

# Updated Watershed Based Plan for the Upper Gallinas River – National Forest Addendum



**HERMIT'S PEAK**  
WATERSHED ALLIANCE

Developed for

## **On-The-Ground Surface Water Quality Improvement Projects: Phase II**

In Partial Fulfillment of Federal Clean Water Act Section 319 (h) Nonpoint Source Grant  
Submitted to the New Mexico Environment Department (NMED)

Contract # 16-667-3000-0019

RFP# 50-667-15-25122

FY 2016

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July 23, 2018



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Cover painting by Martin Montoya titled: Las Vegas and the Gallinas Watershed

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## LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
ARMAS	Achieving in Research Math and Science – Internship program at NM Highlands University
AU	Assessment Unit
BMP	Best Management Practice
CWA	Clean Water Act
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
HPWA	Hermit’s Peak Watershed Alliance
HQCWAL	High Quality Coldwater Aquatic Life
HQCWF	High Quality Coldwater Fishery
HWI	Healthy Watersheds Initiative
LA	Load Allocation
LV	Las Vegas
MMR	Management and Restoration Measure
MOS	Margin of Safety
NEPA	National Environmental Policy Act
NFL	National Forest Lands
NM	New Mexico
NMED	New Mexico Environment Department
NMHU	New Mexico Highlands University
NMOSE	New Mexico Office of State Engineer
NRCS	Natural Resources Conservation Service
QAPP	Quality Assurance Project Plan
SMC	San Miguel County
SSTEMP	Stream Segment Temperature Model
SWCD	Soil and Water Conservation District
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UWC	United World College
W/D, or W:D	Width to depth ratio
WBP	Watershed Based Plan
WLA	Waste Load Allocation
WQCC	Water Quality Control Commission
WQS	Water Quality Standards

## ACKNOWLEDGEMENTS

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

- US Forest Service Staff:
  - Steve Romero
  - Alberta Maes
  - Melvin Danny Burton
  - James Munoz
  - Sarah Naegele
  - Mike Lujan
  - Cecil Rich
  - Carlos Lovato
  - Annmarie Kmetz
  - Esther Nelson
  
- Jeff Ogburn, NM Game and Fish Department
- Devin Kennemore, Pathfinder Environmental
- Margie Tatro and Mark Reineke, Reineke Construction
- Kathryn Mahan, KI Bar Consulting
- Craig Sponholtz, Watershed Artisans
- Daniel Unruh



## INTRODUCTION

This addendum to the *Updated Watershed Based Plan for the Upper Gallinas River* (HPWA, 2012) addresses National Forest (NF) lands managed by the U.S. Forest Service within the Santa Fe National Forest in the Upper Gallinas Watershed. The 2012 Watershed Based Plan only addressed private lands in the Upper Gallinas River Watershed.

Even though stream reaches in the National Forest are not listed as impaired they contribute directly to water quality of impaired reaches found lower in the watershed. The better the water quality that provides the source for impaired reaches, the easier it will be to reduce those impairments. Furthermore, to ignore watershed conditions upstream of impaired reaches does little to approach watershed restoration and management in a holistic, basin-wide manner.

This addendum does not reiterate information that is presented in the *Updated Watershed Based Plan for the Upper Gallinas River* (WBPGR) (HPWA, 2012); that document provides the background to accompany this document.

## GEOGRAPHICAL, ECOLOGICAL, SOCIAL, AND HISTORICAL CONTEXT

The Upper Gallinas Watershed is a sub-watershed of the Pecos Watershed and is located in northeastern New Mexico. The watershed is 48,968 acres (76 mile<sup>2</sup>) from its headwaters on Elk Mountain to the Las Vegas Diversion near Montezuma, NM, including Porvenir Canyon to the headwaters of Beaver Creek. This total of 32.5 miles of stream length descends from 11,661' to 6,800'.

The geographic area covered by this National Forest addendum includes Hydrologic Units numbered 130600010801 and 130600010802 (see Map 1) and includes the upper reaches of the Gallinas River (aka Gallinas Creek) and the National Forest lands of Porvenir Creek and its headwater stream Beaver Creek. Table 1 provides a description of this entire upper Gallinas Watershed. The National Forest in the Upper Gallinas Watershed covers 52% of the watershed's landscape (SWQB, NMED, 2005) or a total of 25,463 acres.

**Table 1 - Project area description for the Updated Watershed Based Plan and National Forest Addendum for the Upper Gallinas River**

NAME	Assessment Units	HUC (12)	HUC SIZE (acres)	MAIN STEM LENGTH (miles)	DESCRIPTION
Porvenir Canyon	NM-2212-01; NM-2212_04; NM-2212_05	130600010801	18,028.6	14.4	Entire length of Porvenir Cr. up to headwaters of Beaver Cr.
Gallinas Cr.	NM-2212_02	130600010802	16,072.9	12.4	Gallinas Cr. from confluence with



NAME	Assessment Units	HUC (12)	HUC SIZE (acres)	MAIN STEM LENGTH (miles)	DESCRIPTION
					Porvenir Cr. up to its headwaters
Gallinas R.	NM-2212_00	130600010805	14,866.6	5.7	Gallinas R. from Las Vegas Diversion to its confluence with Porvenir Cr.
<b>TOTAL</b>		<b>1306000108</b>	<b>48,968 acres</b>	<b>32.5 miles</b>	

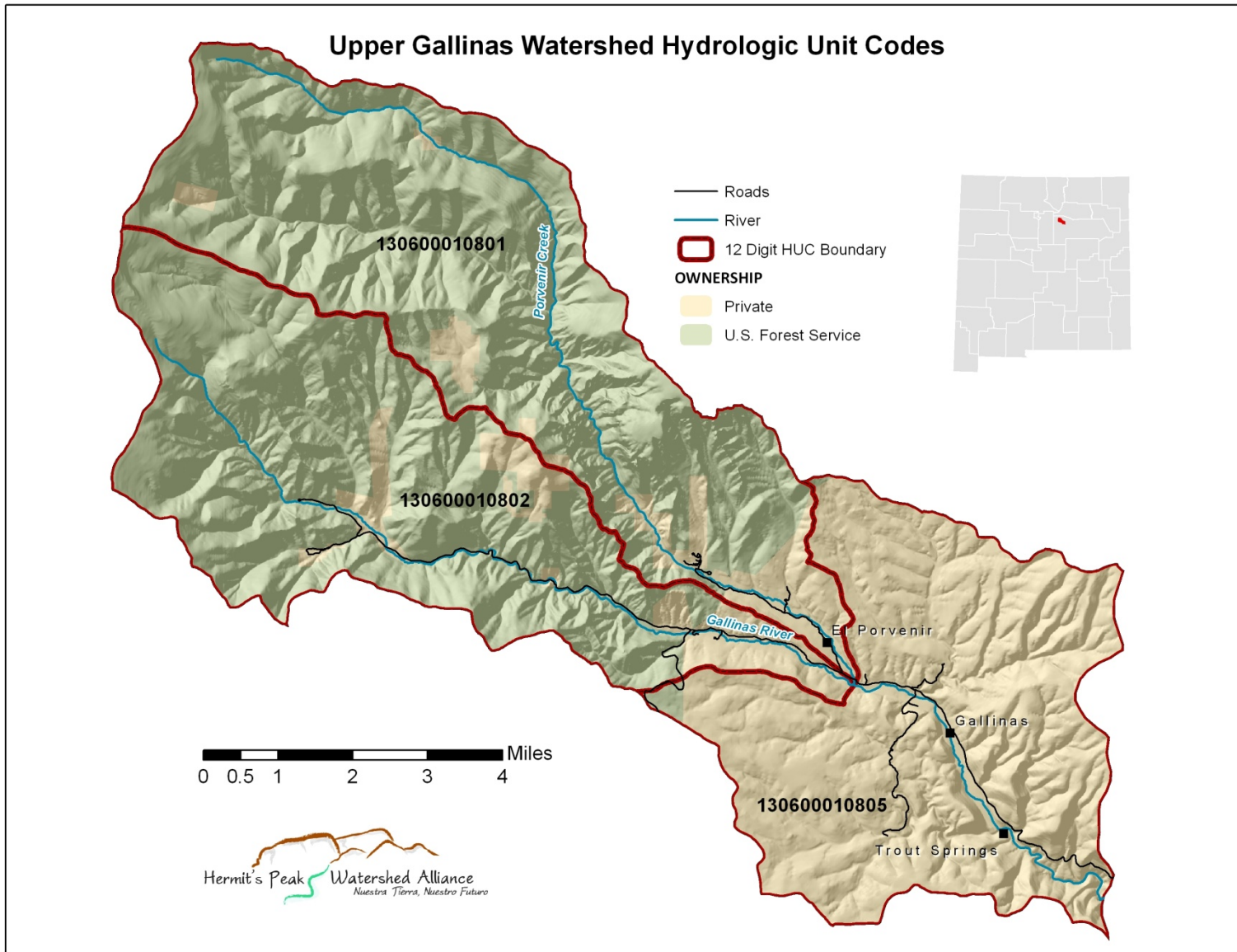
## History

The current day National Forest in the Upper Gallinas Watershed were designated as public in 1892 as the Pecos River Forest Reserve. It was later combined with the Jemez Forest Reserve to become the Santa Fe National Forest in 1915. The Las Vegas District was distinct until 1980 when it was combined with the Pecos District and is now known as the Pecos/Las Vegas District with two ranger stations, one in Las Vegas and one in Pecos.

In 1964 Congress designated more than 168,000 acres as the Pecos Wilderness and in 1980 added 55,000 acres for a total of 223,222 acres with 198,597 acres within the Santa Fe National Forest and 24,736 acres in the Carson National Forest. The upper reaches of both Gallinas Creek and Beaver Creek are within the Pecos Wilderness.

## Climate

The climate in the Upper Gallinas Watershed and the Las Vegas, NM area is defined by both the Rocky Mountains to the west and the plains to the east. Precipitation is variable in annual and seasonal totals. Winter precipitation in particular is variable and winter snowmelt provides the base flow for both the Gallinas River and Porvenir Creeks. Summer monsoons are typically brief and intense and usually occur between July and September. Average annual precipitation for Las Vegas is 16.3 inches (1941-2005), and average annual accumulated precipitation at Wesner Springs Snotel station (elev. 11,120 ft) is 38.3 inches (NRCS, 2014). Average maximum temperature for June, July and August is approximately 80° F (26.7° F), and average temperature for June, July and August at Wesner Springs is 50° F (10° C) (NRCS, 2014).



Map 1 - Project area for the Watershed Based Plan for Upper Gallinas Watershed and this National Forest Addendum with USGS Hydrologic Unit Code (HUC) Boundaries

## Vegetation

The vegetation in the National Forest is comprised of a variety of ecoregions. Below the National Forest at lower elevations (6,400 – 7,400 feet) the uplands between the City of Las Vegas gaging station and the USFS boundaries on both Gallinas River and Porvenir Creek are predominately comprised of ponderosa pine (*Pinus ponderosa*) and oak scrub forests. The lower elevation bottomlands or riparian areas are comprised of narrowleaf cottonwood (*Populus angustifolia*), willow species, predominately bluestem willow (*Salix irrorata*), and thinleaf alder (*Alnus incana* ssp *tenuifolia*). Above the USFS boundary is the mixed conifer vegetation zone, comprised of ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*) and blue spruce (*Picea pungens*). The riparian corridor in this zone contains mixed conifer species, thinleaf alder, willow species and occasionally aspen (*Populus tremuloides*).

Ecological Site and Soils data is not available from the USDA NRCS for over 99% of the Upper Gallinas Watershed (USDA: NRCS, 2014).

## Land Use

Land uses of the National Forest in the Upper Gallinas Watershed are comparable to other areas in the Santa Fe and Carson National Forests. Firewood, timber harvesting and livestock grazing are the primary consumptive uses. Some gathering of medicinal plants and native food plants (e.g. mushrooms) and natural items for cottage industries (e.g. lichen rocks, moss) may occur but are not regulated nor are substantial. The Gallinas and Porvenir Creeks are managed as a coldwater fishery for a self-sustaining population of brown and stocked rainbow trout. Outdoor recreation comprises a significant and consistent public use of these National Forest lands. Hunting, fishing, horseback riding, camping and hiking are the most common types of outdoor recreation with some use for winter cross-country skiing and snowshoeing. The two major trail systems are: the Porvenir Canyon trail #247 that follows Porvenir Cr. to the headwaters of Beaver Cr. and the Gallinas Creek trail # 216 that follows the Gallinas Cr. to Burro Basin.

Porvenir Canyon and the Gallinas Headwaters/ Burro Basin areas are available for livestock grazing. Currently, two grazing permits exist – one that covers the majority of the Upper Gallinas and one is primarily in the Tecolote Watershed with a small portion in the Upper Gallinas.

A number of private in-holdings exist in the National Forest along the upper reaches of Gallinas Creek between the EV Long Campground and Calf Canyon including Evergreen Valley. Many of the in-holdings include the creek. These in-holdings are long-term leases with USFS and most have a summer home. The El Porvenir Christian Camp immediately upstream of the USFS Porvenir Campgrounds is another substantial in-holding. Below the forest service boundary, private lands are used for grazing and the river is diverted for irrigation of agriculture and pasture lands. In addition, many residences in this area occur near the river and/or within the 100-year floodplain and are vulnerable to flood impacts. The primary access road (NM Hwy 65/ FR 263) follows and crosses the river at several places in the Gallinas Canyon and has also been impacted by past flooding.

## Forest Thinning

National Forest lands in the Upper Gallinas Watershed are currently undergoing forest thinning activities set forth in the *Environmental Assessment for the Gallinas Municipal Watershed Wildland-Urban*

*Interface Project* (USDA Forest Service, 2005). A total of 7,775 acres of treatment were planned in that EA. Forest thinning prescriptions followed by some post thinning treatment (e.g. prescribed fire) were planned for 5,936 acres. The remaining 1,839 acres have burn only planned treatments. To date 4,284 acres have been thinned with 1,652 acres remaining.

The watershed condition assessments and this addendum did not address forest thinning and fire prevention since the USFS and others have devoted considerable efforts to this and treatment plans have been well underway since 2005.

## Species of Concern, T&E species

A few threatened and endangered and rare species potentially occur in the National Forest of the Upper Gallinas Watershed. These species should be considered when planning projects in the area; they are particularly important when completing NEPA, 404 Permits or other regulatory needs. Those species are:

- Mexican Spotted Owl, *Strix occidentalis lucida* (Federal Threatened)
- Northern Goshawk, *Accipiter gentilis* (Rare)
- Southwest Willow Flycatcher, *Empidonax traillii* (Federal Endangered)
- New Mexico Jumping Mouse, *Zapus luteus luteus* (Federal Endangered)

Native Cutthroat Trout (*Oncorhynchus clarkii*) historically existed in the Gallinas Creek and Porvenir/Beaver Creek. While they are not currently listed, they are extremely rare. They have likely been extirpated from the Upper Gallinas Watershed but rumors from local fisherman indicate that they might still occur in the upper reaches of Gallinas Creek.

## PROJECT OVERVIEW

The Updated Watershed Based Plan for the Upper Gallinas River (WBPGR) is the foundational document upon which this Addendum is based (HPWA, 2012). This addendum does not reiterate discussions in the WBPGR related to stream impairments and other background information; that document still provides the basic elements of the WBP. This Addendum only addresses ecological and social conditions and recommended Management and Restoration Measures to remediate degraded conditions on National Forest lands.

In order to add the National Forest to the WBPGR, an ecological and social condition assessment was completed to help identify projects needed to improve overall watershed health and ensure the best water quality possible in streams that contribute to downstream temperature impaired reaches.

A subcontractor was hired to conduct the Ecological Condition Assessment and a detailed report contains the specifics of that assessment (Mahan Saleem, 2017). The methods used to assess ecological conditions are discussed below; the assessment included:

- Fluvial geomorphology (Rosgen Level II),
- Riparian condition (New Mexico Rapid Assessment Method, Montane Riverine Wetlands subclass, version 2.1), and
- Degraded site identification with a Stream Walkthrough.

Social perceptions, interests, impediments and resources were then examined by conducting a Public Opinion Survey, having numerous discussions with USFS staff and by conducting a NEPA review of recommended projects.

Information from the ecological and social conditions assessment was then used to recommend projects to improve degraded conditions within the social context of the area and plan their execution. These recommendations will provide the support and direction to request future funding to put this plan into action.

## ECOLOGICAL CONDITION ASSESSMENT

The primary focus of this ecological condition assessment was to understand factors that contribute to the degradation of National Forest streams as they relate to the temperature impairment in the Gallinas River downstream of the National Forest boundary (the river has failed to meet New Mexico Environment Department Water Quality Standards) (HPWA, 2012). The Upper Gallinas River temperature impairment is attributed primarily to a lack of canopy cover (low stream shade), along with excessive stream width and low flows. Some of the contributing factors of low stream shade include stream entrenchment, streambank erosion, a lack of floodplain connectivity, livestock grazing, agricultural fields, roads, residential development, recreational use, and natural conditions that might prohibit woody vegetation. More information on the temperature impairment in the Upper Gallinas River, including other possibly variables, can be found on pages 10-15 of the *Updated Watershed Based Plan for the Upper Gallinas River* (WBPGR) (HPWA, 2012).

Field assessments done by HPWA to form the basis of this WBP Addendum consisted of fluvial geomorphology (Rosgen Level II), riparian condition (New Mexico Rapid Assessment Method, Montane Riverine Wetlands subclass, version 2.1), and the identification of degraded sites with a Stream Walkthrough approach. Temperature and shade assessment was not conducted since temperature data collected during the WBPGR project and *On-the-Ground Improvement Projects Phase I* both indicated that stream reaches in the National Forest all met temperature standards.

Fifteen sampling sites were chosen for geomorphology and/or riparian condition assessment (ten sites per assessment); five sites were assessed only with NMRAM, five sites were assessed only with the geomorphology protocols, and five sites were assessed with both protocols (see Map 2). In addition, nearly 25 miles of stream were evaluated using the walkthrough method (see Table 3 for more detail).

These studies occurred prior to significant thinning projects that occurred along approximately 2.5 miles of the Gallinas Creek upstream of EV Long Campground (the Steelers and Broncos Units). These thinning projects were done very near to the stream channel and include steep slopes uphill of the stream. Thinning was covered in the *Environmental Assessment for the Gallinas Municipal Watershed Wildland-Urban Interface Project* (USFS, 2005). No post thinning sampling occurred of stream or riparian conditions. Future assessment of these sites should occur with comparable methodology used in this baseline study.

## Fluvial Geomorphology

### Methods

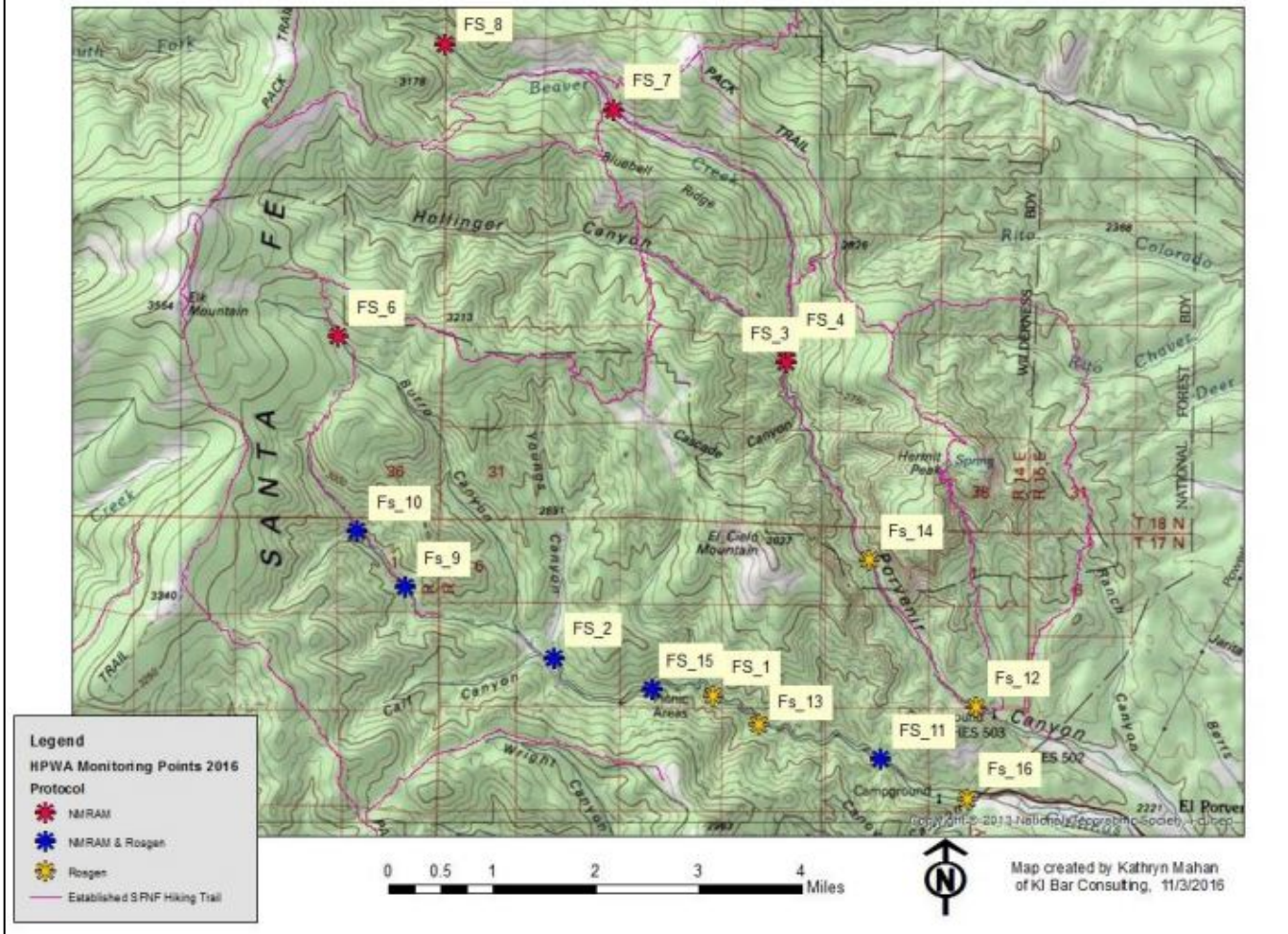
*Stream Channel Reference Sites: An Illustrated Guide to Field Technique I* (Harrelson, 1994) was used as a guide for determining stream channel conditions; cross-sections, longitudinal profiles and pebble counts were all done as part of the assessment. The purposes of gathering fluvial geomorphology data were: to have baseline data for monitoring trends in geomorphic condition over time; to evaluate watershed wide geomorphic condition; and to use the data to potentially determine areas in need of restoration. Sites for possible restoration were identified by fringe characteristics in the cross-sectional data for a particular stream type, in particular entrenchment ratio, in combination with the NMRAM scores.

Geomorphologic data can also be used to identify bimodal distribution of sediments (pebble count) which is an indicator of at-risk stream systems, due to erosion and deposition of fine particles. High sediment loads can decrease dissolved oxygen in the water, scour streambeds leading to higher mortality among aquatic invertebrates, negatively impact the aquatic plant community, and result in “embeddness” where the spaces between substrate become filled, decreasing spawning habitat and locations to lay eggs. Such a bimodal distribution would most simply be observed as two peaks (“two modes”) on a pebble count chart. This methodology is a nationally and USFS recognized manual for fluvial channel dynamics and is similar to the nationally recognized Rosgen Level II (Rosgen D. , 1996).

The cross section and longitudinal profiles can be accomplished with one person (if using a laser level) but a team of two is far more efficient. This method can take between 1 and 3 hours depending on the accessibility of the site and the length of the longitudinal profile. It is important to note that the prescribed longitudinal profile runs approximately 20 times the bankfull width, or 300-500 feet (Harrelson, 1994). Sometimes it was not possible to obtain this full measurement for a variety of reasons including dense vegetation, heavy wrack, topographic or other obstruction, site inaccessibility, or time/weather constraints. In some instances, where deep pools were present or line of sight to the transit was otherwise obstructed, elevation measurements were taken at water surface and then calculated based on depth from water surface to bed. These measurements are included on our longitudinal profile charts only for interest of the reader, and occur mostly commonly at deep pools.



### 15 monitoring sites in the Upper Gallinas



Map 2 - Monitoring Sites in the Upper Gallinas Watershed.



Pebble counts, the third component of the geomorphology survey, similarly can be completed by one person using a metric rule or tape measure, but is more efficient with two individuals. It takes on average an hour per count. Pebble count substrates are identified accordingly:

**Table 2 - Substrate Categories by Size (Mecklenburg)**

	Size Range (mm)		
Material	Low	mid	High
Silt/Clay	0	0.03	0.062
Sand	0.062	1.0	2
Gravels	2	3	4
	4	6	8
	8	12	16
	16	24	32
	32	48	64
Cobbles	64	96	128
	128	192	256
Boulders	256	384	512
	512	768	1024
	1024	1536	2048
Bedrock	2048	3072	4096

Entrenchment ratio (ENT) is defined as the width of the flood-prone area/bankfull width (Wfpa/Wbkf). (Bankfull determinations were cross-checked with regional curves for the area.) When ENT is near the low end of its range (or exhibits more incision), the stream is potentially at risk of losing access to the floodplain. According to (Zeedyk, 2009), an entrenchment ratio over 1.5 is considered “high,” a ratio between 1.2 and 1.5 is “moderate,” and less than 1.2 is considered “low.”

ENT Ratio Wfpa/wbkf	Connectedness of stream to floodplain
>1.5	High
1.2-1.5	Moderate
<1.2	Low

This is important for categorizing streams within the Rosgen system. Please note that entrenchment ratio as discussed in this report for NMRAM-only sites (Mahan Saleem, 2017) will generally be averages of the three less-detailed cross sections required by the NMRAM at each site rather than a single specific cross section.

At each of ten sites on which the Rosgen assessment was used, the two points between cross-sections on left bank and right bank were marked with non-permanent red and white pins. These cross-section pins were identified by GPS coordinates, and photo points standing at the pin and facing the opposite bank were taken at least one of the pins (in many cases, this was not possible from both pins due to steep cliffs).

Channel geomorphology was completed at ten of fifteen sites. The data for geomorphology is presented in text and cross-sectional graphs following individual summaries of each site. It is important to note that the blue line represents bankfull, or the two-year flow that shapes the channel. The red line represents a 15-year flood, or the flood that forms the floodplain. The area within the red line is the flood-prone area.

## Findings

Detailed results of fluvial geomorphology, riparian condition, and identification of degraded sites are presented in *Watershed Condition Assessment – National Forest in the Upper Gallinas Watershed* (Mahan Saleem, 2017).

The fluvial geomorphology study found that the majority of study sites had a high entrenchment ratio – meaning that they are well connected to their floodplain (the river can easily access its floodplain during high waters). Only one site had a moderate entrenchment ratio. While some areas were found to be moderately entrenched during the Stream Walkthrough (see below) and general observations (e.g. site FS9 in one location), most stream reaches are not considered entrenched, so restoration to repair this degraded condition is not generally needed in National Forest areas of the Upper Gallinas Watershed.

## New Mexico Rapid Assessment Method

### Methods

HPWA measured land and stream health using the New Mexico Rapid Assessment Method: Montane Riverine Wetlands (NMRAM) v 2.1 protocol at ten of fifteen sites. This method uses several different metrics to assess landscape health (available nutrient buffer, and context of the site within a larger landscape), biotic health (plant communities, physical structure, and diversity), and abiotic health (river channel shape and function and landscape diversity).

This method takes 4-5 hours per site and is most efficient when performed by three trained individuals. Ideally, the crew member most comfortable with local vegetation identification will complete the vegetation mapping (biotic) portion of the assessment while the other two crew members take stream measurements (abiotic portion of assessment); the landscape portion, as well as the checklists based on general observation rather than specific measurements found in both the biotic and abiotic portions of the NMRAM, are most efficiently (and likely most accurate when) completed jointly by all three members of the field crew.

Landscape health measurements included buffer integrity, riparian corridor connectivity, relative wetland size (compared to historic size), and surrounding land use. Biotic health measurements included relative native plant community composition, vegetation horizontal patch structure, vegetation vertical structure, native riparian tree regeneration, and invasive exotic plant species cover. Within this portion of the method, vegetation communities were mapped according to habitat type, adapted for wetlands from the Hink and Ohmart system. Abiotic measurements included hydrologic connectivity (river to floodplain), physical diversity of the site, channel stability, stream bank stability and cover, and soil surface condition. Additionally, the above-described fluvial geomorphology measurements were performed alongside the NMRAM abiotic assessment.

The NMRAM summary rating system is based on a scale of 1 to 4, where 4 (3.25-4) is considered excellent condition, 3 (2.5-3.25) good, 2 (1.75-2.5) fair, and 1 (1.0-1.75) poor. Rationale for the weighting in the score roll-up can be found in the yet-to-be-published field manual, as it differs significantly from the weighting system used in versions 1.0 and 1.1. Environmental stressors were also recorded, and were ranked according to intensity as minor, moderate, or intense.

For more information, or to obtain a copy of the field manual, we recommend contacting Maryann McGraw in the Wetlands Program of the NMED.

## Findings

All 10 sampling sites except one received an overall score of excellent condition; the exception was that one site was considered good. The lowest ranking site (score 3.24) was in close proximity to the road and near to a day use area so it had physical constraints, a large number of stressors and its historical wetland size was reduced. Component scores (biotic, abiotic, landscape) indicate areas where some improvement in the overall score could potentially be achieved with restoration activities.

The road and heavily used public areas are all in close proximity to the Gallinas River between EV Long Campground and Evergreen Valley. Reduction of riparian vegetation, bare and compacted soils, the road itself and related gabion baskets and streambank erosion were noted in most of these areas and posed the most significant stressor on riparian habitat condition along Gallinas River. However, the NMRAM study was not typically sensitive to the level of degradation caused by these human uses.

Besides fluvial geomorphology, and NMRAM studies, general observations were made while visiting each site; those observations are part of the NMRAM study to generally observe the site in ways that may not be reflected in the overall score. These observations at study sites when combined with the Stream Walkthrough observations provide the basis of some recommendations. See the findings in the Stream Walkthrough section for a summary of general observation of degraded conditions.

## Stream Walkthrough

The principal goal of conducting a Stream Walkthrough was to catalog degraded conditions and restoration opportunities over a wide area to supplement more detailed data collected to document baseline conditions at specific sampling locations.

## Methods

Two observers walked either in the stream channel or immediately adjacent to the channel armed with a highly accurate GPS unit. Some stream reaches were so close to the road that observations were made by driving. During the walkthrough all observed degraded conditions and restoration opportunities were recorded. The catalog was spatially accurate to enable GIS mapping with descriptive annotation to identify the type of feature. Walkthrough inventories focused on drainage channels but may also extend to adjacent meadows, wetlands or other areas of importance.

Stream Walkthroughs occurred along a total of 24.6 stream miles in both the Gallinas Creek and Porvenir Creek drainages (see Table 3). In order to catalog the location and identify the type of stream or upland issue or opportunity, we used a Juno 3B Trimble unit, where satellites allowed, to record spatial and descriptive data. See Figure 1 for images of the ArcPad form used to collect Walkthrough data.

Table 3 - Walkthrough by stream section

Stream Section	Miles covered in Walkthrough (approximation)
Gallinas Cr./ Gallinas River	8.7
Burro Basin	4.1
Porvenir Cr.	4.8
Hollinger Cr.	0.8
Beaver Cr.	6.2
<b>Total</b>	<b>24.6</b>

Features that were expected to be encountered and those of significance to watershed health are as follows:

Upland Erosion Features

- headcuts
- surface erosion (pedestals, rills)
- excessive bare ground

Drainage Channel Erosion

- eroding stream banks or channel erosion (headcuts)
- excessive sedimentation in drainage channel/ high embeddedness
- channel entrenchment (moderate/severe)
- over-wide channel

Degraded Vegetation

- degraded woody vegetation (lack of shade)
- degraded herbaceous vegetation
- lack of reproduction
- non-native vegetation dominance

Man-made impacts

- trail related erosion
- eroding or over-widening trail or livestock crossings
- grazing related impacts
- camp sites
- road impacts
- gabion baskets/bank armoring
- diversions
- bridge related issues
- dams (including installed one-log dams)
- berms/channel constraint

Fish and Macroinvertebrate Habitat (catalog of existing conditions to identify enhancement opportunities)

- Pool/Riffle complex
- Large Woody Debris (LWD) accumulations adequate to form hiding cover or backwater in stream channel
- Habitat diversity features - overhanging banks, back water, oxbows

Beaver sign (catalog of existing conditions to identify enhancement opportunities)

- foraging
- dams
- dens (bank or lodge)

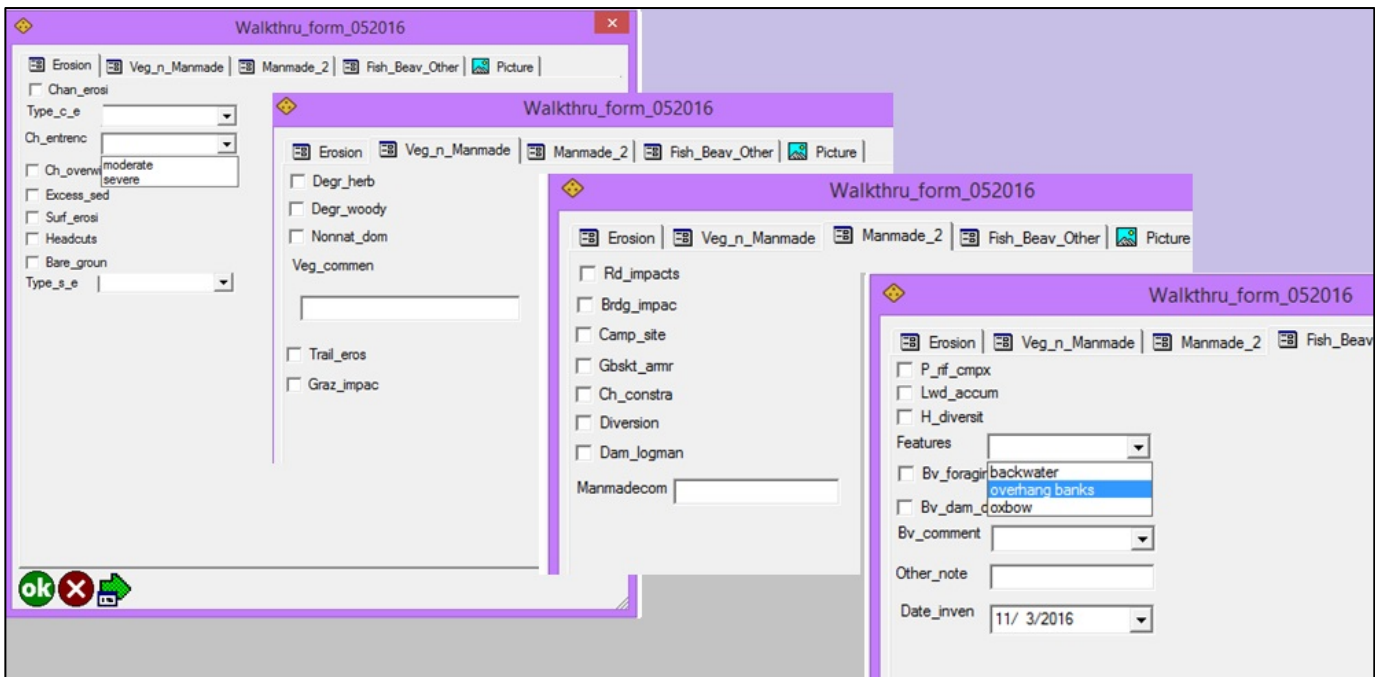


Figure 1 - Screens showing the pages of the walkthrough form used in the Juno 3B.

## Findings

While sampling locations for fluvial geomorphology and NMRAM offer specific and repeatable quantitative data, not all issues and opportunities are detected with those studies. Issues identified during all field assessment work including the Stream Walkthroughs yielded numerous observations of issues and opportunities that helped to develop project recommendations; those are summarized in Table 4.

Table 4 - General observations of issues and opportunities made during Fluvial Geomorphology, NMRAM and the Stream Walkthrough in no particular order. Refer to (Mahan Saleem, 2017) for more details. The FS# listed refers to the sampling location where the issue is found.

Issue/Opportunity	Description	Apparent Causes	Areas Affected	Remediation
<b>ISSUES</b>				
Man-made log dams	man-made log dams can cause channel widening, sequestration of fine sediments	Improperly constructed and sited log dams in 1960's, 70's	Gallinas: EV Long Campground, downstream of Oak Flats, site FS1, lots of them along first half of trail #216,  Porvenir: Beaver Cr. trail #247 meadows near Lone Pine Mesa trail	Remove or repair log dam with notching in center of stream, reinforce log ends with rock, replace log with rock that encourages development of a thalweg
Moderate stream entrenchment	Site specific stream entrenchment	Human use, lack of riparian vegetation the flood erosion	Porvenir: FS12 (Porvenir Christian Camp), FS14 (1.1 mi up Porvenir Cr.)  Gallinas: FS1 (between Fishing Hole & Big Pine), FS11 (Oak Flats), FS13 (Fishing Hole), downstream most ephemeral trib to Gallinas Cr severely downcut maybe unstable	Consider instream restoration with log or boulder structures to arrest further entrenchment
Consequence of logging	Excessive woody debris, limited riparian vegetation	Thinning too close to riparian area, remnant large woody debris on adjacent steep slopes	Steeler's and Bronco thinning units in Gallinas Canyon	should examine conditions after riparian thinning that occurred during fall 2016
Water Diversions	Over-wide channel, adjacent streambank erosion, lack of riparian veg., sequestration	Diversion construction method	Porvenir Christian Camp, EV Long Campground	Evaluate improvements

Issue/Opportunity	Description	Apparent Causes	Areas Affected	Remediation
	of sediments			
Road and bridge impacts	Road too close to stream channel constrains the channel, significantly limits restoration potential, places the road in jeopardy during flood events (as seen in the 2013 flood event), has significantly reduced the overall size of the wetland plant community from its historic condition	The easiest place to build a road	near Fishing Hole day use area ( FS13), in many areas along Gallinas Cr. between EV Long Campground and Evergreen Valley	Relocate the road but probably not practical in most locations, more thorough investigation needed
Recreational area impacts	bare, compacted soils, streambank erosion/bank slumping	People trampling in heavy use areas	EV Long campground, Oak Flats, Porvenir Christian Camp, site FS14 1.1 miles upstream of Porvenir Campground	recommend more thorough assessment of public use impacts and explore possible remediation measures
Gabion baskets	Unstable gabion baskets pose a potential stream channel erosion concern should they become dislodged during a flood event (some of them are prone to failure)	Road protection	Just downstream of Dubois cabin on Gallinas Cr.,	Remove and replace with better/newer structure
	Long gabion basket between road and stream eliminates stream shade and protection from the road	Road protection stabilize the streambank	Near Fishing Hole day use area (FS13) Gallinas Cr.	Revegetate at their edges to compensate for unvegetated basket if possible



Issue/Opportunity	Description	Apparent Causes	Areas Affected	Remediation
Wetland or wet meadow desiccation	Trailing drains wet meadows causing them to dry out	Grazing impacts, trails capture surface flows	Burro Canyon (FS6), Hollinger/Porvenir confluence meadows (FS3, FS4), at bottom end of old Lone Pine Mesa trail	Reroute trails, consider exclosures in specific locations
Bareground/ compacted soils	Compacted and bare soils in areas of high human use	Intense human use	EV Long Campground, Porvenir Christian Camp, day use areas, unofficial trailing	Further investigation of improved trails and siting of intense use area development
Streambank erosion	Streambank slumping	Grazing impacts	Burro Canyon (FS6), Hollinger/Porvenir confluence meadows (FS3), FS4	Replant with riparian veg. and exclosures around impacted areas
	Spider web of trails, trails sited at stream edge	Intense human use	Downstream of Oak Flats day use area, Porvenir Christian Camp, FS14 up from Christian Camp,	Further investigation of improved trails and siting of intense use area development
Riparian Vegetation Limited	Limited willows and woody riparian veg.	Grazing Impacts	Burro Canyon in wet meadows downstream of junction of Trails #216 and #212 (near FS6, FS9), along #216 (at site FS9)	Plant willows, thinleaf alder
	Limited willows and woody riparian veg., also lots of False Hellebore in adjacent meadows	May have resulted from historic overgrazing or the meadows were historically too wet to support willows	Beaver Creek - along trail #247 in meadows up and downstream of Hollinger Cr. confluence (FS3, FS4), wet meadows along #247 near Lone Pine Mesa trail (FS7), Porvenir Christian Camp	Plant willows, thinleaf alder, consider exclosures during veg. growth
	Limited willows and woody riparian veg.	landowner control of willow along	Evergreen Valley in-holding	Ask landowner to reduce will cutting or

Issue/Opportunity	Description	Apparent Causes	Areas Affected	Remediation
		streambanks to improve fishing access		restrict it to specific access locations
Non-native/invasive plants	Reed canary grass		Site upstream of Big Pine day use area (FS15)	convert it to a more native plant community
	Bull thistle and/or Musk thistle		a number of locations along the Gallinas Cr. trail #216 (e.g. near FS10), Burro Canyon at trail #216 and upstream, meadows near Hollinger/ Porvenir Cr. confluence, meadows along Hollinger Cr. trail, along Beaver Cr. trail #247 about 1.1 miles downstream of Lone Pine Mesa Trail and just upstream of that trail	hand removal and should be treated before expansion
<b>OPPORTUNITIES</b>				
Fish Habitat Enhancement	Improve pool habitat, improve vertical habitat diversity (e.g. LWD, overhanging banks) and enhance sinuosity within the constraints of the stream type	Limited LWD, channel straightening and widening	EV Long Campground (pool habitat, vertical diversity, some improvement in sinuosity), Porvenir Campground, Porvenir Christian Camp (pools filled with sediment, straightened channel)	Instream restoration
Beaver Reintroduction	Consider (with assistance from NM Game & Fish) beaver reintroduction in suitable habitat		Near Hollinger/ Porvenir confluence, Beaver Creek (e.g.FS3, FS4, FS7, FS8), Burro Canyon (FS6), EV Long Campground upper end (FS16)	May need to plant willows to improve habitat

Issue/Opportunity	Description	Apparent Causes	Areas Affected	Remediation
Wetland Enhancement	Improve wetland functionality of man-made ponds	Man-made ponds	Evergreen Valley	Wetland enhancement

## Trail Assessment and Design

After trails were identified in the initial watershed condition assessment (Mahan Saleem, 2017) as a significant contributor of streambank erosion, stream sedimentation, channel widening and the reduction of riparian vegetation, Reineke Construction was hired to further assess problematic areas and develop remediation designs.

### Methods

Their assessment aimed to address trail related problems affecting watershed health (e.g. erosion, stream sedimentation, stream channel widening, wetland dewatering) and trail sustainability. GPS locations were recorded at all remediation locations and photos were taken. Details of their assessment and designs are provided in a report (Tatro, 2017).

The Gallinas Trail (#216) assessment took place on October 17, 2017 beginning at the trailhead at the west end of Forest Road 263 and ended four miles north where trail #216 continues northward out of Burro Canyon towards Wesner Spring. The Beaver Creek Trail (#247) assessment occurred on November 1-2, 2017 along 10 miles of the creek starting north of the intersection of Trails #247 and #212 (from Lone Pine Mesa) along the upper reach of Beaver Creek and ended downstream at the Porvenir Campground.

### Findings

#### Gallinas Creek Trail #216

The assessment was done with the goal of improving watershed health primarily (e.g. reducing stream width, reducing erosion and subsequent sedimentation) and trail sustainability secondarily. Twenty-seven locations along Gallinas Creek Trail #216 were examined as potential for improvement. Thirteen trail/stream crossings occur in this four mile stretch of trail. Treatment recommendations were made and prioritized as either high or low priority. Twenty locations were considered a high priority for treatment and seven were considered low priority. The estimated cost of recommended trail treatments are \$54,360 for high priority locations and \$12,450 for low priority areas – a total of \$66,810.

Recommended treatments at or near trail/stream crossings include:

- Constructing 15 rolling grade dips and installing 1 rock culverts to improve tread drainage;
- In boggy trail segments, elevate the trail, add gravel hardening, stabilize streambanks with rocks, and install rock check dams, at minimally 5 locations all to reduce stream sedimentation;
- Install well-embedded rock steps to stabilize banks and/or prevent water from running down the trail ;
- Reroute the trail at 8 locations, moving it out of wet, boggy areas; reroutes will avoid further trail-oriented sediment loading of the stream and reduce the number of stream crossings; and
- Build or repair 2 turnpikes.

#### Porvenir Creek/ Beaver Creek Trail #247

As with the Gallinas Creek Trail, the assessment was done with the goal of improving watershed health primarily and trail sustainability secondarily. Fifty locations along Porvenir Creek/ Beaver Creek Trail #247 were examined as potential for improvement. Forty two trail/stream crossings occur in this 10

mile stretch of trail. Treatment recommendations were made and prioritized as either high (10 sites) or low priority (8 sites); 32 locations required no action. Cost of treatment was for high and low priority sites were estimated at \$62,890. Recommended treatments at or nearby trail/stream crossings include:

- Construct 6 trail reroutes (30'-100') to avoid further trail-originated sediment loading of the stream. Further assessment determined that 2 of those reroutes would be best consolidated into one long (1.4 mile) reroute but more design and a re-estimate of the cost would be needed.
- Rock hardening or raised trail tread construction to stabilize short segments of boggy trail at 4 crossings.
- Construct well-embedded rock steps to stabilize the bank and/or prevent water from running down the trail at 5 sites.
- Install 5 rolling grade dips to improve tread drainage.
- Install 1 rock lined turnpike.

## Log Dam Assessment and Design

During the initial watershed condition assessment (Mahan Saleem, 2017), numerous man-made log dams were found to occur in the Gallinas River/Creek from EV Long Campground to its headwaters including Burro Canyon and along Beaver Creek in meadows near the Lone Pine Trail. These log dams were apparently installed in the 1960's and 1970's and are common to mountain streams throughout northern New Mexico. They were constructed for the purpose of improving fish habitat, long before stream hydrology was well understood. Because they are flat and level, they do not direct water to flow toward the middle of the channel. Consequently, when water encounters a log dam, it is directed laterally against the bank at each end of the log on the upstream side. This frequently causes bank erosion and channel widening (see Figure 2). Sometimes, the water cuts a channel around the ends of the logs or under them. In other cases, channel widening reduces flow energy and causes sediment to fill in the channel on the upstream side.

### Methods

Not all man-made log dams were found to be causing stream channel problems (many were installed in bedrock limited channels). In order to determine which log dams should be either removed or repaired to remedy stream channel degradation, an assessment protocol was developed (see Appendix B: Log Dam Assessment Data Sheet) and employed in the Porvenir Canyon and Beaver Creek. Time and financial constraints did not allow this more detailed assessment along Gallinas River. This assessment will be done in future projects.

### Findings

Thirty one man-made log dams were found and assessed on the Porvenir Creek/ Beaver Creek drainage; all were located in grassy meadow environments. Treatment (repair or removal) was recommended for 11 of those structures and 4 were deemed to be high priority. Those dams with willow roots or large streambank or downstream rocks experienced less end of log erosion compared with dams that have no such anchors. Log dams to be removed may need replacement with one-rock dams to arrest or repair erosion; repairs, such as a notching the log dam, may be sufficient for others. GPS locations and specific recommendations for each log dam assessed are contained in the report *Gallinas Trail and Beaver Creek Trail Assessments* (Tatro, 2017).



Figure 2 - Channel widening caused by man-made log dam.

## Information Gaps

In the course of conducting the condition assessments, the following gaps in information and assessment efforts were identified (Mahan Saleem 2017).

- No assessment of stream and watershed conditions occurred after thinning along the Gallinas River between EV Long Campground and Evergreen Valley.
- No detailed assessment of the stream issues related roads and bridges occurred.
- No detailed assessment of recreation areas (campgrounds and day use areas) occurred.
- A more extensive catalog of invasive plant species is needed.
- No detailed assessment occurred of the effects of grazing on riparian habitat condition, streambank erosion and stream width; this will help assess priority areas and restoration efforts.
- Expand geomorphology assessments to the full range of Rosgen Level II to allow more accurate stream classification. Throughout the study area, the Rosgen Level II-type data collected included the entrenchment ratio and the channel material. Direct measurements of slope, sinuosity, and meander width ratio were not completed, and for this reason stream types of individual sites are not available. Measurement of these parameters would allow a more accurate classification within the Rosgen Stream Classification framework should this classification be desired.

Collect more geomorphology data (increase number of sampling sites) throughout the entire Upper Gallinas watershed. Because of limited access, many areas higher in the watershed were not sampled for geomorphology or not sampled at all. Additional geomorphology data could be collected to capture specific areas of opportunity on the mainstem Gallinas River and along the road and picnic/day use areas.

## **SOCIAL CONDITION ASSESSMENT**

Social Conditions were assessed with Public Opinion Survey of National Forest users during the summers of 2016. Also numerous meetings with USFS staff occurred to improve our understanding of issues, constraints, opportunities, resources and regulatory requirements of doing watershed improvement projects on the National Forest. As a result of the discussions during which we recommended specific watershed improvement projects, it was determined that a NEPA review would be necessary to enable the implementation of some of those projects. Conducting the NEPA review was then the final step in our Social Condition Assessment.

### **Public Opinion Survey**

The goal of the Survey was to collect public opinions about the issues and opportunities of National Forest lands in the Upper Gallinas Watershed as they relate to watershed functions, values and uses. People who use the National Forest in the Upper Gallinas Watershed all have valuable observations and opinions about the problems related to the health of the watershed and also have unique understanding of how the health of the watershed could be improved to provide for our local needs. The survey is a way to capture the perspective of those people. With the exception of two multiple choice questions, all questions were open ended which allowed the respondents to provide more insight into the issues presented.

In-person surveys were conducted at campgrounds and day-use areas on at least two busy weekend days during the summer of 2016. An online version of this survey was also distributed on the HPWA website, email list and social media. Thirty seven in-person surveys and 30 online surveys were completed in 2016. Survey questions and a summary of the results are in



## Appendix A: Public Opinion Survey.

Notable results of the Survey are:

- Most of the people that use the National Forest in the Upper Gallinas Watershed are local residents (70%).
- Their use is most commonly hiking, camping and fishing and they visit the National Forest 2-4 times per year.
- Land health problems noted by respondents were loss of fish and wildlife, streambank erosion, trash, impacts from flood, noxious weeds, excess sediment in streams, forest thinning needed, bare ground, and reduced stream flow.
- Common issues identified regarding how people use the land or the condition of public use areas were: trash, ORV use impacts, water pollution, people cutting switchbacks on trails, and overgrazing/livestock related problems.
- Land health improvements needed: improve fish habitat, protect ecologically important areas such as wetlands, forest thinning, improve wildlife habitat, trail improvements, livestock management improvements, heal erosion, stream improvements, and road improvements.
- Public use or public use area improvements needed: educational information, more trash cans, interpretive signs, improved stream crossings, road improvements, campground facility improvements (water spigots, grills, picnic tables, fire pits), more camping spaces including primitive spaces, better fishing access, and more bathrooms.
- Most fishermen (81%) responded that they would like to see native cutthroat trout reestablished in the upper reaches of Gallinas Creek and Beaver Creek.

## Discussions with USFS Staff

A number of informal meetings were held with USFS staff of the Pecos/Las Vegas District. Meetings first presented the findings of our Ecological Condition Assessment and Public Opinion Survey. Then we presented our recommended watershed improvement projects and discussed USFS support, practicality, and regulatory constraints of implementing those projects. Those discussions led to an agreed upon a list of projects that should be pursued (see the next section on Management and Restoration Measures for details) and an identification of which projects would require NEPA review.

Trail repairs and reroutes, log dam removal/repairs, riparian vegetation enhancement, beaver relocation, and livestock/ungulate fencing enclosures were the management and restoration measures that were agreed upon to pursue further. It was decided that high use recreation sites like campgrounds and day use areas and road improvements were projects that would require resources beyond the scope of this current and likely future 319 grants so would need alternative funding to pursue indepth assessment, design work and implementation.

## NEPA

Forest Service staff (Steve Romero, District Ranger, Melvin Danny Burton, Wildlife Biologist, James Munoz, Recreation Director, and Cecil Rich, Fish Biologist), HPWA, and sub-contractors, Pathfinder Environmental and Reineke Construction, agreed upon the list of projects that would require NEPA and would be desirable to implement in the near future. It was determined that our current planning budget was not adequate to conduct NEPA review for projects in both Gallinas Cr. and Porvenir/ Beaver

Cr. drainages. So, it was decided to focus on Porvenir Cr. and Beaver Cr. projects since that area receives more human use and has greater risk of further deterioration. Pathfinder Environmental, Devin Kennemore, was contracted by HPWA to lead the NEPA review. Mr. Kennemore would take the NEPA to the point that it was ready for a Record of Decision by the USFS. Forest Service staff would finalize the NEPA from that point. The agreed upon list of projects the required NEPA review in the Porvenir and Beaver Creek area included:

1. Trail reroutes,
2. Man-made log dam removal or repairs,
3. Planting riparian vegetation (worthy of mention since it led to item 4.), and
4. Constructing fences to enclose riparian planting areas.

After completion of the NEPA, implementation of these projects will then be eligible for future funding.

## **MANAGEMENT AND RESTORATION MEASURES**

In order to improve temperature conditions downstream of National Forest lands and to contribute to overall watershed health that indirectly affects temperature (e.g. flow, turbidity, underground water storage), Management and Restoration Measures have been specifically developed to address watershed issues and opportunities that were identified during the Ecological Condition Assessment and the Social Condition Assessment. Management Measures pertain to ongoing activities in the National Forest that require continual attention to manage human use. They provide recommendations that deal with: trail management, management of intensively used recreation areas, livestock management, roads and noxious weeds.

Restoration Measures address activities that change the trajectory of one or more watershed elements (e.g. stream channel, riparian area) facilitating their ability to heal themselves over time. Restoration Measures recommended below usually involve one-time efforts like: stream channel restoration, riparian area restoration and beaver reintroduction.

Conservation Programs, Planning and Regulatory Measures and Education and Outreach Measures that are needed to support on-the-ground Management and Restoration Measures are also addressed in this section.

### **Management Measures**

National Forest lands in the Upper Gallinas Watershed are primarily used by people for recreation, livestock grazing, timber and firewood harvest and access to private in-holdings. These uses can degrade watershed health if not managed in a way that considers the flow of water across the landscape, the health and diversity of plant communities and intact and healthy soils. Degraded watershed functions that result from human uses can manifest themselves in many ways but include: reduced water infiltration and filtration, reduced below ground water storage, reduced water quality, changes in the rate of water flow through stream channels, increased evaporation, reduced fish and wildlife habitat and jeopardized infrastructure during natural disturbances. Management Measures recommended below are designed to improve watershed functions and improve overall water quality and quantity.

## Recreational Use Management – Trails

Like roads, the main trails, along the headwaters of Gallinas Creek (#216) and through Porvenir Canyon and along Beaver Creek (#247) were constructed very near the stream courses. This necessitates numerous stream crossings (13 along 4 miles of Gallinas Cr. and 42 along 10 miles of Porvenir/Beaver Cr.) and makes the stream vulnerable to trail impacts in many locations. Impacts to the stream and water quality are generally channel widening, streambank erosion, subsequent sedimentation. Simultaneously, the trails in these locations are constantly wet and boggy which encourages unplanned, ancillary trails to form often furthering the problems. Twenty seven locations along trail #216 and 18 along trail #247 were identified as having significant stream and water quality related impacts requiring remediation.

Feasible and beneficial repairs to the main trails (#216, #247) have been outlined, designed and are ready for implementation. These improvements would not only help to reduce stream sedimentation, channel widening and impacts to riparian vegetation, but they would significantly help the USFS do long overdue maintenance. Repair work, if done as recommended would also improve trail sustainability and encourage the public to use and enjoy back country areas in the Upper Gallinas Watershed.

Trail improvements recommended by Reineke Construction will help to: reduce stream channel width and width:depth; increase stream shade largely by reducing width; reduce stream sedimentation and turbidity; and reduce the desiccation of wetlands and wet meadows. These improvements are needed along 4 miles of stream in the Gallinas Creek headwaters (trail #216) and 10 miles in the Porvenir/Beaver Creek drainages (trail #247) (see **Error! Reference source not found.**)

Recommended trail improvements are needed in selected locations along the Gallinas Creek and Burro Canyon and Porvenir Creek and Beaver Creek, they include:

- ◆ Construct rolling grade dips and rock culverts to improve tread drainage,
- ◆ In boggy trail segments elevate the trail, add gravel hardening, stabilize streambanks with rocks, and install rock check dams to reduce stream sedimentation,
- ◆ Install well-embedded rock steps to stabilize banks and/or prevent water from running down the trail ,
- ◆ Reroute the trail moving it out of wet, boggy areas, reroutes will avoid further trail-oriented sediment loading of the stream and reduce the number of stream crossings, and
- ◆ Build or repair turnpikes.

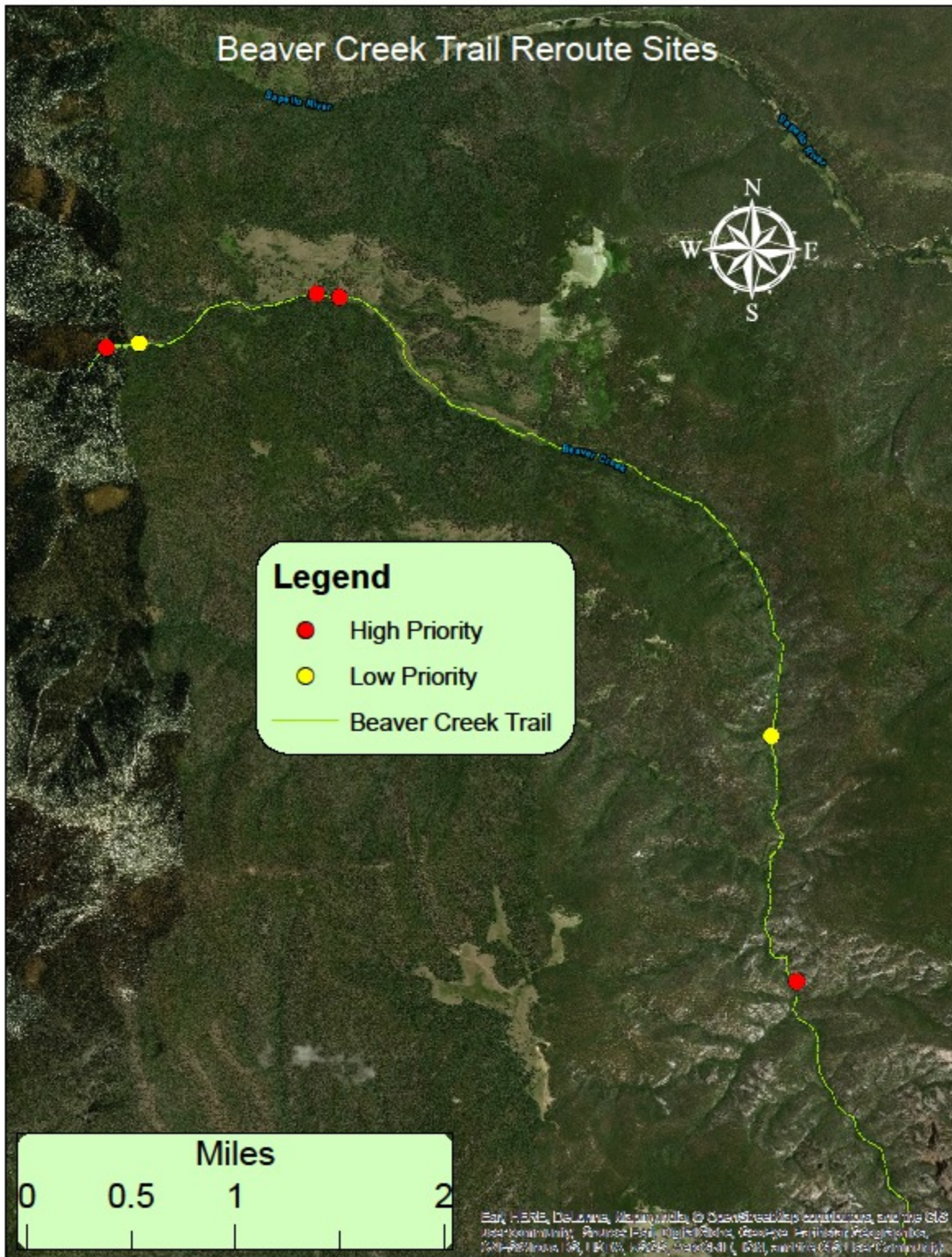
While some activities related to trail improvements are considered maintenance and do not require a NEPA review (Map 3), rerouting the trail involves new ground disturbance so does require NEPA (Map 4).





Map 3 - Recommended trail repair sites





Map 4 - Recommended trail reroute locations

## Recreational Use Management – Intensively Used Recreation Areas

The Ecological and Social Condition Assessments did indicate a number of watershed health and human use concerns in or near intensively used recreational areas. Campgrounds (EV Long Campground, Porvenir Campground), managed day use areas (Oak Flats, Baker Flat, Fishing Hole, Big Pine) and other dispersed but heavily used fishing spots (mostly along the Gallinas Creek) and camping areas in the back country (Burro Canyon and along Beaver Creek) have watershed health issues related to:

- Bare (unvegetated) and compacted soils,
- Degraded channel morphology (e.g. a constrained channel, widening, entrenchment),
- Streambank erosion,
- Spiderweb trailing, and
- Reduced riparian vegetation.

In these same areas, Public Opinion Surveys pointed out issues related to:

- Trash management including a lack of trash cans,
- Lack of signage to direct use, provide interpretation and provide stewardship education,
- Undirected ORV use,
- Degraded stream crossings,
- Trail maintenance concerns, especially switchback cutoffs,
- Infrastructure too close to the river,
- Campground facility improvements needed: water spigots, grills, picnic tables, fire pits, more camping spaces,
- Better fishing access,
- Road improvements, and
- Some facilities maintenance issues.

Managing and redesigning intensively used recreation areas was not the focus of ecological assessments or remediation planning because it is complex and requires significant expertise of people use patterns. Further assessment, design and remediation planning is needed to evaluate and redesign recreation areas to minimize streambank erosion, bare and compacted soils, upland plant cover degradation, and riparian vegetation degradation. The overall watershed health effects of these problems in localized areas also needs to be assessed to determine if they are significant enough to warrant attention especially recognizing that some degree of degradation is inevitable and cannot be completely remedied in high use areas.

In consideration of these conclusions, Management Measures for intensively used recreation area that are recommended at this time include:

- Conduct a more detailed assessment, design and plan (including NEPA if required) to determine needed and practical remediation to minimize recreation related watershed degradation.
- Develop educational information (interpretive signs or other medium) related to recreation uses of Gallinas Watershed campgrounds, day use areas and back country camping areas.

## Roads

The location of the main road up the Gallinas Canyon (State Road 65 and FS road 263) most certainly restricts the stream dimension, pattern, and profile and that of its floodplain. Roads and bridges throughout the National Forest and private land in-holdings were found to have these and other impacts on the river, riparian area and floodplain areas but addressing these on a large scale is not practical with the level of funding available through water quality driven programs like CWA 319.

During the September 2013 flood, the effect of the proximity of the road to the stream had dire consequences for the road from flooding. The road upstream of EV Long Campground and the campground itself were closed for an extended period of time and the repairs were costly. Should major road improvement funding become available, a more thorough assessment of hydrologic-related conflicts with roads and bridges would be necessary. This assessment should be done by a hydrologic engineer. One clear recommendation related to roads, however, is that paving the remainder of FR 263 between EV Long Campground and Evergreen Valley would help reduce stream sedimentation.

Two recommendations of Management Measures for roads are provided below. Because correcting conflicts between roads, bridges and stream channels is a complex and costly endeavor requiring the expertise of both hydrologic and civil engineers, funding to accomplish them will likely require sources beyond CWA 319 programs.

- ◆ Pave remainder of FR 263 from EV Long Campground up to Evergreen Valley.
- ◆ Conduct a thorough assessment of roads and bridges that cross or parallel stream channels to determine areas where the road unnecessarily constrains the stream channel, impacts the distribution of channel sediments and debris, causes excessive streambank or bed erosion or reduces vital riparian vegetation. Assessment should also identify areas where road sustainability because of its juxtaposition to drainage channels poses problems or hazards. Develop remediation measures and cost estimates.

## Livestock Management

Streambank erosion, channel over widening and wet boggy areas along trails is occurring in numerous locations and is caused by a combination of human and livestock trail use. Treatment of trail related problems (discussed above) remedy many of those problems.

Some specific locations along streambanks and in adjacent meadows have experienced compromised woody riparian and herbaceous plant communities. For example, the plant composition in some adjacent meadows has likely been altered by historic grazing (e.g. dominance by false hellebore). Riparian planting in areas without willow and temporary exclosures to limit grazing are recommended. Fencing and gates that separate grazing areas are in disrepair and make managing livestock difficult.

A single grazing lessee holds the grazing allotments in both the Gallinas Creek and Beaver Creek drainages. Discussions with this lessee indicated a few efforts that would help that individual better manage his livestock.

The following measures are recommended to improve livestock management and improve plant vigor.



- ◆ Improve gates and fencing between grazing areas; use gates with springs to improve the chances that they will remain closed,
- ◆ Improve signage to “Keep Gates Closed”,
- ◆ Assist in water development outside of riparian areas,
- ◆ Improve trails (see above trail related Management Measures),
- ◆ Noxious weed control, especially thistles (see below noxious weed Management Measures), and
- ◆ In selected areas where riparian vegetation is planted, construct exclosures to temporarily protect young vegetation (5-10 years) from livestock and deer and elk use. Fences should be removed after the woody vegetation has become well established.

### Noxious/Invasive Weed Treatment

Non-native and invasive thistles were found in a number of meadow areas adjacent to stream courses so are prone to continue to spread. Meadows next to stream courses where significant thistle populations were observed to occur were along Beaver Creek beginning at the Hollinger Creek confluence and upstream as well as the meadows in Burro Basin and near the headwaters of Gallinas Creek.

These aggressive plants compete with native species, reduce plant community diversity and reduce forage productivity. Thistles would be preferably controlled by hand pulling or other mechanical means before they spread further. Treatment would be needed for a number of years to eliminate local populations and then on a continual basis to catch new infestations as they develop (brought in by livestock, boots, etc). YCC crews working for the USFS or other organizations as well as volunteer crews could be assigned this task. It is important that these people be trained to identify thistles (Sivinski, 2016) as there are some native, non-invasive species (e.g. Parry’s thistle) that occur and should be left alone. Because no other non-native and invasive weeds were discovered in our casual inventories and our inventories were not complete, the YCC crews and volunteers could also assist with cataloging locations of thistles and other noxious weeds and be asked to report those locations to the USFS. See Appendix 2 (Mahan Saleem, 2017) for a report about thistles.

YCC and volunteer crews with some supervision are the most likely means of carrying out the two following Management Measures.

- ◆ Conduct regular surveys for noxious and invasive weeds in meadows, uplands and riparian areas, especially in areas adjacent to drainage courses (since they are a significant vector for weed dispersal). The location, coverage and species of weeds should be tracked. Perhaps develop a simple reporting form that volunteers can use to report weed observations and locations to the US Forest Service.
- ◆ Remove noxious and invasive weeds, especially Musk and Bull Thistle, in riparian and upland areas with hand or mechanical techniques on an annual basis. Removal should occur before thistles fully flower or if not possible, flowers and seed heads should be bagged, hauled out and properly disposed of to reduce redistribution. Training in identification of thistles and other weeds is critical since native thistles occur in the National Forest.

## Beaver Management

Below is a general recommendation to help people live with beaver; it is considered a management activity. See below (in the Restoration Measures section) recommendations related to reintroducing beaver into the upper reaches of Beaver Creek and Gallinas Creek.

- ◆ Assist landowners and managers with identifying strategies to coexist with beavers that are in conflict with human infrastructure or land uses. Help to design and construct beaver mitigation structures (e.g. flow devices, beaver deceivers, acequia diversion or culvert cages) to facilitate living with beavers if issues arise with private land in-holdings or on public lands.

## Restoration Measures

Restoration activities that are recommended on National Forest lands and private in-holdings are described below. When location information exists it will be provided, otherwise explanations of the applicable locations will be described.

### Stream Channel Restoration

Work in the stream channel that is designed to recreate appropriate channel configuration (e.g. width, depth, sinuosity, connectedness to a floodplain) or channel structures (e.g. large woody debris, pools, riffles) that will in turn enable the stream to move sediment, adjust to changes in flow, store water in streambanks and floodplains and support fish, wildlife and invertebrates is recommended in this section.

Principal locations that were identified as good candidates for instream restoration are the El Porvenir Christian Camp (an in-holding) and the EV Long Campground. It is expected that a minimum of two other locations along Gallinas Creek and near day use areas would benefit from instream restoration and fish habitat enhancement projects. Streams needing such restoration are often those affected by upstream or adjacent infrastructure like roads, bridges or irrigation diversions. Stream channel restoration often involves the use of heavy equipment and importing logs, boulders or rocks so the location may require accessibility by a road. Typically, instream restoration work needs a permit from the U.S. Army Corps of Engineers required under section 404 of the Clean Water Act. Below describes the recommended Restoration Measures for Stream Channel Enhancement and Fish Habitat Enhancement.

- ◆ Restore appropriate stream geomorphology in degraded areas. Entrenched channels may be elevated with installation of grade control structures made of logs or boulder and related reshaping of the streambanks. Over widened channels can be restored to an appropriate width with instream structures or channel and streambank shaping. Instream structures (e.g. large woody debris, pools and riffles) can be added or recreated with boulders or logs and channel reshaping to restore structural diversity. Restoring stream geomorphology must be designed and constructed by a stream restoration expert.

While no detailed design work of fish habitat enhancement has occurred in or near EV Long Campground, this has been done at and near Porvenir Campground. Watershed Artisans, LLC (river restoration specialist) examined the Porvenir Campground and upstream to the Wilderness boundary looking for good instream restoration opportunities. It was determined that no good opportunities existed in the short stretch of stream in the Campground. Part of the reason for that was the construction of the main bridge over Porvenir Creek that leads to

the Campground. This bridge has affected the channel configuration and sediment dynamics below the bridge and through the Campground. It was the professional judgment of Watershed Artisans that without redesign and reconstruction of that bridge, work downstream would not be lasting.

A detailed design for fish habitat enhancement and instream restoration was, however, completed for the downstream most 1,750' of Porvenir Cr. on El Porvenir Christian Camp property, an in-holding immediately upstream of the Porvenir Campground (see Figure 3). Restoration objectives for this reach are to: stabilize the channel bed, increase bedform complexity, increase dissolved oxygen and aeration, narrow baseflow channel and increase low flow sinuosity and increase the number and depth of pools. This will be accomplished by constructing a series of 18 boulder and log step pools. The design is permit and construction ready.

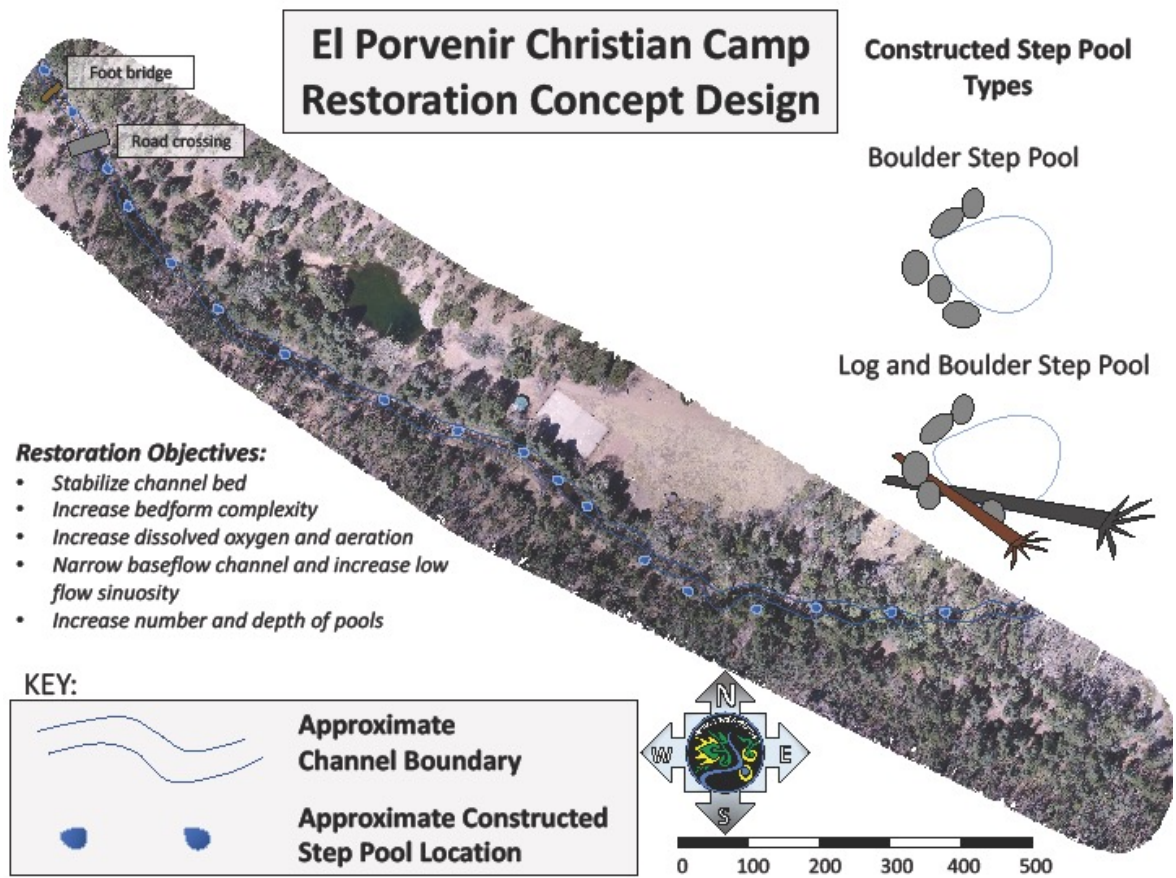
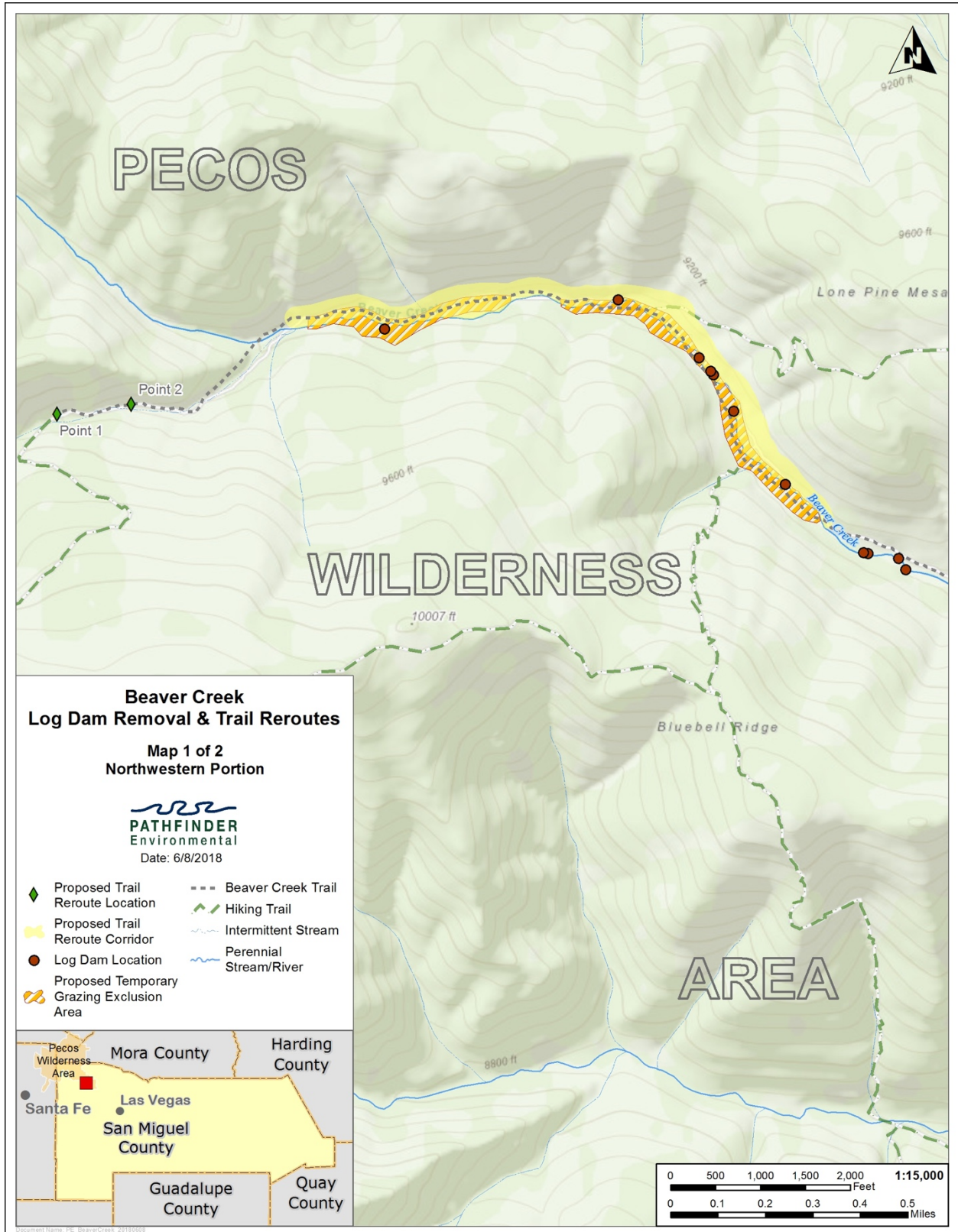


Figure 3 - Instream restoration conceptual design for Porvenir Creek on El Porvenir Christian Camp property

- ◆ Remove or repair man-made log dams in locations where they are causing streambank erosion, an over widened channel or sequestration of fine sediments. Some man-made log dams installed in the 1960's and 70's have caused degradation of stream channel morphology (e.g. channel widening) and sediment distribution and have not accomplished their intended purpose, namely fish habitat enhancement. Appendix B provides a data collection form to facilitate identifying locations with these problems.

Eleven log dams in Beaver Creek were deemed important to repair or remove (see Map 5). Because these log dams are of historical significance, the USFS preferred to repair rather than remove them. Specific repair work has been determined and NEPA has been completed so these 11 log dams are ready for repair. Further assessment of log dams in the Gallinas Creek is needed to determine remediation plans there.





Map 5 - Recommended trail reroutes, log-dam repairs, riparian planting and closures on Beaver Creek.

## Riparian Planting

Replanting riparian vegetation is likely needed in conjunction with other restoration work or in degraded areas that have not been able to revegetate on their own. Healthy riparian vegetation is also needed to help protect the investments made by instream and other restoration.

Plant appropriate riparian vegetation in areas where it has been compromised and it can be supported with sufficient and not excessive moisture (see Map 5 for recommended locations). Emphasize woody vegetation that offers tall shade using species like: narrowleaf cottonwood, thinleaf alder, red osier dogwood, quaking aspen and a number of willows – bluestem, peachleaf, Bebb's, Scouler's and diamondleaf. Willow whips and cottonwood poles can be harvested from nearby areas with abundant riparian vegetation. Consult the NM State Forestry Conservation Seedling Program for commercially available vegetation and consult with knowledgeable people on planting techniques.

In areas where heavy livestock or deer and elk use of newly planted riparian is expected or areas that are particularly vulnerable to trampling, construct fenced exclosures to protect young vegetation. When woody vegetation is well established (3-10 years) the fences should be removed (see **Error! Reference source not found.** for recommended locations).

## Native Cutthroat Trout Reintroduction

While it is believed that native cutthroat trout no longer exist in much of the upper Gallinas River and Porvenir Creek, some possibility of their occurrence in the upper reaches of Gallinas Creek (upstream of the end of FR 263 and along trail #216) still exists and is rumored. For that reason fisherman were asked in the Public Opinion Survey if they would support the study and potential reintroduction of native cutthroat trout into suitable habitat areas of the headwater reaches. Support for this endeavor was strong (81% of respondents) so this pursuit would likely acquire public support. A Restoration Measure for this is:

- ◆ Investigate the practicality, current habitat suitability and logistics of a cutthroat trout reintroduction or population augmentation effort in both the upper reaches of Gallinas Creek and Beaver Creek.

## Beaver Reintroduction

Beaver contribute significantly to watershed health in many ways. Their dams slow water and create wetlands. These wetlands offer water storage in self sustaining reservoirs that also offer extremely productive fish and wildlife habitat. They are particularly important during floods (capture and store flood waters reducing downstream damages) and slowly release that water to maintain stream flow, especially during dry times. Beaver wetlands purify water and sequester large amounts of carbon, helping to mediate climate change. Furthermore, beavers work for free and are self sustaining when allowed to do their work.

The reintroduction of beaver into their former range in both Gallinas Creek and Porvenir/Beaver Creek drainages may offer the most practical, effective and least expensive means of doing watershed wide restoration in valley bottoms. Beaver most likely inhabited much if not all of the perennial streams in the Upper Gallinas Watershed. They now only occur in isolated areas where landowners have permitted

them to persist. No active beaver sign was found in either drainage on National Forest lands. While the exact cause of their elimination is unknown, it is suspected to be a combination of intentional removal by individuals that have had a real or perceived conflict with beavers and habitat degradation of stream and riparian areas by infrastructure or historical excessive livestock grazing. Historical occurrence of beavers along Porvenir and Beaver Creek has been noted by a number of locals and a few isolated yet old beaver cuttings were observed.

National Forest lands offer excellent opportunities to support healthy beaver populations with fewer conflicts than private lands. For all these reasons and to help maintain watershed health high in the watershed, beaver reintroduction into suitable areas is heartily recommended. Below are specific measures needed to continue to pursue this possibility.

- ◆ Assist NM Department of Game and Fish with habitat suitability evaluations in both Beaver Creek and headwaters of Gallinas Creek areas.
- ◆ Together with NM Department of Game and Fish, identify and implement specific beaver habitat enhancement efforts (type and location) that would increase beaver long-term success in National Forest areas.
  - ◆ Identify areas where riparian vegetation should be planted and planting techniques to improve survivability (e.g. temporary exclosures).
  - ◆ Install beaver analogs to facilitate beaver reestablishment.
- ◆ Assist NM Department of Game and Fish with research and arrangements related to beaver relocation logistics.
- ◆ Produce and distribute educational information on the value of beaver and techniques for coexisting with beaver to both public and private landowners and managers. Provide this information to Gallinas area residents prior to beaver reintroduction.

Based on Stream Walkthrough observations, it appears that suitable beaver habitat still exists in the Wilderness areas of Beaver Creek and selected areas of the upper reaches of Gallinas Creek. During the development of this addendum preliminary discussions regarding a reintroduction occurred with Forest Service and NM Game and Fish Department staff. Forest Service personnel were conceptually supportive but passed on all responsibility of investigation and pursuit of any beaver relocation to NM Game and Fish. NM Game and Fish is currently in the process of doing habitat suitability evaluations and investigating the feasibility of such a remote relocation effort.

## Conservation, Planning and Regulatory Measures

Efforts needed to support on-the-ground work to manage and restore watershed health to National Forest lands in the Upper Gallinas Watershed involves using conservation programs, incorporating watershed health in planning efforts and complying with regulatory requirements are covered here.

### Conservation

Since National Forest lands already receive conservation protection, especially areas in the Pecos Wilderness, no additional protections appear needed at this time. However, participating in conservation planning efforts like those involving identifying special areas (e.g. Wetland Gems, Important Bird Areas) that warrant unique attention is a worthwhile endeavor.

In order to help provide the resources and long-term protection of special areas in the Upper Gallinas Watershed to complement work on the National Forest, Conservation Easements on private lands should be pursued.

### Planning and Collaboration

The following gaps in information or topics that were not covered in sufficient detail during the development of this National Forest lands addendum provides a list of future planning, assessment and implementation efforts that HPWA and the USFS could work on together or find other collaborators.

- ◆ Reassess stream and watershed conditions in areas that were thinned after our 2016 assessment. Recommend any follow up Management and Restoration Measures that may have surfaced as a result of that thinning. These areas are primarily along the Gallinas River between EV Long Campground and Evergreen Valley.
- ◆ Pursue funding and implementation of a detailed assessment of roads and bridges as they relate to stream and watershed health issues and recommend needed remediation.
- ◆ Pursue funding and implementation of a detailed assessment of recreation areas (campgrounds and day use areas) as they relate to stream and watershed health issues and recommend needed remediation.
- ◆ Organize volunteer or YCC efforts to develop a more extensive catalog of noxious/invasive plants and develop efforts to do hand or mechanical removal.
- ◆ Together with grazing lessee, conduct a more in depth assessment of the effects of grazing on riparian habitat condition, streambank erosion and stream width. Then together with the lessee, develop remediation to improve conditions.

### Regulations and Guidelines

Regulatory measures needed to implement this Addendum on National Forest lands include:

- ◆ Finalize NEPA review for Porvenir/Beaver Creek projects. This is currently underway.
- ◆ Conduct NEPA review for recommended projects on Gallinas Creek.

### Education and Outreach Measures

Without continual education and outreach the management, restoration, conservation programs, planning efforts, and regulatory measures recommended in this document are not likely to be sustainable. Continual public support is needed for those measures to be effectively implemented and supported. Education and Outreach Measures need to be diverse to reach a diverse public. They need to offer information on the facts of land and water health but also help support values that compel action and an understanding of why watersheds are important to all of us. Below are suggestions for Education and Outreach Measures that are specific to National Forest lands that must accompany on-the-ground work.

Eighteen percent of people surveyed (see



Appendix A: Public Opinion Survey) responded that they would like to see more educational information in public use areas of the National Forest and 11% specifically suggested more interpretive signs. Educational information and interpretive signs explaining local natural history (e.g. plants and animals in the National Forest), information about watershed health (e.g. what are indicators of a healthy/unhealthy watershed), public stewardship recommendations (e.g. leave dead wood on the land and in the stream, do not cut riparian vegetation), and current forest management activities (e.g. thinning and prescribed fire) would help connect the public to National Forest lands and encourage stewardship. Providing digital information may be more cost effective than paper formats. However, interpretive signs in campgrounds and other public areas would offer direct and immediate information for users.

- ◆ Develop educational materials in digital format and publish in a variety of websites (e.g. USFS, HPWA, San Miguel County, etc.). See below topics suggestions.
- ◆ Develop and install interpretive signs in campgrounds and major public use areas about watershed health and responsible use of public lands.
- ◆ Produce and distribute educational information on watershed functions, attributes of healthy watersheds and indicators of unhealthy conditions.
- ◆ Develop an application for Smart Phones and personal computers that contain an interpretive Tour of the Gallinas Watershed from the headwaters to where the water gets used. This app. can offer site specific information on important watershed elements and special areas, telling the story of how water travels through the landscape.
- ◆ Provide educational materials to local area schools.
- ◆ Maintain a social media presence about happenings in the National Forest.

Education topics for the above media might include:

- ◆ The importance and needs of beaver and techniques for coexisting with beaver to both public and private landowners and managers. Provide this information to Gallinas area residents prior to beaver reintroduction.
- ◆ Soil health and its relation to watershed health.
- ◆ The importance of riparian vegetation.
- ◆ The value and management of riparian areas and wetlands.
- ◆ How does a watershed function and how to keep it healthy.
- ◆ Managing your Land for Watershed Health and Water Quality.
- ◆ Livestock management for watershed health.
- ◆ Erosion control techniques
- ◆ River and wetland restoration techniques

## **MANAGEMENT AND RESTORATION MEASURE PRIORITIES AND ASSOCIATED LOAD REDUCTIONS**

In the initial planning grant to write the *Watershed Based Plan for the Upper Gallinas River*, National Forest lands were not included in stream shade measurements (in the field or dot grid analysis). Furthermore, the field assessment work for this National Forest Addendum consisted of studies to identify degraded areas needing remediation, not to specifically study shade conditions since reaches in

the National Forest are not temperature impaired so the assumption was made that they met canopy cover requirements. Because of this, there is no baseline data for stream shade for the National Forest upon which to base load calculations.

The first action to take place would be to do a dot grid analysis and take canopy cover measurements in the field. This would be completed during Implementation-On-The- Ground Improvement Projects Phase III for the Upper Gallinas River.

Once baseline data is analyzed, priority areas will be identified and load reductions can be calculated based on methods set forth in the UWBPGR. See the WBPUGR for methodology related to calculating load reductions (HPWA, 2012).

Potential projects have been identified that will fulfill the following Management and Restoration Measures and can potentially result in load reductions:

- ◆ Reduce Width to Depth Ratio,
- ◆ Reduce Beaver/Human Conflicts,
- ◆ Remove old ineffective stream structures,
- ◆ Manage Recreation Use,
- ◆ Plant Riparian Vegetation.

## IMPLEMENTATION SCHEDULE

Table 5 lays out a 6 year effort, split into two phases, to accomplish the work recommended in this WBP National Forest addendum.

**Table 5 - Implementation schedule of Management and Restoration Measures, Conservation, Planning and Regulatory Measures, and Education and Outreach Measures – two phases of implementation with each phase being 3 years**

DESCRIPTION	NUMBER OF years <sup>1</sup> / projects <sup>2</sup> /miles <sup>3</sup>	Phase I (approx. 2019 – 2021 contingent on funding)	Phase II (approx. 2022 – 2024 contingent on funding)
<b>Project Implementation</b>			
<b>Management Measures</b>			
1. Recreational Use Mgmt. - Trails			
a. Gallinas Trail #216	4 <sup>3</sup>		4 <sup>3</sup>
b. Porvenir/Beaver Cr. Trail #247	10 <sup>3</sup>	10 <sup>3</sup>	
2. Livestock Mgmt. (Gallinas Cr., Porvenir Cr.)	2 <sup>2</sup>	1 <sup>2</sup>	1 <sup>2</sup>
3. Noxious/Invasive Weed Mgmt.	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>
4. Beaver Management	6 <sup>2</sup>	3 <sup>2</sup>	3 <sup>2</sup>
<b>Restoration Measures</b>			

DESCRIPTION	NUMBER OF years <sup>1</sup> / projects <sup>2</sup> /miles <sup>3</sup>	Phase I (approx. 2019 – 2021 contingent on funding)	Phase II (approx. 2022 – 2024 contingent on funding)
1. Stream Channel Restoration - Fish Habitat Enhancement (Porvenir Phase I, Gallinas Phase II)	2 <sup>2</sup>	1 <sup>2</sup>	1 <sup>2</sup>
2. Stream Channel Restoration – restoration of channel geomorphology	4 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>
3. Stream Channel Restoration – log dam removal/repair (Porvenir Phase I, Gallinas Phase II)	2 <sup>2</sup>	1 <sup>2</sup>	1 <sup>2</sup>
4. Riparian Planting	8 <sup>3</sup>	4 <sup>3</sup>	4 <sup>3</sup>
5. Beaver Reintroduction (Beaver Cr. Phase I, Gallinas Cr. Phase II)	2 <sup>2</sup>	1 <sup>2</sup>	1 <sup>2</sup>
<b>Conservation Programs, Planning and Regulatory Measures</b>			
1. Planning - Intensively Used Recreation Areas – Assessment	1 <sup>2</sup>		1 <sup>2</sup>
2. Planning – Road and Bridge Assessment	1 <sup>2</sup>		1 <sup>2</sup>
3. Planning - Noxious Weed Inventory	1 <sup>2</sup>	1 <sup>2</sup>	
4. Planning – Grazing Assessment	1 <sup>2</sup>	1 <sup>2</sup>	
5. Regulatory - NEPA	3 <sup>2</sup>	1 <sup>2</sup>	2 <sup>2</sup>
<b>Education and Outreach</b>			
Develop educational materials in digital format and publish in a variety of websites (e.g. USFS, HPWA, San Miguel County, etc.).	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>
Develop and install interpretive signs in campgrounds and major public use areas about watershed health and responsible use of public lands.	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>
Produce and distribute educational information on watershed functions, attributes of healthy watersheds and indicators of unhealthy conditions.	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>
Develop an application for Smart Phones and personal computers that contain an interpretive Tour of the Gallinas Watershed from the headwaters to where the water gets used.	3 <sup>1</sup>	3 <sup>1</sup>	
Provide educational materials to local area schools.	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>
Maintain a social media presence about happenings in the National Forest.	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>

DESCRIPTION	NUMBER OF years <sup>1</sup> / projects <sup>2</sup> /miles <sup>3</sup>	Phase I (approx. 2019 – 2021 contingent on funding)	Phase II (approx. 2022 – 2024 contingent on funding)
<b>Monitoring</b>	6 <sup>1</sup>	3 <sup>1</sup>	3 <sup>1</sup>

## TECHNICAL AND FINANCIAL ASSISTANCE NEEDED

Table 6 provides an anticipated budget for work recommended in this plan. Table 7 offers possible funding sources that might help fund projects recommended here. And Table 8 identifies technical assistance available from collaborators and other experts that are needed to realize this plan.

Table 6 - Financial resources needed to support recommended Management and Restoration Measures and Education and Outreach activities

DESCRIPTION	NUMBER OF years <sup>1</sup> / projects <sup>2</sup> /miles <sup>3</sup>	COST PER year <sup>1</sup> / project <sup>2</sup> / mile <sup>3</sup>	TOTAL COST
<b>Project Management</b>			
Personnel	6 <sup>1</sup>	\$50,000 <sup>1</sup>	\$300,000
Supplies	6 <sup>1</sup>	\$3,000 <sup>1</sup>	\$18,000
Equipment	6 <sup>1</sup>	\$1,000 <sup>1</sup>	\$6,000
Travel	6 <sup>1</sup>	\$1,000 <sup>1</sup>	\$6,000
<b>Subtotal</b>			<b>\$330,000</b>
<b>Project Implementation</b>			
<b>Management Measures</b>			
1. Recreational Use Management - Trails			
a. Gallinas Trail #216	4 <sup>3</sup>	\$10,000 <sup>3</sup>	\$40,000
b. Porvenir/Beaver Cr. Trail #247	10 <sup>3</sup>	\$10,000 <sup>3</sup>	\$100,000
2. Livestock Management (Gallinas Cr., Porvenir Cr.)	2 <sup>2</sup>	\$25,000 <sup>2</sup>	\$50,000
3. Noxious/Invasive Weed Management	6 <sup>1</sup>	\$5,000 <sup>1</sup>	\$30,000
4. Beaver Management	6 <sup>2</sup>	\$10,000 <sup>2</sup>	\$60,000
<b>Restoration Measures</b>			
1. Stream Channel Restoration – fish habitat enhancement	2 <sup>2</sup>	\$50,000 <sup>2</sup>	\$100,000
2. Stream Channel Restoration – restoration of channel geomorphology	4 <sup>2</sup>	\$50,000 <sup>2</sup>	\$200,000

DESCRIPTION	NUMBER OF years <sup>1</sup> / projects <sup>2</sup> /miles <sup>3</sup>	COST PER year <sup>1</sup> / project <sup>2</sup> / mile <sup>3</sup>	TOTAL COST
3. Stream Channel Restoration – log dam removal/repair	2 <sup>2</sup>	\$26,000 <sup>2</sup>	\$52,000
4. Riparian Planting	8 <sup>3</sup>	\$2,000 <sup>3</sup>	\$16,000
5. Beaver Reintroduction (1 Beaver Cr., 1 Gallinas Cr.)	2 <sup>2</sup>	\$25,000 <sup>2</sup>	\$50,000
<b>Subtotal</b>			<b>\$698,000</b>
<b>Conservation Programs, Planning and Regulatory Measures</b>			
1. Planning - Intensively Used Recreation Areas – Assessment	1 <sup>2</sup>	\$200,000 <sup>2</sup>	\$200,000
2. Planning – Road and Bridge Assessment	1 <sup>2</sup>	\$300,000 <sup>2</sup>	\$300,000
3. Planning - Noxious Weed Inventory	1 <sup>2</sup>	\$10,000 <sup>2</sup>	\$10,000
4. Planning – Grazing Assessment	1 <sup>2</sup>	\$20,000 <sup>2</sup>	\$20,000
5. Regulatory - NEPA	3 <sup>2</sup>	\$35,000 <sup>2</sup>	\$105,000
<b>Subtotal</b>			<b>\$635,000</b>
<b>Education and Outreach</b>			
Education Staff (500 hrs/yr)	6 <sup>1</sup>	25,000 <sup>1</sup>	150,000
Specialist Contractors	6 <sup>1</sup>	3,000 <sup>1</sup>	18,000
Supplies (includes advertising)	6 <sup>1</sup>	1,000 <sup>1</sup>	6,000
Tools & equipment (includes 8 interpretive signs\$2,500/sign)	6 <sup>1</sup>	4,000 <sup>1</sup>	24,000
<b>Subtotal</b>			<b>\$198,000</b>
<b>Monitoring</b>			
Personnel (Coordination listed w/ Project Management)	6 <sup>1</sup>	\$4,000 <sup>1</sup>	\$24,000
Travel, Perdiem	6 <sup>1</sup>	\$2,000 <sup>1</sup>	\$12,000
Supplies and Equipment	6 <sup>1</sup>	\$1,000 <sup>1</sup>	\$6,000
<b>Subtotal</b>			<b>\$42,000</b>
<b>TOTAL</b>	<b>6<sup>1</sup></b>	<b>\$317,167</b>	<b>\$1,903,000</b>

Table 7 - Potential funding sources for implementation.

<b>FUNDING ORGANIZATION</b>	<b>FUNDING PROGRAM</b>	<b>ELIGIBLE ENTITIES</b>	<b>TYPES OF APPLICABLE PROJECTS AND NOTES</b>
NM Environment Department	Clean Water Act 319 On-the-Ground Improvements	citizen watershed groups, non-profit organizations, for-profit organizations, individuals and federal, state and local agencies (including those of Indian Nations, Pueblos and Tribes)	Projects identified in applicable Watershed Based Plans.
NM Environment Department	Watershed Based Plans	citizen watershed groups, non-profit organizations, for-profit organizations, individuals and federal, state and local agencies (including those of Indian Nations, Pueblos and Tribes)	New or updates to existing Watershed Based Plans
NM Environment Department	River Stewardship Program	towns, cities, counties, soil and water conservation districts, irrigation districts, for-profit and not-for-profit organizations, and Indian Nations, Pueblos and Tribes	For the restoration of rivers and streams statewide, including clearing vegetation, lowering river bank lines, replanting native species vegetation and installing erosion control measures. Types of priority projects vary but water quality improvements related to past fires or urban water quality have been past priorities.
USEPA	Wetlands Grants CWA Section 106		Wetland creation and restoration
USFWS	Partners for Fish & Wildlife	Private Landowners	Technical and financial assistance to private landowners with a desire to improve fish and wildlife habitat on their property.
USFWS	North American Wetlands Conservation Act (NAWCA) Standard grants	Public-Private Partnerships	Matching grants to increase bird populations and wetland habitat.
USFWS	North American	Organizations and	Matching grants to carry

FUNDING ORGANIZATION	FUNDING PROGRAM	ELIGIBLE ENTITIES	TYPES OF APPLICABLE PROJECTS AND NOTES
	Wetlands Conservation Act (NAWCA) Small grants	partnerships	out wetland conservation projects that involve long-term protection, restoration, enhancement of wetland habitat for the benefit of wetlands associated migratory birds. Grants cannot exceed \$75,000.
USDA, NRCS	Environmental Quality Incentives Program, Wildlife Habitat Incentives Program, Agricultural Management Assistance, Conservation Reserve Program, Water Bank Program, Regional Conservation Partnership Program	Private agricultural producers	Farm Bill funded programs for a variety of agricultural related improvements that also benefit watersheds.
US Bureau of Reclamation	Various water related grants		Operating support, water infrastructure, educational
Tierra y Montes SWCD		Private Landowners	Erosion control, river and wetland restoration, riparian planting
NM Finance Authority, Water Trust Board	Water Project Fund	1. State agencies; 2. Intercommunity water or natural gas supply associations 3. Recognized Indian nations, tribes or pueblos, and 4. political subdivisions a) municipalities; b) counties; c) land grant-mercedes; d) regional or local public water utility authorities created by statute; e) irrigation districts; f) conservancy districts; g) special districts; h) acequias; i) soil and water conservation	Water conservation or recycling, treatment or water reuse projects; Flood prevention projects; Endangered species act (ESA) collaborative projects; Water storage, conveyance or delivery projects; Watershed restoration and management projects.

FUNDING ORGANIZATION	FUNDING PROGRAM	ELIGIBLE ENTITIES	TYPES OF APPLICABLE PROJECTS AND NOTES
		districts; j) water and sanitation districts; and k) associations organized and existing pursuant to the Sanitary Projects Act	
NM Game & Fish	Habitat Stamp Program	Habitat Stamp funds available for federal lands managed by BLM or USFS	Wildlife habitat improvement projects.
NM Game & Fish	Share with Wildlife	Non-profit, for-profit, other organizations and individuals	Research, public education, habitat protection <b>and</b> wildlife rehabilitation.
San Miguel County	General Funds		Road assessment, road drainage improvements
Private conservation organizations: Ducks Unlimited, National Fish and Wildlife Foundation, Turkey Federation, Quivira Coalition, Trout Unlimited, McCune, Santa Fe Community Foundation, etc.	Various	Non-profit, for-profit, other organizations, various requirements	Education Efforts, conservation, Operating support

Table 8 - Technical assistance available from collaborating organizations and individuals.

TASK	COLLABORATOR
General volunteer assistance	Albuquerque Wildlife Federation, Rocky Mountain Youth Core, Hispanics Enjoying Camping, Hiking and Outdoors
Specialist Instructors for education programs	Tierra y Montes Soil and Water Conservation District NM Highlands University Professors Craig Sponholtz Bill Zeedyk Kirk Gadzia Steve Carson Quivira Coalition
Contractor experts	Watershed Artisans Rangeland Hands Pathfinder Environmental Reineke Construction Zeedyk Ecological Consulting



TASK	COLLABORATOR
	Tierra y Montes Soil and Water Conservation
Livestock management consultants	Quivira Coalition, Michael Bain, Kirk Gadzia
Structures and consultation to reduce beaver/human conflicts	David Blagg, Steve Reichert
NEPA Requirements	US Forest Service
404 permits	Army Corps of Engineers
Floodplain Ordinances	San Miguel County – Land Development Specialist & Floodplain Coordinator
Road related guidelines	San Miguel County Road Department
Subdivision and related development Ordinances	San Miguel County – Land Development Specialist
Monitoring assistance	NMHU, ARMAS internships
Education Programs in schools	NMHU, UWC, WLV Schools, LV City Schools

## MEASURABLE MILESTONES OF IMPLEMENTATION

### Quantitative Measurable Milestones

- Assessment of Standards Attainment** – Project specific and watershed wide monitoring will be regularly done (see Monitoring section) to determine progress toward meeting load reduction targets. Those data will be analyzed at the end of each project phase (approximately in 2021, 2024) in order to assess progress toward Standards Attainment.
- Length of Stream or the Number of Projects Completed** – The length of stream or the number of on-the-ground projects completed in each project category (e.g. riparian vegetation planting, stream channel enhancements) will be compared with target numbers. Actual stream shade (measured with percent canopy) increases will also be compared to targets. This evaluation will occur at the end of each project phase (approximately in 2021, 2024). Table 5 provides the target stream lengths or the number of projects to be conducted in each phase. Stream shade targets will be determined with stream shade sampling and analysis during Phase I (ending in 2021) since it was not conducted during this National Forest Addendum.
- Number of Conservation Programs/Planning/ Regulatory Efforts** – The number of facilitated pursuits of Conservation Programs and progress on planning or regulatory input will be tracked and evaluated relative to targets at the end of each project phase (approximately in 2021, 2024). See Table 5 for targets.
- Number of Education Efforts** – At the end of each phase (approximately in 2021, 2024), the number of education efforts undertaken and/or accomplished to include: landowner consultations, educational materials, workshops, training, presentations. See Table 5 for targets.

Modifications to targets and necessary adaptive management will be based on quantitative assessments of effectiveness and will occur as needed.

## Qualitative Measureable Milestones

- **General Effectiveness** – To accompany the quantitative tracking, a narrative evaluation of project successes will occur. This evaluation will occur at the completion of each Phase and will be incorporated into final reports to granting agencies. It should include: effective techniques for obtaining agreements to do projects, description of effective management and restoration efforts in terms of correcting degraded conditions, practicality of implementing the various planned activities, and evaluations from landowners, land managers or other participants in our programs. General Effectiveness milestones include:
  - Landowners/land managers are willing to embark on improved management and restoration projects.
  - Projects selected are appropriate for the landowner/land manager and locations and are technically and financially feasible.
  - Projects can be maintained by landowners/land managers in the future.
- **General Conflicts/Issues** – A narrative evaluation of conflicts and issues that have arisen preventing progress toward meeting goals. Descriptions of adaptive management measures undertaken or planned should be included.

In the event that this WBP addendum and the original WBPUGR is fully implemented and the TMDL shade targets and temperature standards still exceed water quality standards, HPWA may need to reevaluate the TMDL and surface groundwater interaction. If measureable milestones are not being attained, HPWA will reevaluate flow, width to depth and finally may need to reevaluate use attainability standards.

## CRITERIA FOR EVALUATING LOAD REDUCTION ACHIEVEMENTS

NMED/EPA standards for desirable temperature conditions will be used as a basis for evaluating load reductions. Stream temperatures in the Gallinas River should not exceed 68 F (or 20 C). Additionally, canopy cover should reach at least 61.5 percent to support temperature standards. If this plan has been implemented and the Gallinas River (Las Vegas diversion to headwaters) and Porvenir Creek are found to meet their water quality standards for temperature, then the plan will have accomplished its goals. Assessment of standards attainment initially took place during development of the WBPUGR ( HPWA, 2012), then again after the first phase of implementation in 2014 (HPWA, 2014) and after the second phase of implementation in 2018 (HPWA, 2018). It is expected to be reevaluated at the end of the third implementation phase (approximately in 2021) and after implementation is complete. The assessment of standards attainment are some of the measureable milestones listed in the above section.

If in 2021 (or when the final phase is complete) this plan has been implemented in full and the Gallinas River does not meet its water quality standards for temperature and effectiveness monitoring data show less improvement in water quality than expected given the level of effort of implementation, or if there is no significant improvement in water quality, then this plan will be modified using expert guidance and new management measures yet to be determined. Conversely, if the Gallinas River is found to meet temperature standards in 2021 or when implementation is complete, this plan will be modified to focus on protecting water quality. However, unless this plan is revised under one of the circumstances above,

this plan will be considered valid for the reach of the upper Gallinas River (AU NM-2212\_00). This statement applies as long as a recognized temperature impairment and temperature TMDL are in effect.

## MONITORING PROGRAM

A monitoring program will be instated to evaluate the effectiveness of the implementation efforts based on the criteria outlined in the above section (see Table 9). Continuous stream temperature monitoring will occur every year during summer months throughout all years covered in this plan. Sampling locations will include the 12 baseline sites and additional sites as necessary. At the end of each Phase, a repeat of field measured stream shade and width/depth on 50 random sites will occur watershed wide these random sites will include National Forest lands. Air photo interpretation of stream shade will occur once per Phase if new air photos become available. Effectiveness monitoring of each project site will include field stream shade, width/depth, and Physical Habitat Measurement at each project site before treatment. After treatment, field stream shade, width/depth and Physical Habitat Measurement monitoring will occur at each project site in the final year of each Phase.

At the end of each Phase (approximately 2021, 2024), an assessment of the monitoring data will occur in order to determine whether progress is being made in reducing load. The monitoring will be completed under a new approved Quality Assurance Project Plan (QAPP) which will be written and submitted to EPA at the beginning of each Phase of implementation. Reporting of monitoring progress and methodology will be conducted through standard NMED quarterly reports.

The above targeted monitoring will be completed in order to assess standards attainment, however, other monitoring efforts will also take place to look at the general watershed condition and identify any other areas (besides stream temperature) that may be of concern.

Table 9 - Effectiveness Monitoring Schedule

PHASE OF IMPLEMENTATION	YEAR	MONITORING EFFORT	SAMPLING SITES
Phase I	2019	Write, submit and get approval for monitoring QAPP	
		Stream temperature (continuous May-Sept)	12 (baseline sites). Will identify additional sites in National Forest.
		Field Stream Shade‡ (summer) Pre-treatment	Sites at location of stream shade implementation projects
		Width to Depth† (summer) Pre-treatment	Sites at location of width to depth implementation projects
		Physical Habitat Measurements (NMED SWQB SOP 5.0) Pre-treatment and Post- treatment	Sites at location of river restoration implementation projects
	2020	Stream temperature (continuous May-Sept)	12 (baseline sites), including new sites on National Forest property.
		Field Stream Shade‡ (summer)	Sites at location of stream shade

PHASE OF IMPLEMENTATION	YEAR	MONITORING EFFORT	SAMPLING SITES
		Pre-treatment	implementation projects
		Width to Depth† (summer) Pre-treatment	Sites at location of width to depth implementation projects
		(Physical Habitat Measurements (NMED SWQB SOP 5.0) Pre-treatment and Post- treatment	Sites at location of river restoration implementation projects
		Air Photo Interpretation Stream Shade*	75 ft sampling density along entire length of river.
		Field Stream Shade & Width/Depth	Random sampling of 50 transects throughout watershed, including National Forest property.
		Phase 1 Assessment of Standards Attainment	Review of all monitoring data
	2021	Phase 1 Assessment of Standards Attainment.	
Phase II	2022	Write, submit and get approval for monitoring QAPP	
		Stream temperature (continuous May-Sept)	12 (baseline sites), including new sites on National Forest property.
		Field Stream Shade‡ (summer) Pre-treatment	Sites at location of stream shade implementation projects
		Width to Depth† (summer) Pre-treatment	Sites at location of width to depth implementation projects
		Physical Habitat Measurements (NMED SWQB SOP 5.0) Pre-treatment and Post- treatment	Sites at location of river restoration implementation projects
	2023	Stream temperature (continuous May-Sept)	12 (baseline sites), including new sites on National Forest property.
		Field Stream Shade‡ (summer) Pre-treatment	Sites at location of stream shade implementation projects
		Width to Depth† (summer) Pre-treatment	Sites at location of width to depth implementation projects
		Physical Habitat Measurements (NMED SWQB SOP 5.0) Pre-treatment and Post- treatment	Sites at location of river restoration implementation projects
	2024	Phase 2 Assessment of Standards Attainment	Review of all monitoring data

\*or when data becomes available

‡ will be collected at least once a year, prior to or after a project has been implemented

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## Appendix A: Public Opinion Survey

### Public Opinion Survey of the Upper Gallinas Watershed in the Las Vegas District of the Santa Fe National Forest Results Summary

1. *How do you use this local area of the National Forest? [be specific please - examples: hunting, fishing, hiking, camping, picnicking, nature appreciation, backpacking, livestock grazing, timber or firewood harvesting, gathering medicinal, edible or ornamental plants, cross country skiing or other winter activities]*

67 responses. Most common responses were: hiking (22%), camping (15%), fishing (15%), picnicking (13%), nature appreciation (10%), hunting (5%), firewood harvesting (4%), cross country skiing (2%), and gathering edible, ornamental or medicinal plants (2%). Other responses with 1% or less included backpacking, biking, sightseeing, summer cabin, rock hounding, 4x4 in winter snow, arrowhead hunting, bigfoot hunting, birdwatching, household water (Las Vegas resident), plant and animal identification, playing in snow, general recreation, horseback riding, shed hunting, snowshoeing, swimming and trapping.

2. *Are you a:*  *Local Resident*  *Part-time Resident*  *Visitor*

67 responses. Local residents 70%, part-time residents 8%, Visitors 22%.

3. *How often do you use this local area of the National Forest?*

67 responses. Most common visits to the National Forest were: 2-4 times per year (24%), 12 times per year (16%), every two weeks (13%), 1-2 times per year (12%), once a week (6%), once a year (6%), first time visitor (6%), 4-6 times per year (6%). Other less common responses included: “every day”, “less than once per year”, and “frequently”.

4. *What problems have you observed with the health of the land? [examples – streambank erosion, bare ground, degraded vegetation, noxious weeds, degraded wetlands, excessive sedimentation in stream water, loss of fish and/or wildlife populations, warm stream water]*

55 responses. Common responses included: loss of fish and wildlife (11%), streambank erosion (9%), trash (7%), impacts from flood (7%), noxious weeds (5%), excess sediment in stream (4%), no problems noticed (4%), forest thinning needed (3%), bare ground (3%), and reduced stream flow (3%). Other less common responses included: “algae in stream”, “beaver dams in the way”, “poison ivy in El Porvenir campground”, and a variety of concerns about forest health (“serious excess numbers of small trees”, “too much slag left behind from thinning”, “sick trees”, “dead spruce and fir on hillsides”).

5. *What problems have you observed with the way people use the land or in the condition of public use areas? [examples – ORVs in streams or other sensitive areas, causing erosion or bare ground with overuse, trash, water pollution, excessive harvest or degradation of vegetation or fish and wildlife, degraded vegetation from livestock]*

54 responses. Common responses included: Trash (44%), ORV use (7%), water pollution (6%), no problems noticed (6%), people cutting switchbacks on trails (3%), and overgrazing/livestock related problems (3%). Less common responses included: “structures and roads too close to river”, “general carelessness for the land”, “excess fishing line”, “traffic use and heavy trucks” and “people seem to not be educated in protecting the land and water”.

6. *What improvements would you like to see that would increase the health of the land? [examples – plant vegetation, protect ecologically important areas like wetlands, heal erosion, provide better livestock watering away from streams, improve fish habitat, improve wildlife habitat]*

58 responses. Common responses included: improve fish habitat (15%), protect ecologically important areas such as wetlands (8%), forest thinning (8%), improve fish and wildlife habitat (7%), improve wildlife habitat (7%), trail improvements (7%), livestock management improvements (5%), heal erosion (5%), all of the above (4%), improve access (4%), stream improvements (4%), and road improvements (4%). Less common responses included: “more trash cans”, “weed management”, “toilets at trail head”, “ban ATVs”, and “polite signs to encourage others to respect the land”.

7. *What improvements would you like to see in public use or in public use areas? [examples – more trash cans, better stream crossings, interpretive signs, educational information, better maintained trails, more camping spaces, improved roads, better fishing access]*

63 responses. Common responses included: educational information (18%), more trash cans (16%), interpretive signs (11%), improved stream crossings (8%), road improvements (7%), campground facility improvements (water spigots, grills, picnic tables, fire pits) (6%), more camping spaces including primitive spaces (6%), better fishing access (5%), more bathrooms needed (4%), and all of the above (4%). Less common responses included: “Free access. No payment for use of my public lands”, “Improved opportunity for hikers and backpackers to register before departure”, “Improved open areas (meadows)”, “Local maps for visitors”, “Signs to keep people from cutting trails”.

8. *If you are a fisherman, would you like to see Native Cutthroat Trout re-established and supported in the upper reaches of Gallinas Cr. and Porvenir Cr./Beaver Cr.? [this would mean excluding Rainbow and Brown trout from Cutthroat waters]*

29 responses. 81% responded YES, 11% responded NO, 7% responded “Don’t know”. Other responses included “I feel inclined to support cutthroat though may not have enough information” and “I don't have anything wrong with seeing cutthroat trout. My issue is with the incorporation of triploid trout that cant breed or populate streams on their own. “

9. *How would you rate the overall health of the land in the National Forest of the Upper Gallinas Watershed?*

Excellent  Good  Fair  Poor

30 responses. 46% Fair, 43% Good, 10% Excellent, 0% Poor.

10. *Please provide any additional comments, concerns or information not addressed above (optional):*

33 additional comments were provided, including:

“Encourage leases to maintain their property”

“Good improvements to campground and bridges along Gallinas”

“I should not have to pay to use public lands”

“Invasive species management such as crowds”

“Parties are a problem in campgrounds, concern with cattle using the stream”

“Spend money on thinning and burning”

“Steep fines for garbage littering”

“What native species do we not see any more (plant or animal) apart from cutthroat?”

## Appendix B: Log Dam Assessment Data Sheet

<b>Log Dam ID</b>		<b>Drainage Name (circle one):</b>	<b>Gallinas</b>	<b>Porvenir</b>
Date		Observer Name		
N Coord				
W Coord				
Photo ID				
UPSTREAM ASSESSMENT (circle one)				
<i>Channel Width:</i>	WIDER	NARROWER	SAME	
<i>Erosion:</i>	ACTIVE	INACTIVE	NONE	
<i>Substrate Type:</i>	BEDROCK	LARGE COBBLE	SMALL COBBLE	SAND
DOWNSTREAM ASSESSMENT (circle one)				
<i>Channel Width:</i>	WIDER	NARROWER	SAME	
<i>Erosion:</i>	ACTIVE	INACTIVE	NONE	
<i>Substrate Type:</i>	BEDROCK	LARGE COBBLE	SMALL COBBLE	SAND
AT DAM ASSESSMENT (circle one)				
<i>Streambank Erosion:</i>	ACTIVE	INACTIVE	NONE	
<i>Stream Channel Erosion:</i>	ACTIVE	INACTIVE	NONE	
<i>Drop Height:</i>	> 1 FOOT	TWO LOGS HIGH	NEITHER	
SURROUNDING AREA ASSESSEMENT (circle one)				
<i>Vegetation:</i>	FORESTED	NON-FORESTED		
NOTES: (Removal Difficulty and General Observations)				