River Stewardship Program
Gallinas Village River and Floodplain Restoration Project

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List of Abbreviations

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<th>ABBREVIATION</th>
<th>DEFINITION</th>
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</thead>
<tbody>
<tr>
<td>ARMAS</td>
<td>Achieving in Research Math and Science – Internship program at NM Highlands University</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>HPWA</td>
<td>Hermit’s Peak Watershed Alliance</td>
</tr>
<tr>
<td>HQCWAŁ</td>
<td>High Quality Coldwater Aquatic Life</td>
</tr>
<tr>
<td>HQCWF</td>
<td>High Quality Coldwater Fishery</td>
</tr>
<tr>
<td>LV</td>
<td>Las Vegas</td>
</tr>
<tr>
<td>NM</td>
<td>New Mexico</td>
</tr>
<tr>
<td>NMED</td>
<td>New Mexico Environment Department</td>
</tr>
<tr>
<td>NMHU</td>
<td>New Mexico Highlands University</td>
</tr>
<tr>
<td>NPS</td>
<td>Non Point Source (pollution)</td>
</tr>
<tr>
<td>QAPP</td>
<td>Quality Assurance Project Plan</td>
</tr>
<tr>
<td>SSTEMP</td>
<td>Stream Segment Temperature Model</td>
</tr>
<tr>
<td>SWQB</td>
<td>Surface Water Quality Bureau</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>USEPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>UWC</td>
<td>United World College</td>
</tr>
<tr>
<td>W/D, W:D</td>
<td>Width to depth ratio</td>
</tr>
<tr>
<td>WBP</td>
<td>Watershed Based Plan</td>
</tr>
<tr>
<td>WQCC</td>
<td>Water Quality Control Commission</td>
</tr>
<tr>
<td>WQS</td>
<td>Water Quality Standards</td>
</tr>
</tbody>
</table>
Acknowledgements

Heartfelt thanks to all the following people that contributed to this project.

- NM Environment Department Staff: Abraham Franklin, Neal Schaeffer (retired), Susan Ossim
- US Army Corps of Engineers: Deanna Cummings
- City of Las Vegas: Ken Garcia (former Utilities Director), Maria Gilvarry (current Utilities Director)
- San Miguel County: Les Montoya (former County Manager)
- La Placita Volunteer Fire Company: Karen Baldi (Chief), various volunteers
- Riverbend Engineering, Chris Philips
- Craig Sponholtz, Watershed Artisans
- Bill Zeedyk, Zeedyk Ecological Consulting
- Steve Townsend, Townsend Archaeological Consultants
- Aaron Kauffman, Southwest Urban Hydrology
- Landowners: Rock Ulibarri, Frank Davis, Arnold Padilla
- HPWA Staff: Katie Withall (former employee), Lorraine Garcia (former VISTA), Eliza Montoya (current employee)
- NMHU ARMAS Interns: Aaron Tsinger, Conrad Duran
Introduction

Restoring healthy conditions to the Gallinas River and its watershed has been the focus of work done by the Hermit’s Peak Watershed Alliance and many others so that our small river can sustain both natural and human communities into the future. This document summarizes a significant restoration project, the Gallinas Village River and Floodplain Restoration Project (RSP-GV), funded by the River Stewardship Program of the NM Environment Department. This restoration effort is an important project to help the Upper Gallinas Watershed more fully serve its beneficial watershed functions and be a demonstration to facilitate future restoration.

Project Area

The RSP-GV project took place in the Upper Gallinas Watershed, within NMED Assessment Unit (AU) NM_2212_00. The specific project site is a 30 acre property located immediately downstream of the La Placita Volunteer Fire Department. It is primarily owned by the City of Las Vegas with small parts owned by two adjacent private landowners in Gallinas Village; it has just over a 1/3 mile of river (see Map 1 - Project Area).

The Upper Gallinas Watershed is a sub-watershed of the Pecos Watershed and is located in northeastern New Mexico. The entire watershed is 48,968 acres (76.5 mi²) from its headwaters on Elk Mountain to the Las Vegas Diversion near Montezuma, NM, including Porvenir Canyon and consists of 32.5 miles of stream. The Upper Gallinas Watershed covers the Gallinas River, Gallinas Creek and Porvenir Canyon Hydrologic Unit Codes (HUC) 130600010801, 130600010802 and 130600010805 (see Map 1 inset).

This project location was identified as a River Stewardship Program priority area in Appendix A of the RFP 40-667-14-23110. Located approximately 3.5 miles upstream of the City of Las Vegas diversion, this project advanced source water protection of public drinking water supplies and improved urban water quality and stream habitat within the Las Vegas’ watershed.

The project area is strategically located in the watershed and is part of a coordinated effort to address river and floodplain restoration in a high priority area of the Gallinas River. It is part of the last wide and relatively undeveloped river/floodplain complex before the Gallinas River enters the Municipal Watershed and City of Las Vegas water supply diversion. This project area is complemented by two projects that occurred during 2013 and 2014 to improve conditions immediately upstream of this site. Restoration work also occurred during three other projects just downstream of this area a few years after this project so comprehensive restoration work is occurring in this area of the Gallinas River.

As supported in the Updated Watershed Based Plan for the Upper Gallinas River (HPWA, 2012), this project area provides an excellent demonstration site to showcase the process and benefits of river/floodplain restoration. Complete restoration is attainable here with relatively little investment and the long-term maintenance of the work is secured by public ownership. The project area is desirable for river and floodplain restoration since it is one of very few remaining areas with no existing infrastructure to impede the design and it has had a willing landowner. In a City Resolution (June 24, 2013), the City Council agreed to work with HPWA to improve this property and manage it for river and watershed health (A Resolution Promoting A Partnership Between The City Of Las Vegas And The Hermit’s Peak Watershed Alliance To Embark On Collaborative Projects To Restore The Health Of The Gallinas...
Watershed). For these reasons, a large scale river and floodplain restoration project was designed for this area in 2013 as part of On-the-Ground Improvement Projects CWA 319 grant.

Problem Statement

As the primary source of water for the City of Las Vegas and surrounding communities, the health of the Gallinas River and its watershed is of paramount importance. The quality and quantity of water available to sustain human and natural communities in the Upper Gallinas Watershed is directly related to the condition of the Gallinas River, its tributaries and the uplands that feed them. A healthy watershed reduces the cost of water storage, treatment, and natural disturbance (fire, flood, and drought) mitigation. It also has numerous non-water related benefits. Restoring healthy conditions to the Gallinas River and watershed is a cost effective endeavor that has become an accepted priority in the local area.

Water quality of the Upper Gallinas River (including the reach addressed in this project) is compromised as indicated by its listing as temperature impaired according to the 2002-2004 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix B 2002 Surface Water Assessment, the Gallinas River from the Las Vegas Diversion to headwaters does not support its designated High Quality Coldwater Aquatic Life use (State of New Mexico Water Quality Commission, 2002). The temperature impairment was confirmed in the 2012-2014 State of New Mexico CWA §303(d)/§305(b) Integrated Report Appendix A List of Assessed Surface Waters. The probable cause of impairment is listed as temperature and the probable sources of impairment are livestock, loss of riparian habitat and rangeland grazing.

The TMDL for turbidity and temperature approved by the EPA in 2005 (SWQB N, 2005) states that the Gallinas River (headwaters to Las Vegas Diversion) exceeded temperature in multiple field tests conducted in 2001 and 2003. The Water Quality Standard (WQS) for the upper Gallinas River (20.6.4.215 NMAC) states that temperature should not exceed 20°C (68°F); however the TMDL lists the Gallinas's maximum temperature as 21.51°C. The TMDL recommends a total percent stream shade increase to 61.5% from the current 40% to remedy the impairment.

This temperature impairment affects the City of Las Vegas water supply by requiring additional treatment to remove algae (related to warm water), disinfect water, then remove disinfectants and their byproducts, and improve unpleasant taste. The water quality impairment is also indicative of larger issues related to degraded conditions in the Gallinas River and its watershed as a whole; namely degraded riparian vegetation, degraded stream channel morphology, lack of floodplain access, and a loss of wetlands.

Over the past 8 years (USGS, 2014) water quantity (stream flow) in the Gallinas River has been at the low end of the 100 year average, and 2011 is among one of lowest stream flows recorded. Low stream flow is noted (HPWA, 2012) as a significant contributer of the temperature impairment. Low stream flows have also posed significant challenges in meeting the water demands for municipal use. Reduced water quantity is in part related to persistent drought but is also attributed to a lack of natural water storage in streambanks and floodplains because of degraded stream channel conditions and limited riparian vegetation.
The overall goal of this project was to restore a healthy, functioning river and floodplain on the City of Las Vegas and adjoining properties in the Gallinas Village. The specific goals were to:

1. Improve water quality and contribute to reducing the current temperature impairment;
2. Improve water quantity (i.e. stream flow) and the consistency of flows during periods of floods and drought;
3. Mitigate floods and drought; and
4. Improve fish and wildlife habitat.
To realize these goals, this project entailed restoring the connectivity of the Gallinas River to its former floodplain in this straightened and entrenched river reach. The regained ability of the Gallinas River to more easily spill onto its floodplain during high flow events will not only attenuate floods but will also enable floodwater to be stored in the soil of the floodplain where it can be filtered and slowly released back to the river to help maintain consistent stream flows of clean, cold water. Additionally this project aimed to reconstruct river channel features (meanders, falls, pools, riffles, instream structural diversity) that slow water flow, enhance water infiltration in adjacent riparian areas and improve fish and wildlife habitat. Specific project objectives were to:

1. Regain floodwater, sediment and debris access to the floodplain by excavating a swale that reconnects the river to its former floodplain.
2. Improve distribution and infiltration of floodwater across the floodplain with berms to direct flow and a temporary floodwater detention area. Spreading floodwater, sediment and debris across the floodplain will offer ample opportunity to sequester sediments and debris on the land and slowly return filtered floodwater back to the river underground.
3. Restore native vegetation to the floodplain area to enhance water infiltration and storage in floodplain soils while improving wildlife habitat.
4. Restore healthy and appropriate instream and stream bank conditions by installing log and boulder structures in the river channel and reconstructing healthy stream bank features.
5. Enhance riparian vegetation by planting diverse, native shrubs and trees.

Specific non-ecosystem goals were to:

1. Create a demonstration site of river and floodplain restoration work; and
2. Facilitate collaboration with the City of Las Vegas, private landowners and the Gallinas Village.

This project was part of a coordinated approach to improve water quality and quantity in the Gallinas River and create an overall healthier Gallinas Watershed. This approach was laid out in the *Updated Watershed Based Plan for the Upper Gallinas River* developed by HPWA (HPWA, 2012). It also extends benefits beyond temperature impairment remediation to include: flood control, sediment and debris sequestration, water storage, and improved fish and wildlife habitat by improving instream structural diversity and riparian habitat.

The project aimed to result in a temperature load reduction of 61.81 joules/meter$^2$/second and a stream shade increase of 24.3% (see UWBPG 2012 pg 33-37). Additionally the project will result in an increase of vegetation abundance and diversity, improved entrenchment ratio, and improved fish and wildlife abundance and diversity. See Table 5 and Task 6. (Monitoring task) for information on meeting this goal.

**Time frame**

- May 12, 2015 - Began project
- Feb. 12, 2016 - Completed design (see Appendix 1. As-built)
- June 2, 2016 - 404 Permit obtained (see Appendix 2. 404 Permit)
- May 20, 2016 - Constructed floodplain swale, berms and detention basin and seeded these areas
Nov. 2016 - Constructed instream restoration
Fall 2016 - Planted riparian area and reseeded areas impacted by construction
Summer 2017 - Filled in off-channel wetland and planted with sedges and rushes
Spring 2018 - Distributed Land Management Plan
June 30, 2018 - Project Completed

**Key Persons**

Key persons working on this project were:

*Lea Knutson,* HPWA Executive Director, served as the Project Manager.

*Katahdin Withnall* served as the Monitoring and Compliance Coordinator. She was replaced by *Eliza Montoya* in May 2017.

*Deanna Einspahr* served as Financial Coordinator providing accounting and grant administration oversight and implementation.

*Chris Philips, Riverbend Engineering, LLC* performed Engineering and Construction Management for this project.

*Craig Sponholtz, Watershed Artisans, Inc.* served as the principal construction contractor under the direction of Chris Philips.

**Collaborators**

The following organizations were closely involved or acted as project collaborators:

- NM Environment Department Staff: Abraham Franklin, Neal Schaeffer (retired), Susan Ossim
- San Miguel County, Les Montoya, County Manager – support
- La Placita Volunteer Fire Department – use of facilities for events, support, project review.
- US Army Corps of Engineers – 404 permitting
- NM Office of the State Engineer – compliance support
- NM Highlands University, ARMAS program – provided interns
- NM Highlands University, Professors Edward Martinez, Craig Conley – general assistance
- United World College, Ben Gillock, Environmental Systems Professor – students and vans
- Landowners: Frank Davis, Rock and Lee Ulibarri, Arnold Padilla
- Riverbend Engineering, Chris Philips
- Craig Sponholtz, Watershed Artisans
- Bill Zeedyk, Zeedyk Ecological Consulting
- Steve Townsend, Townsend Archaeological Consultants
- Aaron Kauffman, Southwest Urban Hydrology
Methods

Below is a more detailed description of the restoration work that was done and how it accomplished the above goals and objectives. See Appendix 1. As-built drawings of this project.

Floodplain Restoration
Floodplains are a critical watershed feature; they serve to buffer downstream areas from floods, reduce the severity of droughts and filter and cool water to improve water quality. Floodplains mitigate floods by providing valley bottom space for floodwaters to spread out, slow down and soak in. When floodplains are available to do this they not only attenuate the flood peaks, reducing flood damages downstream, they also help to spread out the benefit of floods over time. Water that is stored in floodplains slowly recharges river flows helping to maintain more consistent stream flows. In order for them to do this they must be connected to the river course and must be relatively free of developments that hinder their function and can be damaged during flood events. Land developments and management in valley bottoms have often resulted in straightened and entrenched river channels that disconnect them from their floodplains (i.e. floodwaters cannot easily reach the floodplain and instead rapidly drain an area gaining momentum and damage as they go).

Floodplains serve as natural water storage reservoirs; millions of gallons of floodwater can be safely stored underground in floodplains where evaporative losses are minimized and soils act to filter sediments, pollutants and cool water temperatures. During periods of drought, floodplains slowly release this water to drainage channels to maintain higher river flows.

When storm water spreads out and infiltrates floodplains sediments, debris and pollutants are sequestered and filtered as it passes through soil and vegetation. Sediments and debris that might be captured and stored in this new floodplain might be those associated with a catastrophic fire higher in the watershed. In underground areas floodwater is protected from evaporation and solar exposure so it is cooled. Higher quality of water is returned to river and stream channels after passing through this natural floodplain filtration system.

Floodplain restoration work in this project entailed reconnecting the Gallinas River to it former floodplain at one significant area at the highest point on the property. The Gallinas River in this area and in much of the developed areas of the Gallinas Watershed has been straightened and as a consequence entrenched.

An earthen floodwater swale was excavated at the upstream end of the project area to allow floodwater to spill onto the floodplain during significant flood events. This 60’ wide swale continues along the length of the floodplain providing floodwater access to the majority of the downstream floodplain area on the property. A berm was constructed part way down the floodplain to help direct floodwaters and prevent them from prematurely re-entering the river channel as surface flows. The floodplain swale and associated berms will decrease peak flood events downstream and will increase water storage in floodplain soils. The swale was originally designed to begin accepting floodwater at 300 cfs at the upstream end, a 1.5 year return frequency flood, and to be fully engaged, accepting floodwater along the entire length of the inlet, at 750 cfs, a 2.5 year return frequency flood event.

A floodwater detention area was excavated in the floodplain at the downstream end of the project area. This detention basin will serve as temporary water storage pond for up to 3.5 acre feet of water during and immediately following a flood event. The detention area is designed to drain in less than 96 hours (NM OSE requirement) but will sequester sediment, ash and other flood debris before floodwaters move onto the adjacent property or return to the river.
The following project objectives were the aim of this work:

1. Reduce water temperature by storing water underground in the floodplain;
2. Improve stream flow consistency by buffering stream flows during flood events and augmenting flows during drought with stored water in the floodplain;
3. Mitigate floods including those worsened by potential fires by providing an off channel floodwater, sedimentation, and debris storage area;
4. Mitigate drought by slowly recharging the river with water stored in the floodplain; and
5. Enhance wildlife habitat by increasing floodplain plant productivity with newly wetter soils offering foraging habitat for ungulates, rodents and birds.

River Restoration

The shape of river and stream channels and the processes that create and change them, determines how the channels affect water quality and quantity in a watershed. Appropriately shaped river and stream channels enable them to moderate streamflow, encourage water infiltration in streambanks and floodplains, filter sediments and pollutants from the water, maintain a dynamic equilibrium of aggradation and degradation (the storage and movement of rock and sediment), adjust to variable stream flow conditions, and provide vital fish and wildlife habitat. Characteristics that affect their ability to perform these functions include the horizontal and vertical shape of the stream channel, the existence of meanders (sinuosity), the degree of entrenchment or the channel’s connectedness to its floodplain, and the existence of instream structures like clean cobble, boulders and large logs that create pools, backwater, slow water, and create hiding areas all referred to as stream geomorphology.

The Gallinas River in this area was probably classified as a “C channel” type according to the Rosgen river classification system (Rosgen, 1996) before people changed the valley bottom. A “C channel” naturally has a pool/riffle/run configuration with a high degree of channel sinuosity (meanders) and is well connected to its naturally wide floodplain. Over 150 years of human use in the valley has caused the shape of the river to change, even changing its stream type in the process (from a C channel to a B3c channel type). The Gallinas River is now straighter, wider, more deeply entrenched, and is only rarely connected to its floodplain. As a consequence, it has lost much of its pool/riffle/run configuration and is less able to store water in its banks and in the floodplain, filter water, mitigate disturbances and offer fish and wildlife habitat.

Instream restoration work was aimed at improving sinuosity, reducing entrenchment and restoring the pool/riffle/run configuration. Restoration consisted of installing rock and log weirs, cross vanes, J-hooks, rock clusters, and large woody debris at appropriate locations to recreate or enhance natural stream geomorphology and instream structural diversity. Streambank enhancements consisted of shaping gravel bars and grading low lying areas to reduce streambank erosion, reinstate river sinuosity and to promote wetland plant establishment. Planting riparian woody and herbaceous vegetation (e.g. cottonwood, willow, alder, dogwood, grasses, sedges, rushes) also occurred at structure construction sites and other areas needing supplemental planting to meet the stream shade standard of 61.5% (SWQB, 2005), to anchor streambanks and beds, and to enhance fish and wildlife habitat.

Numerous project objectives were met with instream and streambank improvements. They include:

1. Lower water temperatures by reducing and maintaining channel width in over-wide areas thereby lessening solar exposure and water overheating, by creating deep pools to store cold water and cool incoming water, and by creating streambanks more capable of supporting riparian vegetation shade;
2. Improve stream flow consistency by improving streambank water storage and slowing water flows;
3. Mitigate floods, drought and fire by creating stable instream structures and streambanks well anchored with riparian vegetation that can withstand flood events without excessive erosion, and by reducing entrenchment that will improve floodplain access lessening flood impacts and improving water storage in floodplain soils; and
4. Enhance fish, wildlife and macroinvertebrate habitat by recreating lost instream structural diversity (cold pools, well maintained riffles, and hiding cover) and by enhancing riparian habitats.

Native Vegetation Restoration
An objective of this project was to restore native vegetation to the floodplain area to enhance water infiltration and storage in floodplain soils while improving wildlife habitat and native plant communities. Additionally, this restoration would more clearly demonstrate the appearance and functionality of a fully restored floodplain. Much of the floodplain of this property is dominated by weedy and non-native species due to historic disturbance by overgrazing and agriculture and the influence of adjacent areas. Although it was the hope to replace non-native species with native plants, this proved to be beyond the funds, practicality and scope of this project. We instead focused on ensuring that any areas disturbed by equipment during restoration activities be revegetated with native plants.

Planting activities consisted of reseeding all disturbed soils with an appropriate native grass and wildflower mix and mulching with native grass hay or straw to improve germination. Also, riparian areas (the area immediately adjacent to the river or wetlands) were planted with native shrubs and trees to enhance both the diversity and abundance of woody vegetation to shade the stream and improve wildlife habitat. This work would improve natural regeneration of native plants once these plants took hold.

The native plant mix of grasses and wildflowers that was used in planting disturbed soils consisted of:

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Percentage in the mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue Grama</td>
<td><em>Bouteloua gracilis</em></td>
<td>5.5</td>
</tr>
<tr>
<td>Little Bluestem</td>
<td><em>Schizachyrium scoparium</em></td>
<td>8.8</td>
</tr>
<tr>
<td>Sheep Fescue</td>
<td><em>Festuca ovina</em></td>
<td>9.7</td>
</tr>
<tr>
<td>Slender Wheatgrass</td>
<td><em>Agropyron trachycaulum</em></td>
<td>4.6</td>
</tr>
<tr>
<td>Indian Ricegrass</td>
<td><em>Oryzopsis hymenoides</em></td>
<td>5.5</td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td><em>Agropyron smithii</em></td>
<td>13.9</td>
</tr>
<tr>
<td>Arizona Fescue</td>
<td><em>Festuca arizonica</em></td>
<td>4.6</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td><em>Andropogon gerardi</em></td>
<td>4.6</td>
</tr>
<tr>
<td>Oats</td>
<td><em>Avena spp.</em></td>
<td>27.8</td>
</tr>
<tr>
<td>Wildflowers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Clover</td>
<td><em>Trifolium pratense</em></td>
<td>4.6</td>
</tr>
<tr>
<td>Sainfoin</td>
<td><em>Onobrychis vicieaefolia</em></td>
<td>7.4</td>
</tr>
<tr>
<td>Firewheel/Gaillardia</td>
<td><em>Gaillardia aristata</em></td>
<td>0.9</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Percentage in the mix</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Blue Flax</td>
<td>Linum lewisii</td>
<td>0.9</td>
</tr>
<tr>
<td>Mexican Hat Coneflower</td>
<td>Ratibida columnaris forma pulcherrima</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Oats and red clover were the non-native components of this mix and were used as a cover crop. Their rapid and prolific germination and ground cover were important to help reestablish plant cover while waiting for the non-native species to take hold. Oats would not be a long lasting species and red clover usually does not pose invasive problem. In fact, no oats were evident in reseeded areas during the summer of 2017 and red clover was infrequent.

Seeds were obtained from Curtis and Curtis, Inc. in Clovis, NM (www.curtisseed.com). They helped to develop this seed mix. Volunteers worked to do the planting work.

The riparian woody species that were planted were obtained by the New Mexico State Forestry Conservation Seedling Program. They included:

- Riparian Package 1 - Narrowleaf Cottonwood (*Populus angustifolia*), Thinleaf Alder (*Alnus tenufolia*), Bluestem Willow (*Salix irrorata*), Red Osier Dogwood – (*Cornus stolonifera*)
- NM Forestiera/Olive (*Forestiera neomexicana*)
- Chokecherry (*Prunus virginiana*)
- Native plum (*Prunus americana*)
- NM Elderberry (*Sambucus cerulean var. neomexicana*)

**Project Analysis**

The following describes the project’s successes and failures related to accomplishing the project goals.

**Goal 1. Improve water quality and contribute to reducing the current temperature impairment**

According to the Upper Watershed Based Plan Gallinas River, by completing the instream restoration in this area, HPWA has achieved a temperature load reduction of 61.81 joules/meter$^2$/second and a stream shade increase of 24.3%. In addition to reducing load, this project has increased vegetation abundance and improved entrenchment ratio.

**Goal 2. Improve water quantity (i.e. stream flow) and the consistency of flows during periods of floods and drought**

No specific studies were done to enable a clear understanding of this projects real ability to improve the consistency of stream flows. Furthermore, no floods of high enough magnitude occurred to engage the floodplain swale and detention basin for us to observe how well they functioned. However, during flood events, it is fully expected that the floodplain swale and detention basin will operate as designed to accept, infiltrate and store floodwater that will help...
attenuate floods and extend the benefit of floodwater on stream flow. This may make a good future graduate level study for the property but would likely entail modeling.

Goal 3. Mitigate floods and drought

No large floods have yet occurred to test the new capacity of this project to mitigate floods. Furthermore, no post project monitoring has occurred to study drought mitigation. This is a topic that has been suggested for graduate level study but as yet no students have taken on this project. As with the previous goal, this type of study would likely entail modeling since flooding is unpredictable. It is still expected that the floodplain swale and detention basin will function as planned during a large scale flood and will help to mitigate both floods and drought.

Goal 4. Improve fish and wildlife habitat.

Thirteen new pools, six new locations with overhanging banks and/or root wads and/or large woody debris, and four constructed riffles were added to this almost 1/2 of a mile of river. All these features improve the quality and quantity of instream habitat for fish, amphibians and macroinvertebrates; these species in turn offer prey to many terrestrial species in the area (e.g. belted kingfisher, great blue heron, raccoon, and black bear) and important habitat features to others. For example, beaver reestablished their use of this river reach during the fall/winter of 2017. They constructed a dam on top of one of the boulder structures we installed and were likely attracted by new deep pools. They also felled cottonwoods along both banks of an approximately 150’ length of the channel. We believe that beaver benefits outweigh the loss of cottonwoods.

Beyond instream restoration, over 1,000 woody riparian seedlings were planted to improve the diversity and abundance of riparian vegetation; some of those seedlings are berry producing shrubs that will support birds. Native wildflowers were added to the grass seed mix for replanting the floodplain swale and other disturbed areas; these wildflowers will support pollinators.

Below is a discussion of successes and failures related to accomplishing project objectives:

Objective 1. Regain floodwater, sediment and debris access to the floodplain by excavating a swale that reconnects the river to its former floodplain.

A 60’ wide and 550’ long floodplain swale was constructed at the upstream end of the Gallinas River on the property. This swale will receive floodwater from a 60’ wide mouth where the streambank was cut down approximately 3’. The swale was originally designed to begin accepting floodwater at 300 cfs at the upstream end, a 1.5 year return frequency flood, and to be fully engaged, accepting floodwater along the entire length of the inlet, at 750 cfs, a 2.5 year return frequency flood event. However, due to the NM Office of the State Engineer skepticism and critique of the project – that design was modified to ensure that NMOSE would not require us to remove the structure or obtain water rights if they found it to be acting as a diversion. In actuality it is anticipated that the swale will require a 5 - 10 year return frequency flood event to be fully engaged.
Soil stability, aided by recovering plant cover of the swale and detention basin was excellent following construction. Should floodwater and associated debris be carried into the swale, it is expected to hold up well and not cause damage to nearby areas.

Objective 2. Improve distribution and infiltration of floodwater across the floodplain with berms to direct flow and a temporary floodwater detention area. Spreading floodwater, sediment and debris across the floodplain will offer ample opportunity to sequester sediments and debris on the land and slowly return filtered floodwater back to the river underground.

The width and length of the swale should allow significant sediment and debris to escape the river and be deposited on the land. Because the natural topography of this former floodplain consisted of a depression (likely location of a former drainage channel) the constructed swale connects to this natural depression, continuing the floodwater’s likely path across the length of the property and ending in the floodwater detention basin. The layout and construction of the swale and detention basin is fully expected to do an excellent job of accepting and distributing sediment, ash, and debris along the length of the property and would prevent it from reentering the river. The permeable soils and abundant plant cover in this area is also expected to facilitate floodwater infiltration.

Objective 3. Restore native vegetation to the floodplain area to enhance water infiltration and storage in floodplain soils while improving wildlife habitat.

Plant cover in the historic floodplain of this property is composed of upland species that are a combination of natives and non-natives. Plant cover is good with very little bare ground. After consultation with a plant restoration specialist (Melanie Gisler of Institute of Applied Ecology) it was determined that costs of eliminating non-native species and restoring a native plant community would be greater than the budget would allow. We did however focus on planting native herbaceous species in all areas with disturbed soils as a result of construction activities. A concerted effort to restore dominance by native species in the historic floodplain and riparian areas could be the pursuit of future grants. The most significant noxious weed problem on the property is that of musk and bull thistle. Some volunteer time was spent doing hand removal and mowing of thistle dominated areas. This too will require considerable future effort to continue.

Objective 4. Restore healthy and appropriate instream and stream bank conditions by installing log and boulder structures in the river channel and reconstructing healthy stream bank features.

A highlight of this project was an extensive reconstruction of appropriate stream channel geomorphology, instream structures and streambank structures and features. Craig Sponholtz masterfully traveled down the channel using metal hands (an excavator with a hydraulic thumb), local vegetation (willow clumps), 200 purchased boulders (3-4’ in diameter), and 72 purchased logs with rootwads to narrow the channel, reinstate falls and pools, riffles, meander bends, floodplain benches, overhanging banks, woody debris and rock habitat structures, cobble bars, stabilized banks, and increase floodplain access. Reconstruction work added:

- 13 new pools,
- 4 cross-vane/pool structures,
- 5 cobble side bars,
- 4 constructed riffles,
• 6 woody debris/rock deflectors and habitat structures,
• 12 rock deflectors,
• 4 constructed floodplain benches,
• 2 areas of significant streambank erosion were armoured,
• the channel was narrowed along its entire length to obtain the optimum width for this channel type, and
• channel sinuosity was improved at 3 locations.

This new structural diversity improved fish and wildlife habitat (see above Goal 4.) and recreated instream obstacles to slow water and improve water infiltration in streambanks. Fish abundance rapidly increased and use of new pool habitat was apparent soon after restoration work. To the untrained eye, this restored channel looks as if nature built it, not a machine.

Objective 5. Enhance riparian vegetation by planting diverse, native shrubs and trees.

Approximately 1,000 woody plants were planted by volunteers along the banks of the Gallinas River. Eight species of riparian shrubs and trees were planted including: Narrowleaf Cottonwood, Thinleaf Alder, Bluestem Willow, Red Osier Dogwood, NM Forestiera/Olive, Chokecherry, Native plum, and NM Elderberry. Seedlings were acquired from NM State Forestry Conservation Seedling Program and planted in appropriate distances from the stream channel with sharp shooters, planting dibles and planting bars. Plants were planted closer together than would be expected to occur to account for mortality. No statistics on seedling survival were collected but from visual estimates 3 months and then a year later, it is guesstimated that survival was about 30%. This low survival rate was likely due to extremely dry weather in the 6 months following planting. Survival at the streambank was greater than areas farther from the banks. How the planting effort improved stream shade will not be known for many years. Survival of willow clumps that were relocated mechanically as part of the stream channel restoration work appeared to be 100%. Some stream canopy improvements that were made were likely negated by a new resident beaver that cut down most cottonwoods along a 150’ stretch of channel. However, the reestablishment of beaver in this area undoubtedly will improve other riverine conditions.

The following questions and answers offer a more general analysis of this project.

What made our project a success?

Upon its conception and early discussion in 2011, to the end of its construction, HPWA had full support from the City of Las Vegas and the community of Gallinas. This support was invaluable in allowing us to proceed with as few hurdles as possible.

Early in discussions about this endeavor both the City and community expressed their clear thoughts that while ecological restoration of this site was very appropriate they were clear that keeping the property closed to public use was also critical at this time. The City could not commit to maintaining public use and the community was concerned about an unmanaged and unmaintained area open to the public. So, HPWA respected this request in the design and implementation of the project.
Because of the City’s full support of our work, they gave us the freedom to develop a project that was best for the watershed. Furthermore, they were willing to commit resources (e.g. SWPPP monitoring) to make sure the project proceeded smoothly.

Beyond this support, we were very fortunate to have such great groups of volunteers help with reseeding, mulching and planting riparian vegetation. Without these volunteers, the project cost would have been much greater.

A strong indication that the ecological restoration of the river channel was positive is the rapid re-use of the area by fish and later beaver. Fish and wildlife are often the first to notice ecological functional lift of an area and in this case we got clear votes of confidence from them. Increased fish use was immediate and beaver occupation occurred in the fall of 2016 and the winter of 2017.

Another ecological success was the rapid recovery of plants in areas where bare soil was exposed after construction. The small sites where tractors accessed the channel and caused some bare soil revegetated very quickly (within a year). Those sites were planted and mulched after construction. The large disturbed soil associated with the floodplain swale and detention basin recovered with modest plant cover after seeding and mulching; this modest plant cover was adequate to help anchor previously bare soils. Dry conditions and a clear attraction of the new seed source by birds (crows, ravens and starlings foraged extensively on the newly planted oat seeds).

The ability of HPWA, the funding organization and contractors to adapt to changes also contributed to a successful project. Each party was responsive to changing requirements and new discoveries. This adaptability is important to factor in to project expectations.

What was not successful?

Partly because of staffing changes at the NM Office of the State Engineer during the project and partly because this project was a relatively new experience for the OSE, the relationship and imposed requirements from OSE required us to make significant design changes in the project that reduced our expectations of its effectiveness. During discussions with OSE when we were only thinking of the project, it appeared that we were not going to have any significant challenges with water related requirements. So, when those conflicts arose (with new staff), we were somewhat surprised. The most significant challenge came from helping OSE staff understand the functional nature of restoration structures we planned to construct. For example, cross vanes and J-hooks were initially described by OSE as dams, when in fact they do not function as dams. OSE staff initially saw the project as one involving dams, diversions and ponds, so had a heightened concern which was unnecessary. Because of this heightened skepticism on the part of OSE, contractors felt the need to be conservative with their restoration design, effectively changing the projects effectiveness.

The most significant effect of this was the design change to increase the height of the mouth of the floodplain swale to prevent any likelihood of the channel changing course into this swale. This change altered that ability for the floodplain swale to accept flows during 1.5 to 2.5 year flood frequency. To adapt to this design change, however, the construction of the cross vane was modified to encourage more flow into the swale and the bed level of the channel was raised as much as possible.

In spite of solid landowner agreements with the two adjacent landowners, it became clear that both of them had different and potentially conflicting objectives than HPWA that jeopardizes the ecological functionality of their properties in the long-run and reduces the potential complementary nature of work on their land and the City of Las Vegas property. In the early stages of the project, it appeared that
the downstream landowner had very comparable objectives but that changed as the project developed. Also in the early stages of this project, the landowner to the west was in full support of the project but he subsequently lost title to the property and the new owner did not share the same land use goals. We were able to accomplish everything we set out to do on this project in spite of these differences but the uncertain future of adjoining properties may reduce (from a watershed perspective) the more comprehensive and complementary nature of these three properties together.

What would we do different?

The preliminary design for this project was developed by the engineer as a precursor to securing funding from the River Stewardship Program. Then, the finalized design was largely completed by the engineer once the project started. In future projects, an interdisciplinary team, especially the restoration contractor who will build the project, should be involved in all design phases. This would result in a better design and reduce refinement challenges after the design is completed. An ecologist would be a good addition to the design team as well.

Although we are not yet clear about how we would change interactions with the NMOSE in the early stages of a project of this magnitude, some changes are called for to alleviate issues later in final design phases and during project construction. In the future, involving the NM Environment Department or other funders in these negotiations is a good place to start.

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

Our current River Stewardship project in the City of Las Vegas has already benefited from experience gained from this project. A design team involving both the engineer and the restoration contractor occurred from the proposal stage and will continue to completion. This has already yielded a better project.

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

NMED could embark on an educational effort with NMOSE to help them better understand the nature, process and goals of river and wetland restoration work and better inform NMED of NMOSE requirements and hurdles. Then information regarding OSE requirements should be provided to grant recipients at the beginning of projects.

What would we suggest for other partners?

Choosing a project in the beginning that has good landowner and community support makes the entire project go smoother and increases the long term effectiveness of the project. Taking on restoration work without full and clear support from all involved parties poses considerable challenges.

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

Following are future endeavors that would be good to do on this property.

- Riparian vegetation that was planted needs a follow up to determine if supplemental planting is needed. This effort could be funded under future 319 projects as they are awarded.
Weed control on the property needs follow up. The weed expert from Tierra y Montes SWCD could be involved in this work and funding from them could be requested.

Reestablishment of native plant communities in the more upland areas of the property would improve its ecological condition. Funding could be sought from the Native Plant Society, or Tierra y Montes SWCD. Expertise to run such of an effort could be found at the Institute for Applied Ecology.

Continue to pursue a graduate student from NMHU to conduct research projects looking at various aspects of the effectiveness of projects like this in the long run.

This site offers innumerable education opportunities (see the Land Management Plan (HPWA, 2018) but requires efforts from HPWA and other organizations to organize. Funding to hold these educational programs might be available from a number of sources.

Trash pickup of the site will continue to be a problem. The City of Las Vegas Keep America Beautiful program could devote a minimum of one or two organized clean ups for this site a year. Alternatively, organizations like HPWA, the La Placita Fire Department, HECHO, or the Lower Gallinas Land Grant could host such events.

Implementation Planned and Completed

Below is a description of project tasks (laid out in the Work Plan) that were planned and accomplished.

Task 1: Engage Stakeholders

At the beginning of the project, individual stakeholder meetings occurred with the significant parties, namely: City of Las Vegas, San Miguel County, La Placita Fire Department, NM Office of the State of Engineer (OSE), Frank Davis (downstream property owner), Rock Ulibarri and the new owner of his property (property owner to the west), and the engineer. These meetings were to inform each party about project details, go over the preliminary project design and begin establishing landowner agreements. The meeting with OSE arrived at an informal verbal agreement with Ramona Martinez. A public meeting was held at the La Placita Fire Station to inform the local community of the project. No substantive comments were made at that time.

Later that fall, Landowner Agreements were fully executed with: the City of Las Vegas, San Miguel County, Arnold Padilla and Frank Davis. NMED attorney, Christopher Atencio, assisted with a meeting with Arnold Padilla and reviewed our Landowner Agreements. Final project designs were also presented to each stakeholder during the spring of 2016 for last minute comments (no changes occurred in the design at that time). HPWA, the contractors and City of Las Vegas staff met to review safety the City’s requirements and ensure all parties on site were informed about those requirements.

During the project, numerous in person meetings happened with stakeholders to keep them abreast of project status, tour the project and offer comments. All comments and cooperation was positive or easily managed.

See Education and Outreach section (Task 5) for a list of public announcements and events related to this project.

Deliverables: 1) report of public meetings, announcements, and tours including number of participants and a catalog of comments expressed (see Education and Outreach section for a list of events); 2)
landowner agreements between NMED and the City of Las Vegas, San Miguel County, Arnold Padilla and Frank Davis (provided to Project Officer). Table 1 lists public and private stakeholders involved in this project.

Table 1 - Stakeholders for this project.

<table>
<thead>
<tr>
<th>STAKEHOLDER</th>
<th>ROLE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landowners</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Las Vegas</td>
<td>Owner of the majority of the project area.</td>
<td>Completed a landowner agreement, CLV provided in-kind contributions, participated in project review, SWPPP, and safety</td>
</tr>
<tr>
<td>San Miguel County</td>
<td>Manager of activities on the upstream land parcel (La Placita Fire Dept.)</td>
<td>General support, provided in-kind contributions of fill and tractor time</td>
</tr>
<tr>
<td>La Placita Volunteer Fire Department</td>
<td>Housed on the upstream land parcel</td>
<td>Hosted community events, participated in volunteer planting efforts, provided design review</td>
</tr>
<tr>
<td>Frank Davis</td>
<td>Downstream landowner</td>
<td>Completed a landowner agreement, paid for removal of the old berm (on his property) that prevented stormwater from entering his property – in-kind contribution. This task was to be done by us in the original proposal. Contributed other resources to planting and mowing.</td>
</tr>
<tr>
<td>Rock and Lee Ulibarri</td>
<td></td>
<td>Original landowner of the wetland across the Gallinas River at the upstream end of the project area and to the west</td>
</tr>
<tr>
<td>Arnold Padilla</td>
<td>Adjacent landowner</td>
<td>Subsequent landowner of the wetland across the Gallinas River at the upstream end of the project area and to the west. Completed a landowner agreement.</td>
</tr>
<tr>
<td><strong>Non-landowner stakeholders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tierra y Montes SWCD</td>
<td>Advice</td>
<td>Provided advice on riparian vegetation planting techniques</td>
</tr>
<tr>
<td>US Army Corps of Engineers</td>
<td>404 permit</td>
<td>Assisted with completion of 404</td>
</tr>
</tbody>
</table>
STAKEHOLDER | ROLE | NOTES
---|---|---
NM Office of the State Engineer | Water rights compliance | Toured site numerous times, provided information related to water rights, reviewed project
NMHU Conservation Club, ARMAS Program, watershed related classes | Help with volunteer projects, Interns, educational tours | Volunteers on Riparian Planting, Provided one ARMAS intern during summer of 2017
Riverbend Engineering | Project design and oversight | 
Watershed Artisans | Project construction | 
Southwest Urban Hydrology | Organized volunteer efforts of reseeding the floodplain swale | Brought a group of volunteers from Wellesley Village Church near Boston
Townsend Archaeological Consultants | Archaeological Surveys required for 404 permit | 

Task 2: Project Administration

Administration activities carried out to complete this project included (see Table 2):

- Coordinated activities with the NMED Project Officer and collaborators.
- Kept and maintained proper financial and administrative records, including expenditure requests and in-kind match.
- Submitted semi-annual and final report of the project to NMED.
- Project oversight: The Project Manager together with Riverbend Engineering provided oversight; the Project Manager focused on administration, stakeholder engagement, promotion, and the Land Management Plan while Riverbend Engineering focused on technical oversight of the construction.
- Ensured that all monitoring was conducted correctly and according to NMED SOP’s.
- Agreements and permits are covered under Task 4.

**Deliverables:** 1) Regular invoices, 2) Semi-annual progress reports, 2) final progress report.

Table 2 – Administrative accomplishments

<table>
<thead>
<tr>
<th>TASK GOAL</th>
<th>PLANNED SCHEDULE</th>
<th>ACTUAL SCHEDULE</th>
</tr>
</thead>
</table>
a) Semi-annual reports progress reports and a minimum of quarterly invoices | Semi-annual Reports – 1. 7/7/15 (5/12/15 – 6/30/15); 2. may have missed this report; 3. 6/30/16 (1/1 – 6/30/16); 4. 1/9/17 (7/1 – 12/31/16); 5. 7/5/17 (1/1 – 6/30/17); |
<table>
<thead>
<tr>
<th>TASK GOAL</th>
<th>PLANNED SCHEDULE</th>
<th>ACTUAL SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) QAPP NOT NEEDED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Final progress report</td>
<td>Final Report – July 9, 2018</td>
<td></td>
</tr>
</tbody>
</table>

**Task 3. Ongoing Stewardship/Land Management Plan**

The ongoing stewardship of this project was addressed with the development of a Land Management Plan for the project area (HPWA, 2018). This plan guides future activities on the City of Las Vegas property and adjacent private lands to ensure they are compatible with river and floodplain health and maintain or improve the integrity of restoration work done during this project.

This plan, distributed to NMED and the City of Las Vegas covers:

- Recommended land uses that are compatible with watershed health and offered specific guidelines for those uses;
- Identified future desirable efforts that were not accomplished in this project;
- Recommended long-term efforts needed to maintain or enhance restoration work;
- Identify vulnerable areas in need of special attention;
- Suggested mechanisms to secure the properties’ future (e.g. conservation easements);
- Identified potential funding sources to accomplish recommendations.

**Deliverables:** 1) Land Management Plan for the property provided to NMED Project Officer (HPWA, 2018).

**Task 4. Project Implementation**

This task covered the project construction including design, landowner agreements, securing materials and subcontractors, logistics planning, permitting and finally actual construction and follow-up planting and site rehabilitation.

1. **Design** - Final review of design by all involved parties and necessary revisions completed 2/12/16. Final design was facilitated and conducted by Riverbend Engineering and presented to NMED for approval prior to implementation. Design reviewers will include: NMED, City of Las Vegas, involved private landowners, OSE, and San Miguel County. See Appendix 1. As-built.
2. **Landowner agreements** - Completed between NMED and affected parties including: City of Las Vegas, San Miguel County, Frank Davis and Arnold Padilla. Agreements included a requirement to maintain the improvements made for a period of 10 years. This work will be coordinated by Project Manager with assistance from NMED. This task is primarily covered under Task 1.
3. **Secure needed supplies** - Watershed Artisans and HPWA worked together to acquire rock, logs, fill, seeds, seedlings, mulch and equipment needed for the project.

4. **404 permits** - Riverbend Engineering with assistance and oversight from Katie Withnall secured the US Army Corps of Engineers 404 permit including the 401 Water Quality Certification, Cultural Resources Survey, clearances from San Miguel County Floodplain Manager, and the NM State Office of the Engineer (see Appendix 2. 404 Permit). The instream work occurred under USACE Nationwide Permit (NWP) Action No. SPA-2016-00155-ABQ.

5. **Project Layout and Logistics** – done by Riverbend Engineering and Watershed Artisans.

6. **Pre, during and post project monitoring** - done by Monitoring and Compliance Coordinator with help from NMHU ARMAS interns (see Task 6). Chris Philips developed the SWPPP plan and City of Las Vegas staff conducted the ongoing monitoring for it until the fall of 2016 after the monsoons and all disturbed sites were replanted. Silt fences and straw bale walls were installed at the downstream end of the property prior to construction.

7. **Construction** – done by Watershed Artisans with oversight by Riverbend Engineering.

8. **Post-construction revegetation** – Was coordinated and supervised by HPWA with oversight by Watershed Artisans, assistance from Southwest Urban Hydrology and many volunteers.

9. **Post-construction site clean-up and rehabilitation** – HPWA coordinated the removal of a dilapidated fence along the river and rebuilt a fence to prevent public use of the property. Work was done by volunteers and NMHU ARMAS interns.

10. **404 Permit annual reporting** – is being done by our current Technical Coordinator, Eliza Montoya.

**Deliverables**: 1) Final design presented to NMED prior to project construction (see Appendix 1. As-built), 2) necessary permits or notices of compliance (see Appendix 2. 404 Permit), 3) Cultural Resources Survey (part of 404 permit), and 4) a final project report including photo documentation (see Appendix 3. Photo Catalog).

**Task 5. Promotion/Education & Outreach**

The Project Manager with assistance from Riverbend Engineering, Watershed Artisans and HPWA’s OSM/VISTA promoted the project to entities that are likely to provide future support for similar work, namely local and state government officials, Gallinas landowners and the general community (see Table 3). Promotional efforts included: 1) community engagement in hands-on restoration as appropriate (e.g. riparian planting), 2) public meetings and tours, and 3) use of the site in HPWA’s educational programs including the Land Stewardship Series and school children programs. No funds are requested for promotion and educational programs; they are supported by other means.

A ground breaking event occurred on April 1, 2016 and the general public was invited. Twenty four people attended the event including City of Las Vegas staff, City Councilors, community members and the media. Frank Davis donated the use of his horse drawn carriage to transport people around the site. The project culminated in a picnic and tour of the fully completed project on August 6, 2017, 16 people attended.

**Deliverables**: 1) list of tours, meetings, presentations, hands-on restoration activities held and articles produced (see Table 3 – Promotion, education and outreach events and efforts).
### Table 3 – Promotion, education and outreach events and efforts

<table>
<thead>
<tr>
<th>TARGET AUDIENCE</th>
<th>EFFORT and DATE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stakeholders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NMED &amp; NMFA</td>
<td>Tour of project area June 2016</td>
<td></td>
</tr>
<tr>
<td>SMC, Fire Dept.</td>
<td>Tour of project July 2016</td>
<td></td>
</tr>
<tr>
<td>USACE, NMED</td>
<td>Project tour Sept. 2016</td>
<td>Army Corps Chief attended</td>
</tr>
<tr>
<td>HPWA Board of Directors</td>
<td>Project tour December 2016</td>
<td></td>
</tr>
<tr>
<td>City of Las Vegas</td>
<td>Project tour Dec. 2016</td>
<td></td>
</tr>
<tr>
<td>Arnold Padilla</td>
<td>Site tour Sept. 2016</td>
<td></td>
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<tr>
<td>NMHU Classes</td>
<td>Project tour Nov. 2016, Feb and May 2017, 3 tours in</td>
<td></td>
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<tr>
<td></td>
<td>fall 2017 and spring 2018</td>
<td></td>
</tr>
<tr>
<td><strong>General Public</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground Breaking Event</td>
<td>April 1, 2016</td>
<td>24 people attended and a tour of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>project site occurred.</td>
</tr>
<tr>
<td>Optic Article written by</td>
<td>Dec. 16, 2016</td>
<td>See Appendix 3</td>
</tr>
<tr>
<td>Lee Einer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volunteer Events:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seeding and mulching</td>
<td>April 30, 2016, November 2016 (2 days), Jan. 2017</td>
<td>A total of 52 volunteers assisted with</td>
</tr>
<tr>
<td></td>
<td>(UWC)</td>
<td>this task for a total of 276 hrs</td>
</tr>
<tr>
<td>Riparian area planting</td>
<td>Feb. – April 2017 3 different volunteer events</td>
<td>A total of 24 volunteers assisted for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a total of 152 hrs</td>
</tr>
<tr>
<td>Thistle Control</td>
<td>July 16, 2016</td>
<td>4 volunteers assisted</td>
</tr>
<tr>
<td>HPWA Newsletter Article</td>
<td>Winter 2017</td>
<td></td>
</tr>
<tr>
<td>Project Completion tour</td>
<td>August 6, 2017</td>
<td>16 people attended</td>
</tr>
<tr>
<td>and picnic</td>
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</tbody>
</table>

### Task 6. Monitoring

The Monitoring and Compliance Coordinator was responsible for supervising and when necessary, carrying out monitoring efforts. Pre and post treatment monitoring consisted of:

1. Stream temperature monitoring above and below project area (NMED Protocol)
2. Stream Shade assessment at 5 transect locations in the project area (NMED Protocol)
3. New Mexico Rapid Assessment Method (NMRAM)
4. Rosgen Level II geomorphology
5. Photo documentation
HPWA will continue to conduct long-term monitoring of the project after the end of the contract term. HPWA is obligated to submit annual monitoring reports to the USACE as a requirement for the Nationwide Permits approved for 4 other instream projects completed in 2014 as will likely be the condition for this project. These reports which are required for 5 years after completion of the project include photographic documentation, post project cross section and longitudinal profiles and discussion of peak flows. Additionally, as part of UWBPGR, HPWA is monitoring stream temperature from May to September annually (when we have a current grant), conducting watershed wide stream shade and width to depth assessments triennially, and conducting Rosgen Level II geomorphology pre and post treatment at restoration sites. These long-term monitoring efforts will continue and complement this project with watershed wide condition tracking.

See the UWBPGR for details and schedules of the monitoring efforts. The monitoring plan for the Gallinas Village River and Floodplain Restoration project will further complement these ongoing monitoring efforts by adding a project monitoring site to the Upper Gallinas Watershed. See the table below for related monitoring efforts.

HPWA intends to continue the above listed monitoring efforts for the foreseeable future provided that our organization receives adequate funding or support from collaborators. Continuing future monitoring efforts on the Gallinas Village Floodplain and River Restoration Project is feasible as the monitoring efforts overlap with other efforts which we have planned.

**Deliverables:** 1) pre and post project monitoring data and report, 2) photo album of pre and post project and project construction.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>GOAL</th>
<th>PLANNED SCHEDULE</th>
<th>ACTUAL SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Stream temperature monitoring</td>
<td>May-September 2015 &amp; 2016</td>
<td>May-September 2016 &amp; 2017</td>
</tr>
<tr>
<td>b)</td>
<td>Stream Shade Assessment</td>
<td>Summer 2015 &amp; 2016</td>
<td>June 2016; July 2017</td>
</tr>
<tr>
<td>c)</td>
<td>Photo Points</td>
<td>Spring/Summer 2015 &amp; 2016</td>
<td>Summer 2016 &amp; 2017</td>
</tr>
<tr>
<td>d)</td>
<td>Geomorphology</td>
<td>Spring/Summer 2015 &amp; 2016</td>
<td>Summer 2016 &amp; 2017</td>
</tr>
<tr>
<td>e)</td>
<td>NMRAM</td>
<td>Spring/Summer 2015 &amp; 2016</td>
<td>Summer 2016 &amp; 2017</td>
</tr>
</tbody>
</table>

**Deliverables:** Pre and post project monitoring data and report, photo album of pre and post project and project construction.

Quantitative GOAL - temperature load reduction of 61.81 joules/meter$^2$/second and a stream shade increase of 24.3%. According to the Upper Watershed Based Plan Gallinas River, this load reduction was achieved based on the instream restoration, riparian planting, and land management plan.
Table 5 - Measures of Success - Quantitative and qualitative indicators that will be measured to document project success as they relate to project goals.

<table>
<thead>
<tr>
<th>Goal/Objective</th>
<th>Indicator(s)</th>
<th>Method</th>
<th>Measure of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve water quality and contribute to temperature load reductions;</td>
<td>a) Stream shade</td>
<td>a) Canopy and width to depth monitoring;</td>
<td>a) Increase in stream shade</td>
</tr>
<tr>
<td></td>
<td>b) width:depth ratio</td>
<td>b) Rosgen Level II;</td>
<td>b) Improved width: depth ratio</td>
</tr>
<tr>
<td></td>
<td>c) stream temperature</td>
<td>c) stream temperature monitoring</td>
<td>c) Decrease in stream temperature</td>
</tr>
<tr>
<td>2. Improve water quantity (i.e. stream flow) and the consistency of flows during periods of drought and flood;</td>
<td>a) Stream flow</td>
<td>a) USGS gage</td>
<td>a) Increased and/or more consistent stream flows</td>
</tr>
<tr>
<td>3. Mitigate floods, potential wildfire, and drought;</td>
<td>a) Area of newly accessible floodplain</td>
<td>a) GIS analysis - aerial photography</td>
<td>a) Improved area for floodwater and debris sequestration</td>
</tr>
<tr>
<td></td>
<td>b) Area of floodwater detention structure</td>
<td>b) GIS analysis - aerial photography</td>
<td>b) Floodwater storage capacity</td>
</tr>
<tr>
<td>4. Improve fish and wildlife habitat.</td>
<td>a) Riparian and instream habitat</td>
<td>a) NMRAM</td>
<td>a) Increased NMRAM rating post-project</td>
</tr>
<tr>
<td></td>
<td>b) Stream channel geometry</td>
<td>b) Rosgen Level II</td>
<td>b) Improved horizontal and vertical diversity and pools</td>
</tr>
<tr>
<td></td>
<td>c) Repeat photographic documentation</td>
<td>c) Photo points</td>
<td>c) Increased visual improvement of project site</td>
</tr>
</tbody>
</table>
ANCOVA: Daily Max Temp (°C) 2016 vs 2017

Mean Difference = 0°C

Yc = 19.9
Yt = 19.9

Xavg= 19.7

Gallinas River (Las Vegas Diversion to USFS Boundary)

Figure 1 - ANCOVA for Gallinas River (Las Vegas Diversion to USFS Boundary)
**ANCOVA**

The sites chosen to be used with the ANCOVA were located above and below three restorations projects. One was completed in November 2016 (this River Stewardship project). The other two were completed in April 2018 (319 On-the-Ground Gallinas Phase II). The results indicated in Figure 1 would be applicable to the River Stewardship Project completed in 2016. Temperature data was not collected after the two projects in 2018 were completed.

The results of the ANCOVA (see Figure 1) indicate that there is insufficient evidence to reject the null hypothesis of no difference between weekly maximum stream temperature between T3A and T5 from 2016 to 2017. The slopes of the regression lines show no significant difference (p=0.69), and neither do the y-intercepts (p=0.96). Therefore, we cannot claim that the stream restoration project has affected stream temperature. However, additional years of data could capture lag time effects and allow a more definitive analysis.

**NMRAM**

The New Mexico Rapid Assessment Method (NMRAM) for Montane Riverine Wetlands was completed pre and post treatment.

The project area received a “B” rating according to the survey and assessment of the project area. This is indicated good condition. In 2017, NMRAM was completed again post treatment. The findings indicated that the rating remained the same. The project area received a “B” rating post treatment.

This could be due to high mortality rates for the saplings that were planted in spring of 2017 after construction was completed.

**Stream Shade:**

Stream shade was measured in the field pre and post treatment. In 2016, stream shade was measured on June 7, 2016. This was before construction had started for this grant. The overall stream shade within the project areas in 2016 was 62.00%.

Stream shade was measured in July 2017 after construction was completed. The overall stream shade through the project area in 2017 was 63.20%.

There was a 1.20% increase in stream shade from 2016 to 2017. This is a positive indication that stream shade will continue to increase if the riparian planting from spring 2017 is successful. Note that in 2016, the project area was meeting stream shade standards set by NMED.
Longitudinal Profile:

River Stewards Longitudinal Profile Pre-Project

River Stewards Longitudinal Profile Post-Project
Looking at the figures above, there are differences between pre-project and post-project profiles of the same stretch of river. The longitudinal profiles started above the beginning of the project and continued through more than 50% of the project. The profile was able to capture where new pools were built and how the river had a pool/riffle/run morphology. In the pre-project longitudinal profile, one pool exists and there are two runs and two riffle areas. Whereas, the post-project longitudinal profile shows more pools that are longer and deeper. There were also more riffles noted in the post project longitudinal profile.

\textit{Cross Section:}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{River_Stewards_Cross_Section_Pre-Project.png}
\caption{River Stewards Cross Section Pre-Project}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{River_Stewards_Cross_Section_Post-Project.png}
\caption{River Stewards Cross Section Post-Project}
\end{figure}
Looking at the two cross-sections above, there are noticeable differences in slope and depth of the channel before and after construction. The channel was widened by 17 feet after construction was complete helping improve entrenchment. Also, the edges of the channel are not as steep after construction and it can be seen in the cross-sections above.

References


State of New Mexico Water Quality Commission. (2002). *2002-2004 303(d)/305(b) Report: Water Quality and Water Pollution Control in New Mexico*. Santa Fe, NM: NMED SWQB.


Appendices

Appendix 1. As-built
Appendix 2. 404 Permit

June 2, 2016

Regulatory Division

SUBJECT: Nationwide Permit (NWP) Verification – Action No. SPA-2016-00155-ABQ, Gallinas River Restoration Project, City of Las Vegas, Gallinas, San Miguel County, New Mexico

Ken Garcia
City of Las Vegas
905 12th Street
Las Vegas, NM 87701

Dear Mr. Garcia:

I am writing this letter in response to your application for the proposed Gallinas River Restoration Project, City of Las Vegas (the City), Gallinas River at Gallinas, San Miguel County, New Mexico located at approximately latitude 35.67722, longitude -105.353106, in San Miguel County, New Mexico. The work, as described in your application, is to conduct stream restoration within the City’s property by the installation of two rock cross-vanes, two rock j-hooks, nine rock deflectors, ten rock and log structures, 27 miscellaneous rock habitat structures, woody riparian vegetation planting, and channel shaping along 1500 linear feet of the Gallinas River. We have assigned Action No. SPA-2016-00155-ABQ to this project. Please reference this number in all future correspondence concerning the project.

Based on the information provided, we have determined that the project is authorized by NWP 27. A summary of this permit and the New Mexico Regional Conditions are available on our website at www.spa.usace.army.mil/rep/nwp. Please refer to our website at www.spa.usace.army.mil/rep/wqc for specific information regarding compliance with water quality certification (WQC) requirements. The City must ensure that the work complies with the terms and conditions of the permit, including New Mexico Regional Conditions and conditions of the WQC and the special conditions listed below.

1. The City may change elements of the proposed plan based upon field conditions, including structure type and/or structure location. A set of as-built plans must be submitted by December 31 of the year of construction. A change in structure type beyond that included in the application requires pre-approval from the Corps of Engineers (Corps).

2. The City shall conduct monitoring as described in our Regional Condition for NWP 27. Your reports are due to the Corps December 31 of each year of monitoring. Additionally, a discussion of peak flows, with focus on spring and monsoon seasons, and the installed structures’ response to high flows. This discussion should be cumulative from year to year to enable the reader to obtain an overall understanding of the structures’ efficacy since installation. Discussion of any unusual events that might have impacted or may impact the structures or the stream or wetland in the future, such as upstream landslides, unusually large snowpack, large-scale erosion event, drought etc.
3. The original monitoring period may be extended upon a determination that performance standards have not been met or that the project is not on track to meet them (e.g., high mortality rate of vegetation). Monitoring requirements may also be revised or extended in cases where adaptive management or remediation is required. At any time, should conditions warrant, additional work to increase or repair the structures' efficacy may be required.

4. Should the proposed project demonstrate functional lift in year three or later, the City may request, in writing, to be released from further monitoring requirements. Monitoring may be ceased only upon written approval from the Corps.

Under Section 401 of the Clean Water Act, certification of compliance with state or tribal water quality standards by the state water quality agency or tribal water quality certifying authority is required for any discharge of dredged and fill material into waters of the United States under Section 404 of the Clean Water Act.

In the State of New Mexico, the New Mexico Environment Department (NMED) has issued WQC for activities that occur in waters of the U.S. The City must comply with all conditions of the certification, including notification to NMED five days prior to initiation of construction (WQC Condition 16). To contact NMED, please use the information below:

Neal Schaeffer, Watershed Protection Section  
NMED - Surface Water Quality Bureau  
1190 South St. Francis Drive  
P.O. Box 5469  
Santa Fe, New Mexico 87502  
(505) 476-3017

Our review of this project also addressed its effects on threatened and endangered species and historic properties in accordance with general conditions 18 and 20. Based on the information provided, we have determined that this project will not affect any federally listed threatened or endangered species or any historic properties. We conducted consultation with the State Historic Preservation Officer on the basis of the cultural resources survey that was submitted with your application and received concurrence with our determination of no historic properties affected on May 24, 2016. However, please note that the City is responsible for meeting the requirements of general condition 18 on endangered species and general condition 20 on historic properties.

This letter does not constitute approval of the project design features, nor does it imply that the construction is adequate for its intended purpose. This permit does not authorize any injury to property or invasion of rights or any infringement of federal, state or local laws or regulations. The City and/or any contractors acting on behalf of the City must possess the authority and any
other approvals required by law, including property rights, in order to undertake the proposed work.

This permit verification is valid until March 18, 2017 (33 CFR 330.6), unless the NWP is modified, suspended, revoked or reissued prior to that date. Continued confirmation that an activity complies with the terms and conditions, and any changes to the NWP, is the responsibility of the City. Activities that have commenced, or are under contract to commence, in reliance on a NWP will remain authorized provided the activity is completed within 12 months of the date of the NWPs expiration, modification, or revocation.

Within 30 days of project completion, the City must fill out the enclosed Certification of Compliance form and return it to our office. The landowner must allow Corps representatives to inspect the authorized activity at any time deemed necessary to ensure that it is being, or has been, accomplished in accordance with the terms and conditions of the NWP.

I am forwarding a copy of this letter to Lea Knutson with Hermit's Peak Watershed Association, Chris Phillips with Riverbend Engineering, and Neal Schaeffer with NMED. If you have any questions, please contact me at 505-342-3280 or by e-mail at Deanna.L.Cummings@usace.army.mil. At your convenience, please complete a Customer Service Survey on-line available at http://corpsmap.usace.army.mil/cm_apex/?p=136:4.0.

Sincerely,

CUMMINGS.DEAN
N.A.L.1246005202
Deanna L. Cummings
Senior Regulatory Project Manager

Enclosure(s)
Certification of Compliance
with Department of the Army Nationwide Permit

Action Number: SPA-2016-00155-ABQ
Name of City: City of Las Vegas, attn.: Ken Garcia
Nationwide Permit: NWP 27

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Deanna Cummings
Albuquerque District, U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109
505-342-3262
FAX 505-342-3498

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

Please enclose photographs showing the completed project (if available).

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Date Work Started ______________________

Date Work Completed ______________________

Signature of City of Las Vegas Representative __________________ Date __________________
Appendix 3. Photo Catalog

Figure 2 - City of Las Vegas property - project site (also see report cover)
Figure 3 - Ground breaking event at La Placita Fire Station
Figure 4 - Volunteer group prepares to seed and mulch

Figure 5 - Volunteer crew spreading mulch

Figure 6 - Volunteer crew seeding floodplain swale
Figure 7 - Building the floodplain swallow

Figure 8 - Cross vane at mouth of floodplain swale
Figure 9 - Seeded and mulched floodplain swale

Figure 10 - Mouth of floodplain swale
Figure 11 - Constructing instream structures

Figure 12 - UWC volunteers seeding floodplain after construction
Figure 13 - Volunteers installing filter fabric to control erosion and protect seeds

Figure 14 - Volunteers planting riparian vegetation
Figure 15 - Volunteers finished with riparian planting
Figure 16 - Floodplain swale the summer following construction

Figure 17 - US Army Corps of Engineers tour
BEFORE AND AFTER TREATMENT PHOTOS

Figure 18 - Before and after construction aerial photo
Figure 19 - Pre and post construction showing new floodplain bench, pools and fish habitat structures
Figure 20 - Pre and post treatment showing streambank anchoring and erosion control, new pool, improved sinuosity
Figure 21 - Pre and post treatment showing new cobble bars, channel narrowing
Figure 22 - Pre and post treatment with channel narrowing and new cobble bars
Figure 23 - Constructed off channel wetland before and after NMOSE required it to be filled in
Straight from the City: Working together to heal the Gallinas River

By Lee Einer
Friday, December 16, 2016 at 4:29 pm (Updated: December 18, 1:29 am)

What if I told you that there was a water storage and treatment system up in the Gallinas canyon? What if I told you it uses green technology to purify our water with zero consumption of fossil fuels?

Such a treatment plant does exist. It's called a healthy, natural river and its floodplain.

All you have to do to recognize the treatment plant is to change your mental focus a little.

Riffles in the stream? They're aerators.

Those wetlands of cattails and reeds that form in the shallow slow spots? They're filters and, amazingly, chemical treatment devices also. They don't just mechanically filter the water — the wetland plants also act as bioaccumulators which pull heavy metals out of the water and sequester them in the plant roots. As an additional benefit, they sequester large amounts of carbon in the soil, helping to combat global warming.

Floodplain soils? They are the storage reservoir, holding millions of gallons of flood water to slowly feed the river and boost flow during dry periods.

With the cooperation and assistance of the City of Las Vegas, the Harveys Peak Watershed Alliance is working to restore a section of the Gallinas River to its natural form and function, reproducing meanders, riffles and deep pools, reconnecting the river to its floodplain and restoring native vegetation to this riparian area.

The expected result is a healthier river, cleaner water and an elevated water table.

The section of river selected for the project was long ago channelled, straightened and shifted to the edge of the flood plain to make room for livestock grazing and farming. This process virtually eliminated the meander, the serpentine winding of a natural river, and also eliminated many of the pools and riffles. Severing the river from the floodplain greatly reduced subsurface water storage.

The City has made an area under its ownership available to the HPWA for restoration work, and has provided some technical assistance with water testing, particularly stormwater pollution prevention monitoring.

The HPWA, under the leadership of Lea Knutson, has done most of the heavy lifting, obtaining the funding and recruiting some of the leading experts in watershed restoration for the project.

The list of contributors reads like a “Who’s Who” of river restoration.

Bill Zeddyk of Zeddyk Ecological Consultants, LLC, a pioneer in the field of induced meandering and many other watershed restoration techniques, helped select the site and conceived the project.

Chris Phillips, a consultant with Riverbend Engineering, LLC, developed the design and guides the construction. Phillips is an expert in fluvial geomorphology, the study of the interrelationships of rivers and their adjoining landscapes. Phillips coauthored a complete rewrite of the New Mexico Department of Transportation’s Drainage Manual.

Craig Sponholtz of Watershed Artsans, Inc. is doing the construction and artistically recreating a natural river character.

Sponholtz, an agro-ecologist, has specialized for many years in riparian restoration of southwestern landscapes. Biologist and botanist Melanie Gister, director of Santa Fe’s Institute of Applied Ecology, and Aaron Knutman of Southwest Urban Hydrology are providing assistance with the reintroduction of habitat-appropriate native plants. Barela Timber Management supplied the logs and May Industries supplied the boulders.

Community volunteers are helping to replant vibrant native vegetation after construction. HPWA staff is overseeing the project and doing the monitoring to track success. Adjoining landowners have not only cooperated but have also contributed various resources, including a male driven harrow to help with planting. It’s truly a collaborative effort.

The river could not be restored to full meander on the floodplain due to several constraints, including budgetary. But the team provided a path for the river to again flood onto the floodplain, lessening potential damage downstream.

They also created river bends where they could, bounded by a staircase-like series of steps and pools, known as “vertical meander.” Vertical meander is often a feature of mountain streams. Fish habitat is consequently vastly improved.

The city and the HPWA have worked together over at least two administrations, and our collaboration is just starting. Another project is planned to revitalize and restore the Gallinas Riverwalk Park.
Figure 25 - Flyer advertising final project event

HERMIT'S PEAK WATERSHED ALLIANCE
PRESENT
PICNIC ON THE GALLINAS
SUNDAY, AUGUST 6TH, 11AM - 2PM

CITY OF LAS VEGAS PROPERTY ADJACENT TO THE LA PLACITA FIRE STATION IN GALLINAS VILLAGE

- Spend a lazy summer day picnicking in the cool Bosque shade along the banks of the beautiful Gallinas River.
- Tour the completed Gallinas Village River and Floodplain Restoration Project
- Watch a Fly Fishing demonstration from master Aaron Juarnos
- Bring your fishing pole for some fishing time (valid fishing license is required)
- Take a nap in the shade

Frito Pie Fixins and drinks provided – bring your own picnic if you prefer.

Directions:
Take Hwy 65 past the United World College up the Gallinas Canyon to the 11 Mile Post.
Meet at the La Placita Fire Station on the left.

Call 505.425.5514 for more information