FINAL REPORT

October 2016

Innovative Design and Restoration of Slope Wetlands in the Comanche Creek Watershed, New Mexico

Assistance Agreement CD#00F434-01 (FY2011)

Log-rock run down structure, an innovative restoration technique designed and installed in Grassy Creek by this project

New Mexico Environment Department

Surface Water Quality Bureau

Wetlands Program

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Project Goals and Objectives

The New Mexico Environment Department Surface Water Quality Bureau Wetlands Program (SWQB Wetlands Program), in cooperation with Quivira Coalition, the US Forest Service – Carson National Forest, the Comanche Creek Working Group, and numerous volunteers, have completed restoration of 94 of acres of slope wetlands along Grassy and Springwagon Creeks in the Comanche Creek Watershed in Northern New Mexico. This project was designed to characterize slope wetlands and develop effective, innovative restoration techniques for slope wetlands at locations where the wetlands are de-watering due to historical land uses. The project goals include developing, implementing, and sharing the innovative techniques widely so that they will be used on other slope wetlands, as well as prioritizing and planning for future wetland restoration in the Comanche Creek Watershed. Objectives for sharing information about slope wetlands included: 1) producing and distributing a Slope Wetland Technical Guide *Characterization and Restoration of Slope Wetlands in New Mexico, A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options;* 2) conducting volunteer workshop weekends where volunteers learned by building restoration structures out of logs, rock and sod; 3) and conducting a one-day *Collaborative Wetland Restoration in the Southwest* workshop. The project also included the development of the *Wetland Action Plan, Comanche Creek Watershed*, a collaborative effort by the Comanche Creek Working Group. The Wetland Action Plan identifies restoration needs and proposed actions for the watershed.

Description of the Project

The SWQB Wetlands Program worked with the Quivira Coalition and several subcontractors to describe slope wetlands characteristic features, identify stressors that are causing degradation, and describe the resultant degraded conditions so that appropriate and effective restoration techniques could be designed. Five slope wetland areas in Northern New Mexico were surveyed to characterize the main attributes of these wetland features. Data collected included hydrology, topography, soils, vegetation, and geomorphology. Common legacy and current stressors that cause slope wetland decline were documented. From this characterization, novel restoration and design techniques were devised and tested in the Grassy Creek sub-watershed. Similar restoration work was done in nearby Springwagon Creek sub-watershed to provide project match using River Stewardship Program state restoration funds and volunteer labor. The project repaired incised channels and numerous headcuts in order to slow the flow of water, spread the water, raise the water table to re-hydrate historic wetlands, and increase water storage in the wetlands. Restoration structures were made from natural materials available in the area: rocks, logs, branches, sod dug on-site, and soil excavated by hand shovel or heavy machinery.

The Project resulted in the design of restoration techniques and the installation of restoration structures that were either new and innovative designs specifically for slope wetlands, or designs that were successful elsewhere and modified for slope wetland restoration. These included log and rock step fall structures; plug and pond, and plug and spread treatments; flow splitters; media lunas; worm ditches; sod plugs; and burrito dams, to name a few.

Figure 1. Site 10, Advancing headcut in Upper Grassy Creek before treatment, August 2014 (*left*). Figure 2. Site 10, Upper Grassy Creek in August 2016, two years after construction of a log step fall structure arrested the headcut (*right*).

The results of the slope wetland characterization and development of restoration designs and techniques are included in a SWQB Slope Wetlands Technical Guide, *Characterization and Restoration of Slope Wetlands in New Mexico, A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options*, by Bill Zeedyk, principal design contractor, and Mollie Walton, PhD. and Tamara Gadzia of the Quivira Coalition.

(https://www.env.nm.gov/swqb/Wetlands/TechnicalGuides/02/SlopeWetlandTechnicalGuide02.pdf) The slope wetland characterization study, restoration techniques and monitoring results were shared through annual meetings of the Comanche Creek Working Group, through volunteer weekend restoration workshops, and through a one-day *Collaborative Wetland Restoration in the Southwest* workshop in 2014.

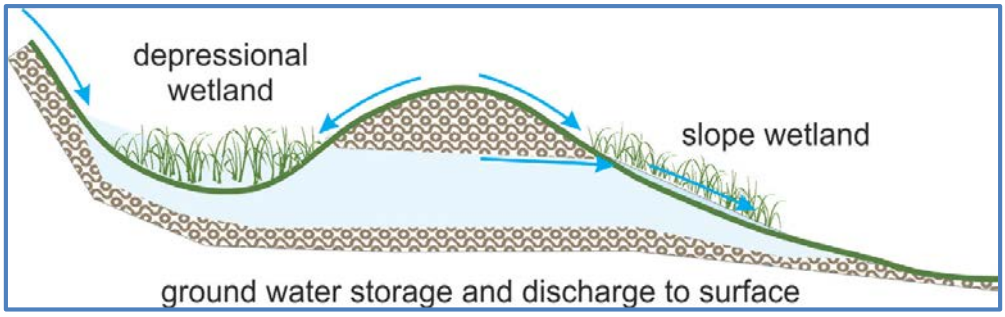


Figure 3. Schematic drawing of a slope wetland versus a depressional wetland from the Slope Wetlands

Technical Guide.

Another result of this project is the development of a planning document for wetlands in the Comanche Watershed *Wetland Action Plan, Comanche Creek Watershed.* (https://www.env.nm.gov/swqb/Wetlands/WAP/WAP_Comanche_Creek.pdf). The Wetlands Action Plan, which was developed by the collaborative Comanche Creek Working Group, describes the resource and includes maps of existing wetlands for the entire watershed, describes stressors, describes shared restoration/protection efforts, prioritizes restoration sites, and lists potential funding sources.

Project Outcomes

- Five slope wetland areas were characterized in Northern New Mexico to provide the basis for developing restoration designs based on hydrology, soils, topography, vegetation and geomorphology, and on the resultant degradation from a variety of stressors.
- 94 acres of slope wetlands were restored in Grassy and Springwagon Creeks, securing these critical headwater resources, improving water delivery downslope to Comanche Creek, restoring wetland habitat, and ultimately improving water quality and quantity in Comanche Creek.
- 187 people attended the *Collaborative Wetland Restoration in the Southwest* one-day workshop, and 500 copies of a Slope Wetlands Technical Guide entitled *Characterization and Restoration of Slope Wetlands in New Mexico: A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options* were distributed, providing targeted technical transfer to those who want to understand more about New Mexico wetlands. Conceptual designs for treatment are included in this publication.
- Over five years, 147 people volunteered for 5 weekend workshops, resulting in the training of numerous volunteers in wetland restoration techniques and the installation of hundreds of small restoration structures in Grassy and Springwagon creeks.

Figure 4. Volunteers digging wetland sod for installing sod plugs into small gullies and for filling gaps in log step fall and Zuni bowl structures in Upper Grassy Creek.

Figure 5. Volunteers constructing small one-rock dams in Upper Grassy Creek.

- Restoration structures were tested and monitored to determine their effectiveness: worm ditches, plug and pond structures and flow splitters at diverting and dispersing flow; burrito dams to spread surface water out over the valleys; one rock dams, log mats and tree mats to raise the bed of incised channels; sod plugs and rock channel liners to restore sheet flow; and Zuni bowls, log step falls, and rundowns (made of either rock, logs, or both) to halt the progression of headcuts. In many cases a combination of structures was constructed in series for the most effective treatment.

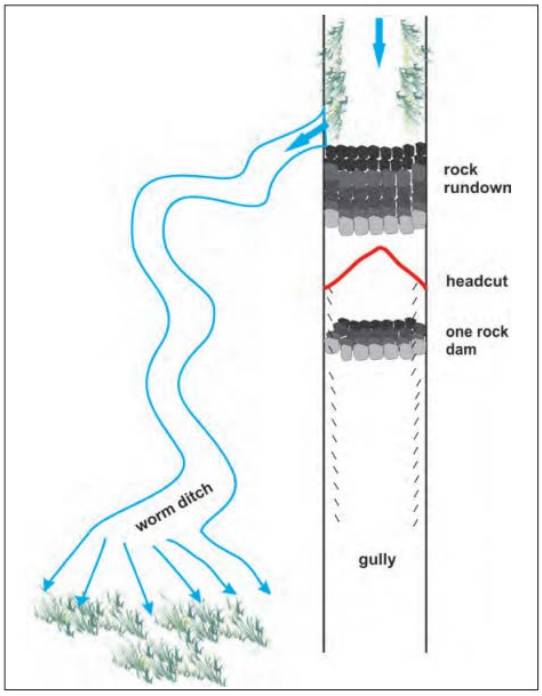


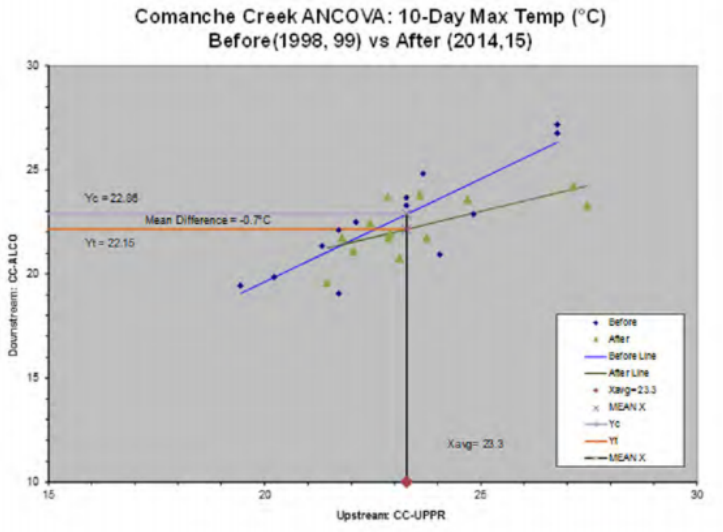
Figure 6. Schematic diagram from the Slope Wetlands Technical Guide showing how a worm ditch can be used in conjunction with other treatment structures to divert water out of an incised gully or channel and spread it out again on slope wetlands.

- The ecological value of this project lies not only in the 94 acres of slope wetlands that were restored, but also in the replicability of this type of work at other locations. There are many slope wetlands in New Mexico that can be restored using the same techniques.
- The *Wetlands Action Plan, Comanche Creek Watershed* has been used by the Quivira Coalition, Trout Unlimited, and US Forest Service-Carson National Forest as an outreach tool to secure approximately $1.6 million in additional grants and awards for more wetlands work in the Comanche Creek watershed. The additional funding includes multiple sources: federal (Pittman-Robertson, Clean Water Act Section 104b3), state (NM River Stewardship Program), and corporate (Coca Cola Company) and private (Stranahan Foundation).

- The Project resulted in popular and useful publications. The Slope Wetlands Technical Guide, *Characterization and Restoration of Slope Wetlands in New Mexico, A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options,* is in its third printing.
- Because of the work done through this project, Quivira Coalition was nominated by US Forest Service – Carson National Forest, and received the *Rise to the Future- Exceptional Volunteerism* award in March 2016 from US Forest Service Headquarters.

- Water quality monitoring conducted in the main stem of Comanche Creek by the Surface Water Quality Bureau Effectiveness Monitoring Program Coordinator indicates that water temperature is on a downward trend over the period of 1999-2016, although the creek is still impaired for temperature.

Comanche Creek gained recognition in 2013 as a water quality success story, for improvements in sedimentation and channel morphology (See the Summer 2013 issue of Clearing the Waters: www.env.nm.gov/swqb/documents/swqbdocs/WPS/CTW/ClearingTheWaters-Summer2013.pdf). Additionally, past projects reduced temperatures in Comanche Creek. An analysis of covariance (ANCOVA) compares the relationship of stations upstream and downstream of the project reach, before and after the work was conducted, in order to isolate the effects of restoration. The projects reduced stream temperature by an average of 0.7 °C in the middle reach from Holman Creek to Little Costilla Creek, with greater effect in the higher temperature range. Although temperature has decreased, Comanche Creek does not yet meet the standard for the high quality cold water aquatic life use, which has an upper limit of 23 °C. SWQB will continue to monitor temperature on Comanche Creek to account for the lag time of vegetation growth and to capture the effect of recent and future stream and wetland restoration projects.



ANCOVA results show that restoration projects on Comanche Creek have decreased stream temperature.

Provided by: Daniel Guevara, Environmental Scientist, NMED

Figure 7. Presentation of data showing a reduction in temperature in Comanche Creek.

Project Location and Previous History

The Comanche Creek Watershed is located in the Valle Vidal Unit of the Carson National Forest in Northern New Mexico.

Figure 8. Comanche Creek Watershed in Northern New Mexico.

The watershed is highly valued for its majestic views and recreational opportunities, such as hiking, camping, fishing, and hunting. Comanche Creek and its tributaries are designated as Outstanding National Resource Waters (ONRW) receiving the highest level of protection under the State's anti-degradation policy. Comanche Creek is home to native Rio Grande Cutthroat Trout, but the water temperature is not optimal for these fish to thrive. Comanche Creek is listed as impaired for temperature on the Clean Water Act (CWA) Section §303(d) list of impaired waters (2016).

Figure 9. Rio Grande Cutthroat trout.

Figure 10. Comanche Creek, downstream of the confluence with Grassy and Springwagon creeks.

The Comanche Creek Watershed is typical of many areas that have experienced intensive historical use of the landscape, including clear-cut timber harvesting, heavy livestock grazing, and mineral extraction. These activities resulted in the creation of numerous inadequately constructed and maintained roads, overgrazed grasslands, depleted vegetation in wetland and riparian zones, eroding stream banks and advancing headcuts throughout the watershed. The results of these land use practices led to an increased erosive tendency of the land. Many slope wetlands have become channelized with numerous gullies that lower the water table and desiccate the wetlands.

Figure 11. Advancing headcut at Treatment Area Site 17 on Upper Grassy Creek, a tributary to Comanche Creek (*left*). Figure 12. The site was treated with a Zuni bowl and one rock dam to stop headcut advancement (*right*).

Although NMED, the USFS-Carson National Forest, and the Quivira Coalition have performed restoration work in the watershed since the late 1990s with Clean Water Act (CWA) Section §319(h) funds, the prior work focused on the main stem of Comanche Creek rather than slope wetlands or the tributary streams.

Original Timeframe

The grant agreement that included this project was approved on December 21, 2011 and was scheduled to be completed by October 31, 2015. The grant award was amended for no-cost extension to October 31, 2016. The final year was used to complete an additional volunteer restoration workshop during which three large headcuts were treated in the Springwagon Creek Subwatershed, and numerous small structures were built and maintained in Grassy Creek Subwatershed. Also in the final year, 200 additional copies of the Slope Wetlands Technical Guide were printed for distribution.

Partners Involved

Contractor: Quivira Coalition- Mollie Walton, Land and Water Program Manager; Avery Anderson, Executive Director; Tamara Gadzia, Publications Coordinator; Michael Bain, Treasurer; Virginie Pointeau, New Agrarian Program Director; and Patricia Jenkins, GIS Coordinator.

US Forest Service - Carson National Forest: Jack Lewis, District Ranger, Questa Ranger District; George Long, Wildlife Biologist; Michael Gatlin, Fisheries Biologist; Greg Miller, Hydrologist; John Littlefield, Hydrologist and Ezequiel Rael, Range Conservationist.

Subcontractors: Bill Zeedyk, Zeedyk Ecological Consulting; Craig Sponholtz, Watershed Artisans, Inc.; Jeff Adams, Terrasophia; Steve Carson, Rangeland Hands, Inc.; Neal Bertrando, RT Permaculture; and Rick Smith, Highland Solutions, LLC.

Other Comanche Creek Working Group Members: Mark Torres, Valle Vidal Grazing Association; Toner Mitchell, Trout Unlimited; Jacob Davidson and Jeff Ogburn, New Mexico Department of Game and Fish; Tony Benson, Taos Soil and Water Conservation District.

Other Organizations or Individuals that Provided Volunteers, Assistance or Supplies:

Philmont Scout Ranch, Vermejo Park Ranch, Albuquerque Boy Scout Troop #189, NM Wilderness Alliance, Cottonwood Gulch Expeditions, Deanna Einspar, Rick Martinez, Insun Blemel, Okmi Blemel (camp cooks), and dozens of other volunteers.

Funding

The original federal funding amount was **$310,298.00** and the original match was **$137,530.00**. The final federal amount spent was **$303,336.31** and the final match amount was **$281,063.79 ($143,533.79 overmatched)**.

Project Highlights and Chronology

- The project was approved and funded by EPA on December 21, 2011 under Assistance Agreement CD#00F434-01 (FY2011).

- NMED executed a sole source agreement on June 7, 2012 with Quivira Coalition, a Contractor with the expertise and resources to implement the project.

- NMED executed an Intergovernmental Agreement with the US Forest Service – Carson National Forest on May 9, 2012 to assist with assessment, planning and implementation of the project.

- The Wetlands Project Officer met with the Quivira Coalition (Avery Anderson and Mollie Walton) and the Carson National Forest (George Long) on March 27, 2012 to discuss how to proceed through compliance with National Environmental Policy Act (NEPA).

- Field work to characterize slope wetlands was conducted by the Wetland Project Officer, Quivira Coalition, Zeedyk Ecological Consulting, US Forest Service (Josh Hall and Greg Miller) in 2012 on April 12, May 1, July 16, July 17, 2012, and in 2013 on May 20-24, June 21, August 18-19 and October 5. The field team decided that in order to obtain the clearest characterization for this subclass of slope wetlands, the reference domain would be restricted to slope wetlands with similar slope, aspect and elevation in the Sangre de Cristo mountain range. Several preliminary data collection methods, parameters and questions were discussed that needed to be analyzed in order to correctly characterize this wetland subclass. Reference materials regarding slope wetlands were identified and shared with project team members. Data were collected at five slope wetlands sites in the Comanche Creek Watershed for use in the characterization of this wetland subclass. Data included GPS data, longitudinal and cross-sectional profiles, wetland soil characteristics (based on 1987 US Army Corps of Engineers Wetland Delineation protocol), and plan view maps.

- Quivira Coalition conducted a volunteer weekend workshop in the Comanche Creek Watershed on August 10-12, 2012. Volunteers and consultants worked with Quivira Coalition and USFS staff to collect preliminary hydrogeomorphological measurements of lower Grassy Creek and the associated wetlands, and the upper portion of Springwagon Creek and associated wetlands. The workshop provided matching funds as well as data to inform the characterization and restoration of slope wetlands.

- On August 24, 2012 the Wetlands Program Team met with Quivira Coalition, Zeedyk Ecological Consulting, and Wetwater Environmental Services (a potential subcontractor) to clarify and discuss the scope of this project and the relationship to the (state-funded) River Ecosystem Restoration Initiative (RERI) grant that was also restoring wetlands in the Comanche Creek Watershed and providing matching funds for this grant through volunteer weekend workshops. It was decided that the Slope Wetlands grant objectives would be met by restoring 60 acres of wetlands in Upper Grassy Creek, whereas the RERI project objectives would be met by restoring 30 acres of wetlands (and 2.5 miles of stream channel) in Springwagon Creek and Lower Grassy Creek. The two projects would be distinct but similar in goals and implementation.

- A PQAPP was submitted by the Wetlands Project Officer and SWQB QA Officer, and was approved by EPA on August 29, 2012 (QTRAK #12-471).

- On September 25, 2012, the Wetlands Project Officer and Wetlands Program Coordinator met with Quivira Coalition and Zeedyk Ecological Consulting to review GIS Landscape Level wetland mapping of the area to narrow the selection of potential wetland reference sites. Several sites were selected in the Valle Vidal and Vermejo Park Ranch area.

- On November 14, 2012, the Wetlands Project Officer attended a Wetland Ecology Lecture presented by John Vradenburg of the US Fish and Wildlife Service as part of the Festival of Cranes annual event by Bosque del Apache National Wildlife Refuge. On November 15 & 16, 2012, the Wetlands Project Officer attended the Quivira Coalition Conference. Participation in these two events provided background on the audience and presentation format for the upcoming Slope Wetlands Workshop at the Quivira Coalition Conference.

- The Carson National Forest issued a NEPA Categorical Exclusion Decision Memo for the restoration work on February 26, 2013.

- The Clean Water Act Section 404 Permit/401 Certification was approved on July 15, 2013.

Figure 13. Design document for location of restoration structures in Upper Grassy Creek. This document was part of the CWA 404 permit application, along with schematic drawing of the various stuctures that would be employed.

- The Wetlands Project Officer attended Applied Fluvial Geomorphology training with Wildland Hydrology in Montana in June 2013. This course is sometimes referred to as Rosgen Level I training. The class, taught by Dave Rosgen, PhD, directly assisted the

Wetlands Project Officer with characterization of the slope wetlands and hydrogeomorphic classification (HGM). This intensive course covered valley type, stream type, longitudinal profiles, and cross-sections, as well as other stream data collection methods and a general overview of restoration techniques and principles for rivers, riparian areas, and wetland types such as wet meadows.

- Quivira Coalition conducted a volunteer weekend workshop in the Springwagon Creek Sub-Watershed on July 26-28, 2013 as match for this project. Quivira Coalition hosted 29 volunteers for the weekend. All of the scheduled restoration for the RERI project in Springwagon Creek was completed (30 acres of wetlands restoration and 2.5 miles of creek channel).

Figure 14. A log mat was installed in at Site 15 in Upper Springwagon Creek to raise the channel and lateral worm ditch was dug to redirect flow to rewet a meadow. Photo taken August 2013 just after installation (*left*). Figure 15. Site 15 in Upper Springwagon Creek two years after log mat and worm ditch Photo August 2013 just after completion (*right*).

- Quivira Coalition conducted a volunteer weekend workshop in the Grassy Creek Sub-Watershed on August 16-18, 2013. Quivira Coalition hosted 29 volunteers for the weekend. All of the scheduled restoration was completed. Restoration experts were on hand to demonstrate hand work techniques to the volunteers, including building log structures, rock structures, sod plugs, and worm ditch techniques.

Figure 16. Volunteers building a one-rock dam in Springwagon Creek subwatershed at the August 2013 restoration workshop.

- The Wetlands Project Officer and Quivira Coalition met on August 21, 2013 to discuss development of the Wetland Action Plan.

- The Wetlands Project Officer attended two days of the Quivira Coalition Conference on November 14-15, 2013. The conference featured a presentation on native trout management by Bill Zeedyk of Zeedyk Ecological Consulting, a subcontractor for this project.

- The Comanche Creek Working Group met on December 10, 2013 to discuss the slope wetland project as it relates to temperature impairment of Comanche Creek.

- The Wetlands Project Officer and Quivira Coalition staff met on December 11, 2013 to discuss the format and potential speakers for the preconference workshop on February 18 and 20, 2014 to finalize format, logistics and speaker lineup for the preconference workshop.

- Quivira Coalition submitted a draft of the WAP to the Comanche Creek Working Group on April 16, 2014 for the members' review.

- The Comanche Creek Working Group met on June 19, 2014 to finalize the WAP. The group discussed prioritization of wetlands for restoration and future funding needs.

- A volunteer group from Cottonwood Gulch Expeditions spent a day working in the Grassy Creek Subwatershed on July 23, 2014. Seventeen volunteers spent the day collecting rocks to be used in restoration structures during the August 2014 work weekend.

- Quivira Coalition conducted a volunteer weekend workshop in the Grassy Creek Subwatershed on August 16-18, 2014. Quivira Coalition hosted 59 volunteers who completed 105 small structures over the course of the weekend. An additional 19 structures were built by Watershed Artisans between July 28-August 24, 2014.

Figure 17. Volunteers building a log step fall structure in Upper Grassy Creek at the August 2014 workshop.

Figure 18. Site 10 in Lower Grassy Creek had a large headcut in a steep section of the channel (*top left*). Figure 19. Subcontractors used machinery to construct a log-rock rundown structure in August

2014 (*top right*). Figure 20. This structure holds the grade and prevents the headcut from migrating and draining the wetlands upstream (*bottom*).

Figure 21. Volunteers listening to Craig Sponholtz, Watershed Artisans, describe the function of the log-rock rundown structure built by subcontractors at Site 10 in lower Grassy Creek.

- The Slope Wetlands Technical Guide *Characterization and Restoration of Slope Wetlands in New Mexico, A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options* was completed and 500 printed copies were delivered by November 2014.

- A second small contract by direct purchase order with Quivira Coalition was executed on October 16, 2014 in order to provide funding for speakers at the Preconference Slope Wetlands Workshop.

- The one-day *Collaborative Wetland Restoration in the Southwest* workshop was conducted on November 12, 2014, in conjunction with the annual Quivira Coalition Conference. The workshop was attended by 187 people, including the SWQB Wetlands Program Coordinator Maryann McGraw and team member Karen Menetrey.

QUIVIRA COALITION

COLLABORATIVE WETLAND RESTORATION IN THE SOUTHWEST

Full-Day Classroom Workshop
Wednesday, November 12, 2014

$90/PER PERSON

EMBASSY SUITES HOTEL, ALBUQUERQUE, NEW MEXICO

Wetlands in the Southwest, from high mountains to low plateaus, are increasingly precious in a drying landscape. Addressing wetland degradation has implications for the health of an entire watershed, not just the wet areas. As climate change strongly influences the success of restoration projects, it is ever more important to combine efforts and ideas to bring these essential ecosystems back to health.

This full-day workshop is anchored by restoration specialist, Bill Zeedyk who owns and operates a small consulting business specializing in the restoration of wetland and riparian habitats. Bill is familiar to Quivira audiences as the innovator of successful riparian restoration methods based on his philosophy of "thinking like a creek" and using low-tech, hands-on methods and native materials. He will share his latest ideas and new restoration strategies for adapting to hotter and drier conditions developing across the Southwest.

Speakers from a variety of backgrounds—nonprofit organizations, volunteer groups, small businesses, ranches and other private land holdings, and public land management agencies—will share their experiences with collaborative wetland restoration.

Workshop presented by the Quivira Coalition in collaboration with the New Mexico Environment Department – Surface Water Quality Bureau, Wetlands Program.

BACK TO THE FUTURE

This full-day event is part of the 2014 Quivira Conference.
conference@quiviracoalition.org
Register online: www.quiviracoalition.org
(Lunch not included.)

- Bill Zeedyk, ZEEDYK ECOLOGICAL CONSULTING, LLC
- Michelle Barnes, NMED, SURFACE WATER QUALITY BUREAU, WETLANDS PROGRAM
- A.T. Cole, BURRO CIENEGA RESTORATION PROJECT
- Shawn Conner, BIO-LOGIC, INC.
- Kristina Fisher, ALBUQUERQUE WILDLIFE FEDERATION
- George Long, USFS, CARSON NATIONAL FOREST
- Brett Redden, RANCHER, REDDEN RANCH
- Bob Sivinski, RCS SOUTHWEST
- Craig Sponholtz, WATERSHED ARTISANS, INC.
- Dan Taylor, BAT CONSERVATION INTERNATIONAL
- Mark Torres, VALLE VIDAL GRAZING ASSOCIATION
- Mollie Walton, PhD, QUIVIRA COALITION LAND AND WATER PROGRAM DIRECTOR

Figure 22. Advertising flyer for November 2014 *Collaborative Wetland Restoration in the Southwest* workshop.

- Wetlands Project Officer Shelly Barnes left the agency and went to work for the US Army Corps of Engineers in April 2015. Karen Menetrey became the Wetlands Project Officer for the project at that time. The SWQB Wetlands Program had a team meeting on March 25, 2015 to facilitate a smooth transition.

- The Comanche Creek Working Group took a field trip, hosted by the US Forest Service, on May 5, 2015 to plan a project that will be funded by Coca Cola Company as part of their Water Neutrality 2020 Initiative. Coca Cola Company is particularly interested in the "water replenishment value," i.e. the water storage aspect of slope wetlands. Field trip participants included the SWQB Wetlands Program, USFS- Carson National Forest, US FS Headquarters (Partners Program), National Forest Foundation, Quivira Coalition, Trout Unlimited, and Valle Vidal Grazing Association.

Figure 23. Holman Creek during May 5, 2015 field trip. The red arrow points to a headcut that was draining a five-acre fen. The headcut was stabilized in 2015 by installing a Zuni bowl with funds from Coca Cola Company.

- The Comanche Creek Working Group met on May 8, 2015 at the US Forest Service Taos Field Office. The group discussed revisions to the WAP, prioritization of wetland restoration areas, future funding needs, and the Coca Cola Company project planned for Summer 2015.

- Quivira Coalition conducted a volunteer weekend workshop on August 7-9, 2015. Quivira Coalition hosted 59 volunteers who completed 105 small structures over the course of the weekend. Volunteers ranged in age from 10 to 80 and included members of Trout Unlimited, Boy Scout Troop 189, and a wide range of individuals. Volunteers were separated into four groups who worked with crew bosses (subcontractors). The groups went to different areas in the Grassy Creek and Springwagon Creek subwatersheds where they built one-rock dams and log step fall structures, dug worm ditches and place sod plugs in small channels.

Figure 24. Volunteers digging a worm ditch in Springwagon Creek subwatershed.

Figure 25. Site 13, Lower Grassy Creek. Series of advancing headcuts, August 2013 (*left*). Figure 26. Site 13, two years later after stabilization with Zuni bowls built by the subcontractors, August 2015 (*right*).

- The Comanche Creek Working Group met October 6, 2015 at the US Forest Service Taos Field Office to review restoration work completed during 2015, including: the restoration work for this project, restoration work conducted with funds by the Coca Cola Company, and a fish passage barrier study (regarding native Rio Grande Cutthroat trout) conducted by the Quivira Coalition with funds from the US Fish and Wildlife Service. The Group also had a final discussion about the prioritization table for wetlands restoration in the WAP.

- NMED requested a grant extension of the project and budget modification from EPA in order to complete an additional volunteer restoration work weekend. EPA approved the request on June 9, 2016.

- NMED extended the contract with Quivira Coalition on December 3, 2015, and increased compensation in order to complete the Summer 2016 workshop and to construct fencing that protects prior restoration work from livestock grazing.

- The Comanche Creek Working Group met on February 12, 2016 at the US Forest Service Taos Field Office to discuss Summer 2016 work.

- EPA approved a PQAPP update (QTRAK #16-215) for this project on April 18, 2016.

- The final *Wetland Action Plan, Comanche Creek Watershed* was submitted to NMED by Quivira Coalition on June 2, 2016.

- Quivira Coalition conducted a volunteer weekend workshop in the Springwagon and Grassy Creek Subwatersheds on August 4-7, 2016. Quivira Coalition hosted 40 volunteers. Work completed included: stabilizing three large headcuts in Springwagon Creek; fencing two sensitive wetlands areas to exclude cattle from sites where plug and pond structures were previously constructed, and building or maintaining several small structures on Grassy Creek.

Figure 27. Installation of a step fall structure at Site 2, Upper Springwagon Creek in August 2016.

Figure 28. Construction of a livestock exclosure fence around one of the plug and pond structures in a sensitive wetland area in Upper Grassy Creek in August 2016.

Figure 29. Site 1, Upper Springwagon Creek, shows a migrating headcut, July 2013 (*left*). Figure 30. Site 1, immediately after installation of a log step fall and rock rundown structure to arrest the headcut in August 2016 (*right*).

- Annual restoration project monitoring occurred in the summer/fall of 2012, 2014, 2015, and 2016. The 2014 monitoring included only photopoint monitoring, whereas the other years included Rosgen Level II and greenline and photopoint monitoring. The monitoring complies with the requirements of the Clean Water Act Section 404 permit for the project and shows that the project structures are firmly embedded and wetlands acreage is expanding.

- The Comanche Creek Working Group met on September 16, 2016 to discuss an upcoming field trip to highlight the restoration work in Comanche Creek Watershed prior to seeking corporate (Coca Cola Company) and federal (Pittman-Robertson) grant funding.

- The Comanche Creek Working Group toured restoration work in the Comanche Creek Watershed. The field trip was led by the US Forest Service-Carson National Forest and 42 people participated, including: representatives from the US Forest Service Southwest Supervisor's Office and National Headquarters; the Wetlands Project Officer; Quivira Coalition; NM Department of Game and Fish; National Forest Foundation; Trout Unlimited; Valle Vidal Grazing Company; Coca Cola Company; Natal Energy; Intel Corporation; Facebook; The Nature Conservancy – Rio Grande Water Fund; congressional staff from the offices of Senator Tom Udall, Senator Martin Heinrich, and Representative Ben Ray Lujan; a blogger from Albuquerque Mom's Blog; and reporters from the Taos News and Santa Fe Reporter. The result of the field trip was a pledge by Coca Cola Company for approximately $240,000 in wetland restoration funds over a two-year period (2017-2018), which will match a pledge from the NM Department of Game and Fish for $840,000 in federal Pittman-Robertson funds for wetland restoration. These funds will use the innovative methods developed in this project to restore slope wetlands in the headwaters of Vidal Creek in the Comanche Creek Watershed.

Figure 31. Comanche Creek field trip participants visited headwaters of Vidal Creek *(left).* Figure

32. A two tiered log mat in the headwaters of Comanche Creek that was built in 2016 with Coca Cola Company funding *(right).*

- The Wetlands Project Officer attended the Quivira Coalition Conference on November 9-11, 2016 and presented project materials at an Exhibitor table.
- The Wetlands Project Officer attended a four-day Stream Assessment and Stability Workshop titled "Inventory and Assessment of Stream Channels in the Arid Southwest." The workshop was taught by Natural Channel Design, Inc. on October 17-21, 2016 in Flagstaff, AZ. Materials covered included a review of the Rosgen channel classification system, including hydraulic geometry, channel pattern and profile and hydrology. New materials covered included stream stability assessment methods: the BANCS model using the Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS); Pfankuch; SVAP-2; vegetation; channel evolution; and bar sampling. Also covered were: modeling (FlowSed and PowerSed) and stream stability monitoring techniques (bank pins, scour chains, monumented cross sections and monitoring protocols). In addition to classroom lectures, the students spent 1.5 days in the field conducting stream stability measurements on creeks south of Flagstaff and several hours in the classroom processing and interpreting the data. Information obtained in the workshop will be helpful for continuing to develop the NMED Wetlands Program. Specifically, it will be useful for evaluating stream channels and developing projects for wetlands protection and restoration.

List of Major Deliverables (on file at NMED)

Notes from Comanche Creek Working Group Meetings

PQAPP

Project design elements

Clean Water Act 404 permit/401 certification

Monitoring reports

Semi-annual reports to EPA including photographs of project progress

Documentation of expenditures, including project match

Characterization and Restoration of Slope Wetlands in New Mexico, A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options

Wetland Action Plan, Comanche Creek Watershed

Final report

Lessons Learned

An important lesson learned is that an innovative project truly requires a collaborative team. From the permitting, field assessment, and restoration implementation, to the completion of monitoring and reporting, attention to details is critical. The project must have reliable and knowledgeable contractors, subcontractors and agency contacts. Ongoing communication between the Contractor (Quivira Coalition) land management agency (US Forest Service), funding agency (NMED) and permitting agency (US ACE, NMED, and US Forest Service) was a key to success. As the project progressed, communication among team members was strengthened through formal meetings of the Comanche Creek Working Group as well as numerous smaller meetings, phone calls and field trips.

What Made the Project Successful

The project was successful due to many key partnerships developed among knowledgeable, committed and competent individuals and organizations. These partnerships strengthened the effectiveness of the Comanche Creek Working Group for this project and future restoration projects.

- The Quivira Coalition was the primary contractor to the SWQB Wetlands Program and provided invaluable commitment, technical expertise, and leadership to the Comanche Creek Working Group and project subcontractors (Zeedyk Ecological Consulting; Watershed Artisans, Inc.; Terrasophia, LLC; Rangeland Hands, Inc; Highland Solutions, LLC; and RT Permaculture). The Quivira Coalition also contributed staff hours and conducted the *Collaborative Wetland Restoration in the Southwest* workshop that reached many landowners, land managers, students, agencies, tribes and interested citizens.
- The restoration design that was developed by the contractor/subcontractor team was successful because it was based on rigorous scientific assessment and the principles of natural channel design. Innovative techniques developed through the project will inform future restoration projects on slope wetlands. Many of the techniques will be used to increase water storage in wetland soils to improve wetland condition, and also to positively impact the local hydrologic cycle in degraded systems.
- As the land manager of the Valle Vidal, the US Forest Service was a critical partner in the success of the project. Carson National Forest managers and staff were very involved and supportive of the restoration work, from completing necessary permitting requirements, to purchasing and staging materials, to constructing the treatments along with the subcontractors and volunteers.

- The Valle Vidal Grazing Association recognizes the restoration work as beneficial because it increases forage volume for livestock. The grazing association participated in the volunteer workshops, built fencing to exclude cattle from sensitive wetland areas, and is managing cattle grazing in a manner that protects the project. Quivira Coalition and Valle Vidal Grazing Association have shared the message about slope wetlands by presenting to organizations in other watersheds such as the Cimarron Watershed Alliance and the grazing association in the Rio Tusas Watershed in Northern New Mexico. Mollie Walton (Quivira Coalition) and Mark Torres (Valle Vidal Grazing Association) speak about the importance of wetlands for increasing forage in a way that increases understanding and concurrence from cattle ranchers.
- Trout Unlimited contributed through involvement in planning, outreach and recruitment of volunteers.
- Rangeland Hands, Vermejo Park Ranch and Valle Vidal Grazing Association donated logs and fencing materials.
- Philmont Scout Ranch and Boy Scout Troop #189 consistently provided dedicated volunteers.
- Many other volunteers contributed labor and mileage that resulted in the project accruing a wealth of matching funds.

Figure 33. Volunteers carrying logs for step fall structures at August 2014 restoration workshop in Grassy Creek.

Figure 34. Volunteers carrying sod to use for sod plugs and to fill gaps in step fall structures and Zuni bowls at the August 2014 restoration workshop in Upper Grassy Creek.

What Made the Project Not So Successful

Although the project was very successful, there were many challenges and obstacles that had to be overcome.

At the beginning of the project, Wetlands Project Officer charged most of her time to state funds as match for the project instead of charging directly to the grant. She did this in order to ensure sufficient project match. However, the project was popular with volunteers so there was no problem accumulating match once the implementation started. By the end of the project, there was abundant match but the personnel category of the grant had not been spent. The SWQB Wetlands Program turned this issue into an advantage by requesting an extension from EPA, which was approved and allowed for an additional work weekend to mend three big headcuts in Springwagon Creek.

There were also obstacles with permitting. In 2012, NMED implemented a new anti-degradation rule for Outstanding National Resource Waters. The rule requires 30-day public notice before issuing the CWA Section 401 certification for a CWA Section 404 permit. This caused a delay in obtaining the CWA Section 404 permit for the Summer 2012 and prevented the start of restoration implementation. This problem was addressed by using the Summer 2012 volunteer weekend to collect data for the characterization of slope wetlands rather than starting restoration implementation.

There were numerous concerns about getting appropriate supplies staged in time and other constraints related to performing work at high altitude (9,000-10,000 feet), where weather, threats of wildfire, and elk calving/hunting closures make for a very short available work season. Each of these problems required unique and creative back-up plans. For example:

- The risk of wildfire was high in New Mexico during the summers of 2013 and 2014. There were access or activity restrictions in several National Forests and that caused uncertainty about being able to conduct the volunteer restoration workshops. Fortunately, the restrictions were lifted in time to hold all the workshops.

- Approximately 25 shovels were stolen from a well-hidden, remote cache in Springwagon Creek. Quivira Coalition had to scramble to local hardware stores to replace the shovels just before the August 2015 volunteer work weekend.

- Logs that the Carson National Forest had cut in 2015 for the log step fall structures were green and too heavy for volunteers to carry to the restoration treatment sites. Instead, those logs were used for other restoration work, and Rangeland Hands donated seasoned logs that had been stored in their business yard.

- Mice had infested Shuree Lodge a vacant building where Quivira Coalition planned to store camp food for the volunteers. Instead, Quivira Coalition rented a van to transport and store the food.

- A camp cook was not available to cook for the 40 volunteers for the 2016 restoration workshop, until a 16-year-old boy scout and his mother volunteered at the last minute. This young man and his family has participated in workshops at Comanche Creek for six years. Quivira Coalition has determined it is most efficient for the volunteers to contribute a nominal amount for communal meals, rather than have everyone buy, transport and cook their own food at the remote campsite.

Figure 35. Volunteer workshop campsite near Shuree Lodge in August 2016. The camp kitchen is to the right in the beige canvas tents.

Technical Transfer

- Seven hundred copies of the Slope Wetlands Technical Guide have been printed and most have been distributed. The guide is available for downloading from the SWQB Wetlands Program webpage.

- The Slope Wetlands Technical Guide has been requested by restoration practitioners from as far away as Australia and China. The public availability of the guide ensures that the information is being disseminated in wetland restoration practitioner circles as well as to the interested public. The innovative techniques have application for different types of slope wetlands across many regions. The techniques work in non-depressional wetlands and wet meadows and have application for water spreading techniques at degraded wetland sites.

- Fifty copies of the WAP have been printed and most have been distributed. The WAP is available on the SWQB Wetlands Program webpage and is being used for restoration planning and fundraising.

- 187 people attended the *Collaborative Wetland Restoration in the Southwest* one-day workshop.

- 147 people volunteered their labor to build restoration structures, at the same time learning about the ecological functions of slope wetlands, stressors that damage wetlands, and ways to fix the damage.

- The Wetlands Project Officer attended the Quivira Coalition Conference in Albuquerque, NM on November 9-11, 2016, and displayed information about the slope wetlands project at an exhibitor table. A dozen copies of the Slope Wetlands Technical Guide were distributed to interested people at the conference. Approximately 400 people attended the conference.

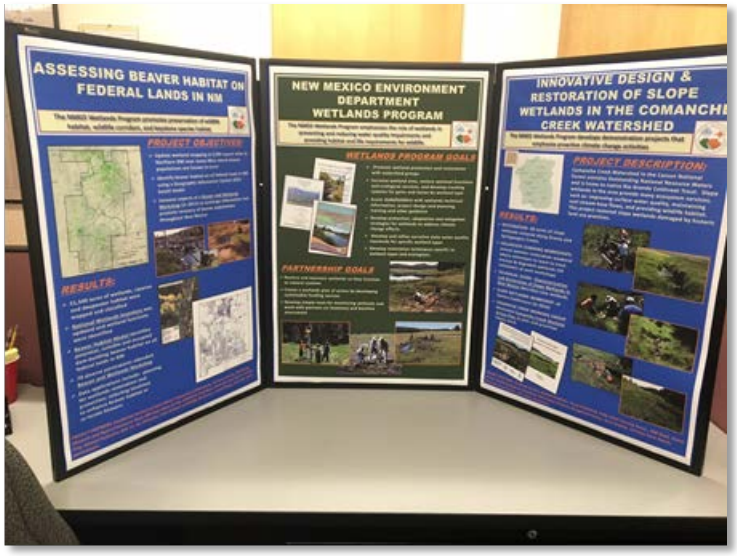


Figure 36. Exhibit board used at Quivira Coalition Conference, November 2016.

EPA Feedback Loop

EPA was very supportive in all aspects of the project during the grant period. The grant extension was especially appreciated, because it allowed NMED to complete additional outreach and restoration, and significantly contributed to the culmination of a successful project.

Future Activity Recommendations

The *Wetland Action Plan, Comanche Creek Watershed* was developed in order to prioritize future activities and recommendations for restoration.

Each of the subwatersheds in the Comanche Creek Watershed has had historical stressors and needs restoration work to recover fully functioning wetlands. Funding has been obtained by NMED to address wetland restoration in the Holman Creek subwatershed through a federal Clean Water Act Section 104(b)(3) Wetland Program Development grant that emphasizes the use of keyline design. Restoration of wetlands in the Sawmill Creek and Foreman Creek subwatersheds is being funded through the New Mexico River Stewardship Program. Restoration of the Vidal

Creek subwatershed will be funded through federal Robertson-Pittman and corporate Coca Cola Company funding. However, there are still several other tributary watersheds that need wetlands restoration work.

Restoration of slope wetlands in Grassy and Springwagon watersheds is expected to be sufficient for natural processes to support wetland functions going forward. However, ongoing monitoring and field maintenance will still be beneficial. Future volunteer workshops should include having a small team check the restoration treatment structures and perform any small repairs that are needed. The US Forest Service - Carson National Forest and the Valle Vidal Grazing Association will be important partners in identifying and addressing upcoming issues.

The SWQB Wetlands Program and the Comanche Creek Working Group will continue to promote the techniques developed in this project to for use in other watersheds. Areas where slope restoration may occur in the near future include the Rio Tusas, Rio San Antonio, Rio Chamita in Northern New Mexico.

The SWQB Wetlands Program is expecting to develop a Slope Wetlands Rapid Assessment Method in the future, although funding is not available to do so at this time. Information gained in this project will form an initial basis for future assessment criteria.