upon means of identifying the best places to target for restoration work. While this was a noble idea, there was not adequate financial

support and adequate commitment from contractors to offer in-kind match to accomplish this at the end of the project. To pay adequate attention to developing a new means of evaluating watershed condition and a means of prioritizing projects is a significant effort and warrants a project devoted to that task.

Technical Transfer

What information can we pass along to other agencies, cooperators or local landowners in other watersheds about this project?

1. **To watershed or land stewardship groups** – 319 projects provide a win-win situation for watershed groups, private landowners, government agencies and the entire watershed itself. The development of a WBP is an excellent opportunity to engage the community early on in watershed stewardship and restoration. Since it is not a regulatory program it is comfortable to discuss with others and provides needed resources to do good things for everyone in a community. Because it is such a positive contribution to watershed and community health, 319 efforts can be carried out in a very positive and productive manner without criticism and controversy. This helps to create a good reputation of an organization that can make significant, positive contributions to the community.

2. **To landowners** – Most government funding sources require cost share, long-term commitments, complex contracts and work that meets strict agency specifications; this can be daunting. 319 funds offer greater flexibility and encourage creative solutions to repair degraded streams while meeting landowner objectives. While cost share is required, watershed groups can help provide that cost share and help coordinate work on private lands, lessening the work load of private landowners. For these reasons, working with watershed groups can have many advantages and facilitate private landowners making significant contributions to watershed health without burdensome investment. Furthermore, improving the health of private lands can have long-term benefits to landowners by increasing land productivity for forage, timber and other agricultural products. It can also improve available water, beauty, recreational areas, personal pride and an overall quality of life on private lands.

3. **To agencies/cooperators** – A degree of flexibility in carrying out grant projects should be expected in the beginning. Grant proposals are developed with the best intentions but as the realities of a project progress, modifying tasks or the approach to doing tasks is important to adapt to the circumstances. Not holding a Watershed Conference but instead developing and carrying out our Land Stewardship Series is a good example of this. Another example is our stream visual assessment. This was not in the original work plan but it became clear that we needed an additional effort to rapidly identify potential projects over a larger area than could be covered with our in-depth sampling.

What other projects that are currently in progress or on the drawing board could benefit from this information?

1. HPWA hopes to progress to other watersheds to develop Watershed Based Plans, especially the Sapello and the Tecolote Watershed. Conclusions drawn regarding education and outreach efforts and stakeholder engagement are helpful to plan more efficient and effective work.
2. A current effort to locate collaborative wetlands projects (by Alan Hamilton – NM Wildlife Federation) in NE New Mexico (NE NM Wetlands Action Committee) and seek funding for their implementation could benefit from our literature review indicating that wetland restoration is one of the most effective means of reducing nutrient impaired streams. Furthermore our developed list of landowners interested in doing wetland restoration projects is likewise helpful.
3. The USFWS and Denver Zoo at the Rio Mora National Wildlife Refuge hope to support private landowners throughout the Rio Mora Conservation Area. Our Management and Restoration Measures and internal lists of landowners interested in doing projects can offer Rio Mora ideas for projects should they acquire funding beyond the refuge itself. Recommendations related to education and outreach could also offer USFWS ideas for needed educational topics they might present.
4. The High Plains Grassland Alliance is interested in furthering landowner education as well; our plan offers suggestions for them and potential collaborative educational efforts.

Feedback Loop

What would we suggest NMED or EPA do differently to improve the NPS process in regard to similar projects in the future?

1. Encourage the evolution of a strictly TMDL driven 319 effort to one that is more comprehensive, addressing overall watershed health. Water quality standards could still be a significant measuring stick but other measures of watershed health could be added. This would provide greater opportunities to enhance other critical aspects of watershed condition without needing to justify them on the basis of meeting TMDLs exclusively. This sentiment is captured in EPA's "Healthy Watersheds Initiative".
2. Reevaluate the updated 2015 TMDL for the Mora River. As noted above in Task 7 Draft Watershed Based Plan, the updated TMDL is significantly different than the original 2007 TMDL. These differences should be reevaluated to determine whether the new TMDL is reflective of actual loads on the Mora River.
3. EPA provides very helpful BASINS tutorials and a BASINS listserv forum, however it would be very helpful if modeling workshops were offered either in person or as online webinars.

What would we suggest for other partners?

1. If at all possible, conduct 319 planning and implementation work with entities and resources available within the community rather than outsource the work to remote consultants. Use school

groups, college students, and related organizations whenever possible. This helps support community "buy in" and ownership of the work. It also develops a product that is well grounded in local, community pertinent circumstances. If this is not possible, ensure that hired contractors make every effort to assess and include the local community.

2. Build direct relationships with landowners/managers and agency stakeholders. Plan many different types of opportunities to personally interface with these people, including one-on-one situations.
3. The development of the Watershed Based Plan is an important opportunity to do critical assessment and community building work and should not be seen as a token effort needed to gain future funding. Use the planning work to its fullest extent to build organizational capacity, community support and educational opportunities.

Future Activity Recommendations

What programs, activities and/or assessments are or should be planned for our area? How will those be funded?

1. On-the-Ground implementation of the WBP for lower Mora – funded by EPA 319 but also pursue NRCS funding for landowners.
2. Pursue a WBP project for the entire Sapello Watershed – headwaters to confluence with Mora R.
3. Further develop River Behavior and Recovery Assessment methods in the course of building Watershed Based Plans for other areas. Work with the NE NM Wetlands Action Committee (Alan Hamilton) to find collaborative funding projects with NMG&F, USFWS, NM Wildlife Federation and others.
4. Potentially update the Watershed Based Plan for the Mora River depending on the outcome of the reexamination of the updated 2015 TMDL.

Supplemental Information

Following are references to HPWA reports produced in this planning project and past reports done by other entities that serve as important background.

References

Hermit's Peak Watershed Alliance. (2016). *Watershed Based Plan for the Mora River Upper Canadian Plateau.* Hermit's Peak Watershed Alliance. Retrieved from www.hermitspeakwatersheds.org/WBPMR

NM Office of the State Engineer/Interstate Stream Commisssion. (2016). *DRAFT Mora-San Miguel-Guadalupe Regional Water Plan.* NMOSE.

NMED SWQB. (2004). 2004-2006 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2004 Surface Water Assessment. Santa Fe, NM. Retrieved from https://www.env.nm.gov/wqcc/303d-305b/2004/AppendixB/Part01.pdf

NMED SWQB. (2009). *US EPA- Approved Total Maximum Daily Load (TMDL) For the Dry Cimarron River Watershed.* Santa Fe, NM: NMED.

NMED SWQB. (2011). *US EPA- Approved Total Maximum Daily Load (TMDL) for the Mainstem of the Canadian River (from Texas to Colorado) and Select Tributaries.* Santa Fe, NM: NMED.

NMED SWQB. (2014). 2014-2016 State of New Mexico Clean Water Act §303(d) /§305(b) List of Assessed Waters. Santa Fe, NM. Retrieved from https://www.env.nm.gov/swqb/303d-305b/2014-206/index.html

NMED SWQB. (2015). Procedures for Assessign Water Quality Standards Attainment for the State of New Mexico CWA §303(d) /§305(b) Integrated Report: Assessment Protocol. Santa Fe, NM. Retrieved from https://www.env.nm.gov/swqb/protocols/documents/2016_FINAL_AP_062215.pdf

NMED SWQB. (2015). *UPDATE USEPA Approved Total Maximum Daily Load (TMDL) for the Mora River (USGS Gage East of SHowmaker to Hwy 434).* Santa Fe, NM: NMED. Retrieved from https://www.env.nm.gov/swqb/Mora/Nutrients/MoraRiver-NutrientTMDL_EPAapproved.pdf

NMED SWQB. (2007). USEPA-Approved Total Maximum Daily Load (TMDL) for the Canadian River Watershed – Part 1 (Mora River to the Colorado Border). . Santa Fe, NM. Retrieved 2015, from https://www.env.nm.gov/swqb/documents/swqbdocs/MAS/TMDLs/Canadian/Pt1/CanadianTMDL-Pt1.pdf.

Thompson, B. a. (2009). *Water Resources Assessment of the Mora River.* Water Resources Program University of New Mexico.

U.S. Census Bureau. (2015). QuickFacts Mora County, NM. Retrieved from http://www.census.gov/quickfacts/table/PST045215/35033

U.S. EPA. (2010). *Multi-Resolution Land Characteristics Consortium: 2001 National Land Cover Data (NLCD)*. Retrieved 2016, from Environmental Protection Agency: http://www.epa.gov/mrlc/nlcd-2001.html