2011

Rio de las Vacas Wetlands Action Plan

New Mexico Environment Department

Surface Water Quality Bureau

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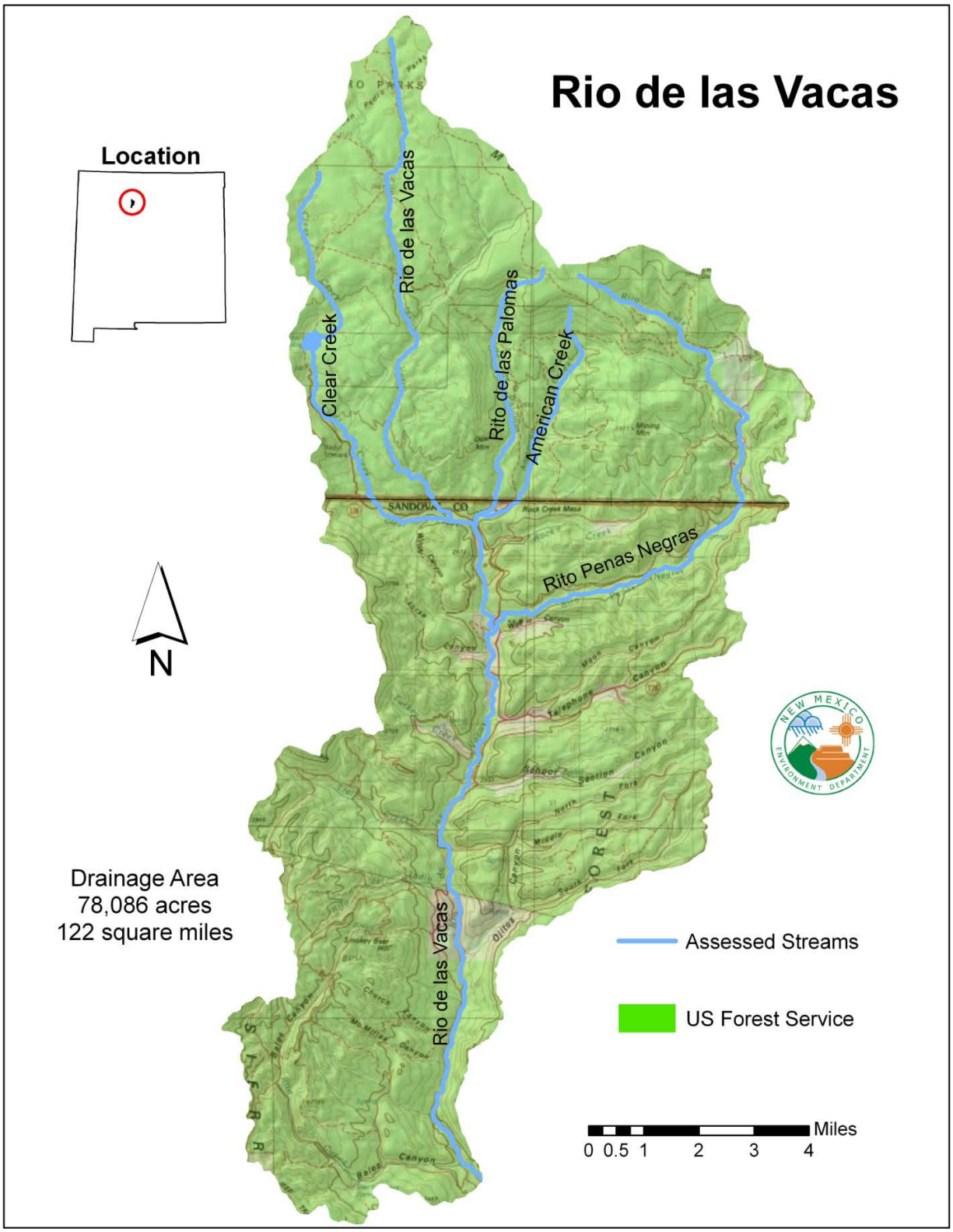

Figure 1. Map of the Rio de las Vacas Watershed

Introduction

The Rio de las Vacas Watershed is a sub-basin of the Jemez River Basin (HUC #13020202), located in northcentral New Mexico (see Figure 1). The watershed is approximately 25.1 miles long with a drainage area of approximately 122 square miles. The headwaters begin at a spring source in the San Pedro Parks Wilderness and the upper nine miles of the river are located within the wilderness. Rio de las Vacas is a fifth order tributary to the Rio Guadalupe. The Rio de las Vacas and Rio Cebolla converge at Porter Landing to form the Rio Guadalupe.

The watershed is dominated by both forest and rangeland. In the middle section of the Rio de las Vacas, the canyon opens up to a valley floor with many private in-holdings within the Cuba Ranger District, Santa Fe National Forest (SFNF) property. Wolf Creek, a small tributary to the lower reach of the Rio de las Vacas, is intermittent and mostly wetland, and is mostly privately owned. The Rito Penas Negras, the tributary upstream from the Wolf Creek confluence is perennial and also has some private inholdings. However, the Rio de las Vacas is mostly public land as are the three other tributaries, Clear Creek, Rito de los Palomas, and American Creek entirely on SFNF property.

Wetlands Action Plans

A Wetlands Action Plan (WAP) is a planning document designed to address wetlands within the boundaries of a specific watershed. Wetlands and riparian areas have ecological, economic, and aesthetic value and serve many vital functions including water purification, storage, and erosion reduction. Riverine wetland and riparian vegetation store storm water runoff, increasing the duration of stream base flows, stabilize stream banks thus reducing erosion, improve wildlife, fish habitat and overall ecological conditions. A WAP provides guidance on protecting and restoring wetland functions with an emphasis on conserving habitats of threatened and endangered species, migratory birds, and other species of concern.

This WAP will become an addendum to the Jemez Watershed Restoration Action Strategy (WRAS) that covers watersheds in the Jemez Mountains area. The Jemez Watershed WRAS lists specific water quality problems; identifies sources of contamination causing those problems; and a schedule of action items to abate water quality problems along with estimated funding requirements. A WRAS is a non-regulatory, voluntary approach to performing these actions that provides a game plan or strategy in prioritizing issues unique to this watershed. The New Mexico Environment Department Surface Water Quality Bureau (SWQB) is providing guidance to facilitate watershed groups throughout the state to develop WAPs as an additional component of their WRAS.

Wetlands are “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances to support, a prevalence of vegetation typically adapted to life in saturated soil conditions” (U.S. ACE 1987). Wetlands generally include swamps, marshes, bogs, fens and similar areas; and lands that are transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land. Wetlands must have one or more of the following attributes; (1) at least periodically, the land predominantly supports hydrophytes (plants dependent on saturated soils or

a water medium); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water of covered by shallow water at some time during the growing season of each year.

The upland limit of a wetland is the boundary between land that supports predominantly hydrophytic cover, soil types that are predominantly hydric, and evidence of hydrology that supports wetlands and land with predominantly mesophytic or xerophytic cover, soil that is non-hydric and land that is not saturated or flooded some time during the growing season. The lower boundary between wetlands and deeper water habitat associated with riverine and lacustrine systems lies at 2 meters (6.6 feet) below low water, or the maximum depth at which emergent plants normally grow.

Riparian areas are also included as part of the analysis. Riparian ecosystems are characterized by phreatophytic and mesophytic vegetation and habitats associated with bodies of water and dependent on existence of perennial, intermittent or ephemeral surface and subsurface drainage. The strict water requirements of wetlands are not as drastic in riparian areas however they occupy the same areas of the landscape, may contribute to the same functions within the landscape, and are interdependent, and therefore are considered together during the assessment phase of the WAP development.

Geography and Geology and Land Use

The Rio de las Vacas flows through areas associated with the Nacimiento Uplift (Eddy et al, 2004). The bedrock is granitic, and this non-porous bedrock and loss of wetlands are what make this stream prone to flash flows (Kelley et al, 2007). Streams in the Jemez River basin arise in two distinct geologic settings. In this case, the western region of the basin, Clear Creek, the Rio de las Vacas and the Rito Peñas Negras originate in Precambrian metamorphic, granitic and Permian sedimentary rocks. Fossils such as petrified wood can be found as part of the substrate on the middle Rio de las Vacas. The Rio de las Vacas is somewhat a boundary to the Nacimiento uplift in the west and the volcanic Jemez Mountains to the east.

The majority of the watershed is located on public lands managed by the Santa Fe National Forest. The upper nine miles of the river in is in the San Pedro Wilderness, one of four wilderness areas in the Santa Fe National Forest and the only one within the Cuba Ranger District. This upper section is entirely managed by USDA Forest Service, Cuba Ranger District.

The Rio de las Vacas is very popular as a destination for recreation activities. It is the home waters for a popular fishing organization, New Mexico Trout, and is well known as a destination for fish enthusiasts. There are over 30 miles of trails and the terrain is gentle enough for idyllic horseback rides or bicycling. There are at least 3 officially developed campgrounds, although dispersed camping does occur. Hunting also occurs in season. Other than recreational uses, the Rio de las Vacas has been used by the cattle industry. There is a system of cattle permitted allotments, however this area experiences a few situations of cut fences and cattle trespass. Generally, what this means to the watershed, is that if allowed, the cattle will graze riparian and wetland forage more frequently given the opportunity. In many cases the private portions are easily identified because the riparian corridor is missing.

Below the confluence with Rito de los Palomas, which is close to the wilderness boundary, approximately 95% of land ownership is managed by the USDA Forest Service, 4 % is private land, mostly in the valley bottom, and <1% Indian lands. The Rio de las Vacas begins in an open meadow in the San Pedro Parks, elevation 10,440 feet, and flows down a wide valley with forested patches. As it enters a canyon type morphology, the gradient increases to 5% slope. At the mouth of Clear Creek, the Rio de las Vacas flows through the valley adjacent to NM Highway 126 averaging a slope of 2.1% (USFS, 2004) Along the middle section of the Rio de las Vacas and accessible through Forest Road 539 is the Rancho del Chaparral Girl Scout Camp. This encompasses about 1200 acres and has an annual Forestry camp to teach youth appreciation for the natural and cultural resources on their public land. At the confluence with the Rio Cebolla was a camp town called Porter Landing. This became the center of logging activity, with two to three hundred people living there between 1920 and 1940. A rail line was constructed to efficiently move timber off the mountains. (Santa Fe Northwestern Railway, The Cañon de San Diego Land Grant, USFS)

Local Hydrogeomorphic Conditions

The hydrograph of the Rio de las Vacas is typical of northern New Mexico streams, with peak flows linked to snowmelt typically occurring in late spring. The stream is prone to flash flows during the summer monsoon precipitation season (July-August). NMED (2002) states the calculated bankfull flow as approximately 2.5-3.5 cubic feet per second depending on location along the Rio de las Vacas. The area studied follows a Rosgen Morphological Description of a C3, the entrenchment ratio was between 3 and 6 in three cross sections, the width/depth ratio was between 16 and 21 and the slope was between 0.4 and 0.5%. The channel materials were predominantly a cobble size, with materials in the banks much finer in size.

Initially, the focus was on riparian wetlands and promoting that function of the ecosystem. During survey studies, we discovered there were many seeps and springs alongside and above the terrace of the Rio de las Vacas. Other than Wolf Creek, which was an excellent example of a slope wetlands, there were three other areas that if remediated, would also function as a slope wetlands, the School Section Canyon, Telephone Canyon and Turkey Creek, all ephemeral but very wet areas. Many of these slope wetlands, springs and seeps had been damaged by hoof prints and grazing. Many had eroded into a single thread flow rather than as a slope flow, which minimizes the vegetative potential.

Photo 1. Telephone Canyon, lone Gooding's Willow

In 2005, the riffle dominated stream went dry, there were only a few pools carrying water and fish. In the USFS Santa Fe National Forest Rio de las Vacas Stream Inventory Report, 2004, the report noted that although the stream is riffle dominated, fine sediment fills the space between the gravel substrates and negatively impacts spawning habitat. This fine sediment is due to runoff from roads and unstable stream banks.

Photo 2. Newly built beaver dam in a young willow patch

The report also notes that although the average pool was of an adequate size, the number of pools was far below acceptable levels for a stream of this type. Two issues occur with the lack of quality pools, most importantly for water quality and fisheries is the decreased thermal protection and rearing habitat for fisheries. The lack of large woody debris and the absence of beavers were also noted. Beavers can survive during the summer months eating only rushes and sedges and other wetland plants, but need woody species to survive the winter months.

Threatened and Endangered Species

Within the Rio de las Vacas watershed, the Mexican spotted owl (threatened) is the only federally listed species that has known documented habitat. The State listed sensitive species are Rio Grande cutthroat trout, New Mexico jumping mouse, and the Northern goshawk. The Rio Grande cutthroat trout is present and contained in the upper nine miles of the river, below which there it a fish barrier to protect the trout from hybridization with the more popular game trout, rainbow and brown trout.

Other aquatic biota in the watershed include the fish species rainbow trout, brown trout, cut-bow and Rio Grande sucker; as well as the amphibian species tiger salamander, western toad, leopard frog and chorus frog (Eddy et al, 2004).

Vegetation

A plant species list for Rio de las Vacas wetlands was created during the Rio de las Vacas wetlands project (Vrooman, 2008):

Acmi (Achillea millefolium)	yarrow
Agde (Agropyron desertorum) Aggi (Agrostis gigantea)	Crested wheatgrass redtop
Agrostis (Agrostis gigantean Roth)*	
Alnus (Alnus Mill.)	alder
Arfr (Artemisia frigid)	fringed sagebrush
Aster (sp)	aster
Bogr (Bouteloua gracilis)	blue grama
Brin (Bromus inermis)	smooth brome
Caaq (Carez aquatillis)	water sedge
Cage (Carex geophila)	dryland sedge
Calamagrostis inexpansa (Calamagrostis stricta)*	
CALA (Carex lanuginose)*	
Cale (Caltha leptosepala)	marsh marigold
Caut (Carex utriculata	beaked sedge
Ciar (Circium arvense)	Canada thistle
Danthonia parryi	Parry's oatgrass
Deca (Deschampsia caespitosa)*	
Desx (Descurainia ssp)	tansy mustard
Eltr (Elymus trachycaulus)	slender wheatgrass
Elpa (Eliocharis palustris)	spikerush
Epilobium (Epilobium ciliatum)*	
Erdi (Erigeron divergens)	creeping fleabane
Geum spp (Geum aleppicum)*	
Irmi (Iris missouriensis)	rocky mountain iris
Juba (Juncus balticus)	Baltic rush
Jun sp2 (Juncus dudleyi Wieg.)*	
Jun sp1 (Juncus nodosus L.)*	
Lyph (Lycurus phleoides)	wolftail
Mear (menthe arvensis)	field mint
Pasm (Pascopyrum smithii)	western wheatgrass
Phpr (Phleum pretense)	timothy
Poco (Poa compressa)	bluegrass
Pohi (Potentilla hippiana)	potentilla
Popr (Poa pratensis)	Kentucky bluegrass
Rhus (Rhus L.)	sumac
Rile (Ribes leptanthum)	gooseberry
Rowo (Rosa woodsii)	woods rose
Stro (Stipa robusta)	sleepygrass
Taof (Taraxacum officinale)	dandelion
Thpo (Thinopyrum ponticum)	tall wheatgrass

Trre (Trifolium repens)	white clover
* found only on the Wolf Creek survey	

Threats and Impairments

Santa Fe National Forest staff conducted two extensive stream surveys on the Rio de las Vacas, in 2002 and 2004. The more recent survey (USFS, 2004) determined that the stream is not properly functioning for all of the survey criteria in categories of habitat characteristics, and channel condition and dynamics, except pool quality and streambank condition. The report identified several land use practices that have impacted the health of the Rio de las Vacas.

1. Poorly designed and poorly maintained roads. The roads cause excessive sediment to wash into the stream and cause erosion that can drain wetlands.
2. Timber harvesting. Historic timber harvesting reduced sources for large woody debris that would slow the water and support appropriate hydrologic conditions for wetlands.
3. Fire. The report describes fire activity but does no assert whether fire has had positive or negative effects.
4. Grazing. Historic grazing, and to a lesser extent current grazing practices, have reduced riparian vegetation, exacerbated streambank erosion, and drained wetlands.
5. Recreation. The San Pedro Parks Wilderness area receives heavy recreational use from horseback riders, outfitter guides, hikers, and backpackers. Downstream of the wilderness area there are four developed recreational sites and numerous dispersed trails and campsites. The heavy recreation use has caused bank instability, reduced riparian vegetation, erosion, soil compaction, and stream widening.

Excessive fine sediment loads and high turbidity are also found in Rio de las Vacas, exacerbated by historic grazing practices, an extensive road system, past timber harvest, and dispersed recreation practices within the active floodplain (USFS, 2004). Unstable banks and fine sediments that runoff during storm events result in a thermally unstable system often with nuisance algae and fluctations in dissolved oxygen and pH.

Photo 3. Heavy algae growth observed on the Rio de las Vacas

Although the Santa Fe National Forest has taken many steps to reduce these impacts on the Rio de las Vacas, recreational use and grazing continue to effect the stream, wetlands, and riparian areas. In particular, recreational users and cattle owners cut fences to allow access to the stream. This wouldn't be so much of an issue if the cattle were managed more promptly, but given the opportunity, the cattle will not move out of the riparian. Elk, deer and other mammals graze on the high protein forage that wetlands and riparian plants provide, but are not likely to remain in the same area for very long. Many heavily used dispersed camping sites in the active floodplain result in reduced riparian and wetlands vegetation due to trampling, firewood collection, and campfire rings that burn the ground vegetation as well as deplete large woody material that could be available to support instream ecosystem functions. There are also areas where people drive vehicles either as a challenge in a muddy wet area or to be closer to a favored spot to camp and/or fish.

According to the NMED/SWQB 2010-2012 §303(d)/ §305(b) List of Impaired Waters, the Rio de las Vacas (Rio de las Vacas (Rio Cebolla to Clear Creek) is impaired for temperature and nutrients. A Total Maximum Daily Load (TMDL) was calculated and approved for temperature in 2002 and a TMDL for nutrients was approved in 2009. A TMDL for total organic carbon (TOC) was developed for this reach, however the Water Quality Control Commission (WQCC) deleted the TOC criterion for the high quality coldwater fishery designated use in 2002; therefore TOC was removed as a cause of non-support for this reach.

The 2002 TMDL report (NMED, 2002) attributes warmer temperatures in the Rio de las Vacas to reduced riparian vegetation and channel morphology disturbances to rangeland grazing practices which have destabilized stream banks, widened the stream channel and reduced shade.

Temperature is problematic for the Rio Grande cutthroat trout because water temperature influences the behavior, metabolism and mortality of aquatic organisms. Warmer temperatures are directly related to the degradation of wetlands because wetlands store water in the subsurface where it remains cooler before slowly releasing it to the stream. Thus a larger acreage of wetlands should correspond with cooler water temperatures in the stream.

The 2002 TMDL report (NMED, 2002) provides target temperatures for streams in the Jemez Mountains. The target temperature used in the TMDL for the Rio de las Vacas is the high quality coldwater aquatic life criterion in 20.6.4.108 of 20^{o}C (68^{o}F). The Jemez WRAS (Jemez Watershed Group, 2005) provides modeling of the temperature exceedances. According to the

Jemez WRAS, the daily solar load should be reduced by 42.17 joules/meter2/second in the lower reach of the Rio de Las Vacas and 54.37 joules/meter2/second in the upper reach of the Rio de las Vacas.

TMDLs for total nitrogen and total phosphorus were calculated for the (Rio de las Vacas (Rio Cebolla to Clear Creek) (NMED, 2009) assessment unit. Based on a comparison between the water quality data collected in 2005 and the TMDL calculation, the reduction estimate for total nitrogen is estimated to be 41% and no load reduction is necessary for total phosphorus.

Loss of riparian habitat and streambank destabilization are cited as probable sources of nutrient overloading in the Rio de las Vacas. Similar to temperature, nutrient loading can be correlated to wetland degradation because wetlands can filter and absorb nutrients through plant utilization. Thus, increasing the quality and acreage of wetlands in the Rio de las Vacas watershed has a positive effect on water quality in the river.

Photo 4. Post vane structure and hemi-fence to protect riparian wetland.

Education and Outreach/Local Initiatives

1. The US Forest Service's Respect the Rio program is a combination of environmental education, watershed restoration, and public involvement that empowers local communities and forest users to participate in watershed restoration. The program identifies specific activities ready for implementation that would benefit riparian zones, land use, and water quality. The program concentrates on overall watershed health by incorporating treatment of dense forest stands, meadow maintenance, livestock grazing, roads, and recreation management. Recent Respect the Rio program activities that are specific to wetlands in the Rio de las Vacas watershed include:
    - pasture fencing in the middle section.

- Maintenance of fences and gates
- Treatment of noxious weeds
- Support and participate with volunteer organizations such as Albuquerque Wildlife Federation and New Mexico Trout.
- Improve road drainage, so that it doesn't drain into the Rio de las Vacas
- Improve buck and pole riparian fences.

2. The *Rio de las Vacas Wetlands Restoration Project:* This was a grant submitted to the Region 6 Environmental Protection Agency and was funded under Clean Water Act Section 104(b)(3) Wetlands Program Development grant. The goals were:
   - To improve the condition of the riparian wetlands on approximately 3 miles of stream.
   - To educate agencies and the public of the benefits of beavers.
   - To provide innovative technologies to remediate impairments to the ecosystem.

   SWQB met these goals by surveying and understanding the watershed. Working with some private land owners initially, we showed them how to improve the drainage on their roads so as not to drain into live water and minimize maintenance. We worked with the USDA Forest Service to improve their riparian pastures and a wonderfully innovative type of fencing was developed that would require minimal maintenance for a gain of wetland acreage, these were called hemi-fences. We also put other innovative structures in the slope wetlands to spread the water out and increase wetted area during snowmelt and rain runoff. We had several workshops to show the benefits of a beaver population and how to live with them. We planted several thousand willows during the life of this project

3. Albuquerque Wildlife Federation (AWF) has been involved in on the ground restoration work along the Rio de Las Vacas during the summers of 2008-2010. Each year AWF has conducted a three day workshop during which 30-50 volunteers have worked on restoring the river, riparian areas, wetlands, and tributary creeks. The volunteers, directed by NMED staff and restoration consultants, planted willows, mended fences, and built or augmented rock structures to divert water flow, reduce erosion, and improve wetland drainage., AWF's work was based on the restoration designs in the Rio de las Vacas Wetlands project described above.

4. Rancho de Chapparral Girl Scout Camp hosts the New Mexico Forestry Camp annually. This six-day, residential, outdoor workshop for 13- to 17-year-olds is a great way for youth to learn about how New Mexicans use, care for, and appreciate the natural and cultural resources on their public lands (http://nmforestrycamp.org/about.html). In early June each year, approximately 40 young campers attend New Mexico Forestry Camp. The camp was started in by two member The 1,200-acre camp, located along the Rio de las Vacas, provides an ideal setting, with beautiful ponderosa pine, aspen, oak, and mixed conifer forests. NMED SWQB participated in the camp during the summers of 2006-2009 by teaching sessions to campers about water quality, aquatic invertebrates, and the importance of wetlands and

riparian zones. Forestry Camp is the brainchild of Betty-Jane Curry and Peggy Ohler, who are members of the Cuba Soil and Water Conservation District. Both women had observed that young people tended to come to emotional conclusions about such topics as range management and stream health, rather than basing their determinations on scientific facts. Betty-Jane and Peggy decided that some type of resource camp — where students could gain firsthand knowledge about appropriate resource decisions from the public land managers and community agencies entrusted with such decisions — would help students' understanding immensely. Betty-Jane and Peggy contacted friends within the various natural resource agencies in New Mexico to develop a program around understanding the "how and why" of resource management decisions. The first camp, held in 1990, was a huge success, and there has been a Forestry Camp almost every year since. Camp did not occur in 1996 and 2000 because of the extreme fire danger in the Jemez Mountains during the first week in June.

5. NMED SWQB has funded under CWA Section 319 grant FY11-E *Lower Rito Peñas Negras Riparian Restoration and Temperature Reduction Project*. The primary goals for this project include:
    - Reduce and then stabilize stream temperature through native riparian plantings and fencing to protect plants in the riparian zone.
    - Restore the natural ecology such that water quality is improved and wildlife habitat restored.
    - Build consensus and support for a shared vision of a healthy ecosystem for the Jemez watershed
    - Engage and educate schools and local citizens via environmental restoration and education activities throughout the duration of the project.

6. NMED SWQB has been selected for a 2011 CWA Section 104(b)(3) grant for a project titled *Assessing Beaver Habitat on Federals Lands in New Mexico*. The project contains the following elements:
    - Creating and utilizing a Geographic Information Systems (GIS) model to identify potential, suitable, and occupied beaver habitat on federal lands statewide to assess wetlands reestablishment potential.
    - Map existing wetlands in the Jemez Mountains where climate change effects are acute and where conditions may be ideal for beaver reintroduction pilot projects.
    - Convening a statewide workshop on beaver and wetlands restoration as a climate adaptation tool.

7. *Riparian Restoration along the Rio de las Vacas, NM: Addressing non-Point Source Impairments* is a project selected for Clean Water Act 319 funding in 2011. Rocky Mountain Ecology will perform several project tasks to reduce temperature in the river in the two mile reach downstream of the Chapparral Girl Scout Camp, including:
    - Installing 10,090 of fence to prevent grazing in the riparian area.
    - Planting 300 cottonwood poles, 1,000 willow whips and 150 containerized shrubs and trees
    - Ripping and reseeding 1,500 feet of roads

- Closure, revegetation of dispersed camp sites adjacent to the river, and installation of fencing to prevent vehicular and ATV access
- Using local materials for installation of up to 5 instream structures to create deep pools, stabilize eroding bands, and decrease the width to depth ratio
- Involving schools and local communities in riparian restoration activities and conducting environmental education workshops

Project partners are expected to include Cuba Soil and Water Conservation District and Cottonwood Gulch Foundation (www.cottonwoodgulch.com).

8. US Forest Service actions. The Cuba Ranger District, the agency managing this watershed has been very instrumental in their support of all the above activities and has improved their focus on this area. In 2010 a tanker carrying asphalt overturned, losing most of its load directly to the Rio de las Vacas. Quick thinking from the Cuba Ranger District staff resulted in minimal transport of the asphalt; it was contained to a pool and segregated from the rest of the flow. Staff has also responded in the case of an unknown fish kill in their investigation of the problem. Given current budget problems, they are knowledgeable about the area and patrol it often.

Potential Funding Sources

- CWA Section 319 Watershed Restoration grants
- CWA Section 104(b)3) Wetlands grants
- EPA Environmental Education grants
- U.S. Fish and Wildlife Partners Program grants
- NM Water Trust Board grants
- National Fish and Wildlife Foundation grants
- NM State Forestry R-Leaf program
- US Forest Service
- Individual donations and in-kind services

Inventory and Monitoring

The NMED SWQB utilizes a targeted, rotational watershed approach to ambient water quality monitoring. Water quality surveys are conducted approximately every eight years, and the next survey for the Jemez Watershed is scheduled for 2013.

Assessing Beaver Habitat on Federals Lands in New Mexico (see Education and Outreach/Local Initiatives) will result in GIS mapping of wetlands and potential beaver habitat of all streams in the Jemez Mountains. This mapping will be in preparation for the development and application of a New Mexico Rapid Assessment Method (NM RAM) for wetlands in the Jemez Mountains. As of October 2011, the NM RAM has been developed for montane riverine wetlands on the Upper Rio Grande (see hwww.nmenv.state.nm.us/swqb/wetlands/NMRAM/index.html). It is anticipated that NMED SWQB will expand the ability to use this NMRAM in new adjacent territories, including the Jemez streams. The intent is for the use the NMRAM for assessment following the next water quality survey in 2013.

We have collected data about the stream using Rosgen Level II classifications. The stream is on the CWA §303(d) list for temperature. The structures and the streambank plantings, and hopefully the return of the beaver will all contribute to cooling the water through this area. We will reproduce these surveys to note trend activity. The vegetative information collected will also let us know if the slope wetlands that were restored are moving towards a stable condition and within our fences, we should be able to document increased wetland habitat acreage. Already two beaver ponds have been documented where there were none. Because there is further restoration work in this watershed, we will be able to return to the site and follow up with the monitoring.

In addition, the project *Riparian Restoration along the Rio de las Vacas, NM: Addressing non-Point Source Impairments* (see description in Education and Outreach/Local Initiatives section) will conduct temperature, vegetative monitoring over the next four years. Monitoring activities will include:

- Installing two water temperature data loggers within the treated stream segments; take pre- and post-treatment measurements to evaluate effects of riparian plantings on water temperature (and solar radiation)
- Collecting pre- and post-treatment canopy cover data. An increase in canopy cover by ≥ 20% will indicate project success
- Conducting cross sectional data prior to and after treatments to ascertain if width to depth ratio was decreased at key locations
- Monitor pre- and post-treatment vegetation transects to ascertain success of both woody and vegetative riparian plantings
- Continue to collect photo monitoring points and capture pre- and post-treatment images
- Data collection to continue to measure the increased wetland acreage. We reported 39 acres of 'new' wetland that was observed as a result of Rio de las Vacas Wetlands Restoration project, and will continue to get GPS data to monitor these newly developed areas.

Site Prioritization and Proposed Projects

The Santa Fe National Forest issued a stream and riparian restoration plan and recommendations for the Rio de las Vacas in 2002 (USFS, 2002). Although the plan focused on habitat restoration for Rio Grande cutthroat trout, the general restoration goals stated in the plan are applicable to wetlands restoration:

1. Reduce summer and fall water temperatures.
2. Decrease bankfull width to depth ratios.

3. Increase the amount of large woody debris in the channel and floodplain where appropriate.
4. Increase the amount of side channel habitat where possible.
5. Increase the amount of suitable cutthroat spawning habitat.
6. Decrease the amount of fine sediment in the (sand, silt, clay) in the bankfull channel.

The following are specific wetlands restoration actions that still need to be accomplished on the Rio de las Vacas.

1. Monitoring.

- Staff will continue to conduct repeat photo monitoring at select photo points.
- Vegetation monitoring should be conducted annually for the next 2 years. Without funds this may be a little more difficult to achieve, however a new Section 319 project will be continuing to work on the next phase of Vacas restoration.
- Beaver occupancy. Continue trend of carrying capacity for beavers. The project area should be inspected annually during mid-Fall (October) to confirm presence/absence of beavers.
- Geomorphological. Channel morphology should be repeated every 5 years using Rosgen Level II survey techniques to ascertain channel response to structural and vegetative treatments.
- Expansion of wetland-riparian areas. Cross-sections and plan view surveys should be conducted to determine additional acreage created by combination of restoration activities.

2. Maintenance and repair of fences and structures.

- Mini-exclosures and Hemi-exclosures
- Minor maintenance of instream structures and erosion control structures
- USFS riparian exclosure pasture fence.
- Install new cross fences and water gaps between the upper and middle reach to minimize trespass cattle movement.

3. Revegetation

- Continue to plant willows: Willow cuttings should be planted at favorable sites in al hemi and mini-exclosures. Second priority is to plant willow cuttings at all instream structure sites installed during 2010. Third priority is to plant willows at protected cutbank in the USFS riparian exclosure pasture.
- Revegetation of the School Section wetland should be considered if natural vegetation does not occur. Use select species of sedges and rushes.

4. Wet Meadow restoration (in order of priority)

- School Section and Telephone Canyon. Maintain existing structures; install additional structures as appropriate.
- Install erosion control to protect/restore slope wetlands, springs and spring seeps in valley right tributaries including and especially Turkey Canyon.

5. New instream structures (confirmation of future funding and volunteer labor)

- Install the crossvane to provide grade control for the upper meadow. Crossvane at

Station 3952.

- Install planned hand built structures (28 baffles) in the middle reach or “B” section of the Vacas between Stations 4000 and 9000.
- A new 404/401 permit would be required.

6. Other – volunteer. If the two recommended riparian cross fences are installed, the existing riparian fences on the east side of the Rio de las Vacas between Stations 5000 and 9000 could be removed to enhance recreational value of the river for camping, fishing, wading, etc.
Riparian fence on the west side should be maintained as “drift fence.”

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