

**San Pedro Parks Wilderness**  
*Fisheries, Arizona Willow and Water Quality Monitoring*

**Annual Monitoring Report**

**Santa Fe National Forest**

**Surveyed: 2001 to 2002**

**Submitted: May 2004**



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## **Executive Summary**

### ***Introduction***

San Pedro Parks Wilderness is located on the western edge of the Santa Fe National Forest and encompasses 41,132 acres of the San Pedro Mountains and averages 10,000' in elevation.

The northern and eastern portions of the wilderness have headwater tributaries to the Rio Chama and is mostly on steep ground with mixed conifer forest or aspen supported by mostly sedimentary soils. In the higher elevations, sensitive and erodible granitic soils become prevalent. The steepness is exemplified in this portion of the wilderness where elevations go from 8,320' at the northeast boundary to 10,523' at the summit of the subtle San Pedro Peak.

The central and southern portions of the wilderness are headwaters to the Jemez Watershed and the western portion is the headwaters to the Rio Puerco Watershed. This portion of the landscape is characterized by rolling park-like terrain with a mix of conifer, aspen and wet meadows supported by a mix of stable sedimentary and erodible granitic soils.

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San Pedro Parks Wilderness was established in July 1964. Five grazing (5) allotments are currently utilized inside the boundary of the wilderness area, covering 96% of the wilderness (see Table 1). 730 head of cattle are permitted to graze inside San Pedro Parks Wilderness at various times.

Jemez and Rio Puerco watersheds host two allotments: San Pedro and Seniorito. San Pedro Allotment covers 21,620 acres within the wilderness boundary. Nearly all of the allotment is located within the wilderness. The whole allotment is utilized as open pasture for 440 head from June 16 to October 15 (one permittee is allowed to stay until October 31). 355 head utilized this allotment in 2001. Major drainages that are within this allotment include Rio de las Vacas, Anastacio Creek, Clear Creek, Rito de las Perchas, La Jara Creek, Rito de los Pinos, and Rio Puerco (referred to as Rio Puerco herein). With 27.2 miles of perennial stream located within the allotment, there is 2166 acres of riparian available for grazing. The Seniorito Allotment covers the southwest corner of the wilderness, approximately 2600 acres. With 400 head of cattle permitted on this allotment, only 120 graze within the wilderness, mostly along Clear Creek and San Gregorio Reservoir, from September 15 to October 15. The Cuba Ranger District has established an agreement with the Grazing Association to finance a range rider. The San Pedro and Seniorito allotments have been managed with the use of a range rider since 1994. These two allotments are mostly on rolling terrain with open wet meadows, aspen groves and mixed conifer forest.

One irrigation ditch has a point of diversion inside the wilderness and withdraws water from Clear Creek and occasionally Rio de las Vacas. Nacimiento Ditch is part of a recent adjudication and is going through the process of improving their point of diversion to allow fish passage and monitor the amount of their water withdrawal. Nacimiento Ditch Association utilizes San Gregorio Reservoir to store water for late-season release.

Since the area has been established as a wilderness, only one major lightning-caused fire has burned. On June 21, 1990, Pedro Fire consumed 300 acres in the eastern portion of the parks northeast of Vega Redonda near Rito Resumidero.

San Pedro Parks Wilderness is home to two regional sensitive species, Arizona willow (*Salix arizonica*) and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*). Willow monitoring has been on-going since the inception of the range rider program in 1994. Rio Grande cutthroat trout populations have been looked at off and on through the 1990's. No monumented population monitoring effort had been established to this date. Water quality monitoring inside San Pedro Parks Wilderness did occur in 1989 and 1990 for purposes of determining surface water sensitivity levels. Also, during an analysis of streams containing Rio Grande cutthroat trout in 1975, water quality samples were taken. This data will be incorporated into future analyses as more streams are sampled and monitored in upcoming years.

The purpose of the 2001 and 2002 survey was to locate species and determine the range of the population within the wilderness. Based on this analysis, general observation and incorporating water quality data, this and future efforts would make recommendations for management of the wilderness as well as for the species of concern.

## *Fisheries*

With 72.2 miles of perennial stream in San Pedro Parks Wilderness, 28.7 miles have known populations of Rio Grande cutthroat trout (RGCT) (see Photo 1) and 0.5 miles are suspected (see Table 2). Three miles of stream once occupied by RGCT have been extirpated and currently host non-native fish. Surveys conducted in 2001 and 2002, confirmed locations, established upper limits, located barriers and determined general population density. No other native fish were found during the survey.

Follow-up work in 2001 and 2002 did locate and remove 280 brown trout from Rio de las Vacas above a man-made barrier downstream from the wilderness boundary. Brown trout removal extended upstream to the confluence of Rito Anastacio (FS Files).

**Table 2.** Jemez Mountains Geographic Management Unit. Populations of Rio Grande Cutthroat Trout within San Pedro Parks Wilderness.

<b>SAN PEDRO PARKS WILDERNESS</b>	<b>STREAM</b>	<b>MILEAGE</b>	<b>COMMENTS</b>
<b>KNOWN</b>	Rio de Las Vacas	10.5	Above barrier, including tributaries, brown trout found above barrier to Rito Anastacio (2002)
	Clear Creek	2.9	Above San Gregorio Reservoir, mixed with rainbow trout
	Rito Resumidero	2.2	Above point of diversion, secure; includes Oso Creek
	Rio Puerco	8.7	Includes unnamed trib (Cowhump), secure
	Rito de las Perchas	3.4	Need to determine upper limits
	Rito de los Pinos	0.7	Brook trout in lower extent
	La Jara Creek	0.0	Upper limits are outside wilderness; Cañon Madera in wilderness unoccupied in 2001 and dry below wilderness in 2002
	Cecilia Creek	0.3	A more intensive mapping effort needed; needs genetic testing; not secure
	<b>Total</b>	<b>28.7</b>	
<b>SUSPECTED</b>	San Jose Creek	0.5	Need to survey
	Capulin Creek	0.0	Likely impure, needs genetic testing; remnant population outside wilderness
	<b>Total</b>	<b>0.5</b>	
<b>PROPOSED (extirpated)</b>	Rio Puerco de Chama	0.0	Jarosa Canyon to San Pedro Parks; fish distribution needs to be fully mapped
	Clear Creek	0.9	Mouth to San Gregorio Res.
	Rito Redondo	0.0	Currently occupied from mouth to FS Road 93; fish distribution needs to be fully mapped
	<b>Total</b>	<b>0.9</b>	
<b>EXTIRPATED</b>	Rio Gallina	2.0	Occupied by rainbow trout; Dove Creek does not support fish
	Cave Creek	0.1	Occupied by rainbow trout
	<b>Total</b>	<b>2.1</b>	

Rio Grande cutthroat trout found in San Pedro Parks Wilderness compose 27% of the known current range in the Jemez Mountains Geographic Management Unit (GMU). It is estimated that Rio Puerco alone hosts over 11% of this native fish population in the Jemez Mountains GMU. RGCT from Rio Puerco have been utilized by NMG&F to re-introduce natives to other waters in the Jemez Mountains, including Rio de las Vacas. Easily, San Pedro Parks can be considered a stronghold for this sensitive fishery.



**Photo 1.** Healthy, adult Rio Grande cutthroat trout from Rio de las Vacas.

Concerns that arose during the 2001 and 2002 survey were the loss of aquatic habitat and decrease in water quality and storage in locations where heavy grazing was evident. Such concerns were the lack of woody riparian habitat, actively eroding streambanks, loss of undercut banks, widened streams, sediment-filled pools, high water temperatures, accumulation of algal growth, and hardened formerly wet meadows.

A noticeable white fungal growth was observed on fins of RGCT in Rio de las Vacas and Cecilia Creek (see Photo 2). Fungal growth is usually a flag for a disease that has attacked an individual fish. Speculation from the NMG&F fish pathology lab (Doug Eib, personal communication, 2001) is that this is possibly related to natural stresses from the recent drought or water quality concerns. A major pathological assessment would have to be made to make definitive conclusions. At this time, we will monitor the populations on an annual basis for die-off or further development of disease.



**Photo 2.** Rio Grande cutthroat trout with white fungal growth on scales and fin along back.

Fish population surveys were conducted inside San Pedro Parks Wilderness in all three watersheds:

➤ **Jemez Watershed** –

1. Rio de las Vacas and its unnamed tributaries (2001),
2. Rito Anastacio (2001),
3. Lower Rito de las Perchas (2001),
4. Upper Clear Creek (2001; above San Gregorio Reservoir);

➤ **Rio Puerco Watershed** –

1. Cañon Madera (2001 and 2002),
2. Rio Puerco (2001 and 2002) and its unnamed tributaries (2001; including “Cow Hump” Creek),
3. Rito de los Pinos (2002),
4. La Jara Creek (2002);

➤ **Rio Chama Watershed** –

1. Rio Gallina (2001 and 2002),
2. Rio Capulin (2001 and 2002),
3. Dove Creek (2002),
4. Cave Creek (2002),
5. Cecilia Creek (2002),
6. Oso Creek (2001 and 2002),
7. Corralitos Creek (2002),
8. Rito Redondo (2002),
9. Rio Puerco de Chama (2002),
10. Rito Resumidero (2001 and 2002; at the wilderness boundary)



## *Arizona Willow*

Arizona willow (*Salix arizonica*) surveys were completed in September 2000 and July 2001 for portions of the San Pedro Parks Wilderness. The purpose of the surveys were to re-visit known plants, document their condition, look for new plants and expand the range of inventories completed in 1997 and 1998 by Dr. Duane Atwood. Two new willow observations were reported in 2000; and two additional observations in 2001. In both years, seasonal cattle grazing had already begun by the time the surveys were conducted.

Presently, at least eleven groupings of willows (approximately 3-5 stems in a 25 foot square area) in San Pedro Parks are protected from browsing by wooden or metal enclosures. In both years, it was evident that the enclosures are having a positive effect on the willow judging by their height and relative vigor. Plants within the enclosures are up to six feet tall, whereas no willows outside enclosures are any taller than a foot, and usually less than six inches in height. Numerous new leader stems were present on many of the enclosed plants. Several of the plants displayed fairly thick, older stems, indicating the plants are more mature. New enclosures are being constructed each season as time permits.

Arizona willow can be observed growing either directly adjacent to flowing streams, or in marshy meadows full of small springs with the roots systems submerged in the water table. The plants grow as distinct individuals, or as large clone populations occupying up to 400 square feet. Willows were usually seen in association with *Salix planifolia* and *Pedicularis groenlandica*. Both of these plants were used as indicator species to identify areas for potential Arizona willow habitat during the 2000 and 2001 surveys.



**Photo 3.** Typical Arizona willow habitat (July 2001).

In 2000, Rio de las Vacas, Rito Anastacio and Rito de Los Pinos were surveyed. The two new locations are both along the Rio de las Vacas. One of them was identified by Howard Cordova, the ranger rider, a few weeks previously, but by September, the plant was no longer evident. Howard was able to re-locate the plant the following July. Most of the known willows in the large meadow below the confluence of the Rio de las Vacas, and Rito Anastacio are inside enclosures. Another willow growing out of the crevice of a rock along Rio de las Vacas is tall and vigorous (see Photo 4). In general, if the willow is protected either by an enclosure, or a natural barrier, the plants are relatively tall and full.



**Photo 4.** Arizona willow adjacent to Rio de las Vacas (September 2000).

In 2001, Rio de las Vacas was re-visited on the initial hike-in, while concentrated surveys centered about Rio Puerco and Cañon Madera. Two previously unrecorded, small populations of Arizona willow were observed within the first mile down stream from the headwaters of Rio Puerco. All other populations observed along the Rio Puerco were previously reported by Atwood. All the open meadow within Cañon Madera were surveyed. Previously known populations were relocated; no new populations were found in the drainage.

## *Water Quality*

On August 21-23, 2001 assessment of stream health in the San Pedro Parks Wilderness was accomplished using different methods: water quality monitoring was conducted, Rosgen Stream Classification (Rosgen, 1998) and Thalweg Watershed Area Link (T-Walk) method adapted from Ohlander, 1995. The purpose of the monitoring was to gather and analyze data for determining existing water quality by examining physical (temperature and turbidity/sediment) and chemical (dissolved oxygen, pH, and nitrate concentration) parameters of the stream. Using Rosgen Stream Channel Classification, stream channel morphology was established. Incorporating the T-Walk survey, reaches were identified as reference sites for comparison with other reaches on their productivity, diversity, and ecosystem stability.

The western and central portions of the Parks were strategically chosen for sampling. In a prior trip to the Parks the fisheries team had identified areas of concern, which enabled the watershed team to focus on those areas. The streams chosen for sampling were the headwaters to the Jemez and Rio Puerco. Clear Creek and Rio de las Vacas are headwater tributaries to the Jemez River. The remaining are the headwaters to the Rio Puerco, the main stem of the Rio Puerco and Cow Hump Creek (USGS unnamed tributary to Rio Puerco, lovingly named by the fisheries crew).

The State of New Mexico Water Quality Control Commission has instituted the “Water Quality Standards for Interstate and Intrastate Streams in New Mexico” in an effort to preserve the quality of the streams in the State (WQCC 2000). The standards are consistent with Section 101(a)(2) of the federal Clean Water Act (33 U.S.C. 1251 et seq.) which states that “it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved...”

The New Mexico Water Quality Standards (WQS) apply standards to surface waters based on designated uses: Coldwater Fishery, Domestic Water Supply, High Quality Coldwater Fishery, Irrigation, Limited Warmwater Fishery, Marginal Coldwater Fishery, Primary Contact Recreation and Warmwater Fishery. The WQS also designates uses of major surface water of the State. Section 2106 & 2107 of the WQS addresses the Jemez and Rio Puerco, respectively, in the following manner:

“The Jemez River and all its tributaries above State Highway 4 near the town of Jemez Springs and the Guadalupe River and all its tributaries.

- A. Designated Uses: domestic water supply, fish culture, high quality coldwater fishery, irrigation, livestock watering, wildlife habitat and secondary contact.
- B. Standards:
  1. In any single sample: conductivity shall not exceed 400  $\mu$ mhos, pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20°C (68°F), and turbidity shall not exceed 25 NTU. The use-specific numeric

standards set forth in Section 3100 of this Part are applicable to the designated uses listed above in Section 2106.A of this Part.

2. The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 mL; no single sample shall exceed 200/100 mL.”

“Perennial reaches of the Bluewater Creek, Rio Moquino, Seboyeta Creek, Rio Pagate, the Rio Puerco within the Santa Fe National Forest, and all other perennial reaches of tributaries to the Rio Puerco including the Rio San Jose in Cibola County from the USGS gauging station at Correo upstream to Horace Springs.

- A. Designated Uses: coldwater fishery, domestic water supply, fish culture, irrigation, livestock watering, wildlife habitat and primary contact recreation.
- B. Standards:

## Water Quality Analysis

In areas where grazing and recreation occur, physical and chemical parameters suggested for evaluation are: temperature, turbidity, pH, dissolved oxygen, nitrate and fecal coliform. (WQCC, 2000). Discharge and velocity are important tools for determining nutrient loading, concentrations and distributions. Flow volumes (discharge) were calculated based on stream channel dimensions and velocity.

In order to assess the existing water quality of these streams, water samples were taken and concentrations of important constituents were determined. Other important characteristics such as pH, turbidity, and temperature were measured in situ.

All constituent concentration determinations (dissolved oxygen, nitrate and fecal coliform) were made from grab samples. Water samples were taken in a representative part of the reach. Hach Multi-Parameter Surface Water Kit was used. Fecal coliform bacteria tests were conducted using American Water Service PurTest® Bacteria Test Kit.

The following characteristics were measured in situ. Turbidity was measured using a Hach 2100-P Portable Turbidimeter, pH was measured using a Hach portable pH meter (included in the Surface Water Kit), and an Enviro Safe portable thermometer was used for determining water and air temperature.

Temperature in forest streams is a function of latitude, elevation, season, time of day, rate and depth of flow, and canopy cover. The canopy cover moderates stream temperatures by shading the stream channel from direct solar radiation. Changes in temperature affect physical, biological and chemical processes in streams. An increase in temperature decreases the solubility of oxygen in the stream while increasing the oxygen demand of fish. The measurements that influence stream temperature are listed below:

<u>Stream</u>	<u>Time</u>	<u>Depth(ft)</u>	<u>Canopy Cover(%)</u>	<u>Water Temp (°F)</u>
Clear Creek	13:10	0.75	40%	55
Cow Hump	11:18	0.5	10%	57
Rio Puerco	13:36	0.6	0%	60
Rio Vacas	14:58	1.0	0%	58

Turbidity is defined as a measure of the suspended particles, such as silt or clay, microorganisms, or organic matter in water that are held in suspension by turbulent flow. The turbidimeter measures the reduction of transparency of water due to the scattering and absorbing effect of light by suspended particles. High turbidity or sedimentation can harm aquatic communities by affecting reproduction, respiration, and photosynthesis, and by interrupting the food chain.

Dissolved oxygen is essential to aquatic organisms. Variability in the percent of dissolved oxygen affects species reproduction and development of populations. The amount of oxygen in water varies depending on temperature, salinity, turbulence or mixing of the stream, atmospheric pressure, and the consumption of oxygen during decomposition of organic matter. Habitat for cold-water fish populations should not be less than 5 ppm or

5 mg/L. The current state standard is 10 mg/L, and all streams were below standard, which may be due to temperatures and mixing.

The term pH is an indicator of the acids and bases in water. Most natural waters have pH values from 5.0 to 8.5. Surveyed streams had values 6.9-8.1, which met the state standard for pH.

Nitrogen is essential for plant growth, but an excessive amount in water presents a major pollution problem. Nitrogen compounds may enter water as nitrates or be converted to nitrates via drainage from livestock feeding areas, sewage, and other means. Nitrates in conjunction with phosphate stimulate the growth of algae, leading to difficulties associated with excessive algae growth (i.e., eutrophication).

Fecal coliforms are a group of organisms found in the intestines of warm-blooded animals. They are indicators of pathogenic organisms, though not pathogenic themselves. The WQS for the Jemez and Rio Puerco streams are 100 counts/100 mL. This means that when colonies of fecal coliform are grown in a culture in the lab from a 100 mL water sample, no more than 100 colonies are counted. For the purpose of this survey, only presence or absence of the microorganisms was determined. Lab analysis was not feasible at this time, though it may be done in the future to determine what concentration fecal coliform is present in a 100 mL sample.

Due to time constraints and the area to be covered, sampling techniques were not optimal. Recommendations for the future include increased frequency and duration of sampling. Two possibilities may be considered: (1) a series of samples may be taken at the same location but at different times; or (2) a series of samples may be taken simultaneously at different locations in a stream or lake.

### **Stream Classification**

The streams chosen for monitoring were characterized using the Rosgen Stream Classification method (Rosgen, 1998). A level-two geomorphologic survey determined that all streams fit the “E” stream classification. San Pedro Parks Wilderness is a series of broad valleys and high mountain meadows, which are characteristic of “E” stream types. These “E” streams are highly sinuous with low width/depth ratios and low gradients. The bed materials are comprised primarily of gravel sized material with smaller accumulations of sand and cobble (therefore making it an E4 stream). The banks are comprised of materials finer than that of the channel material, usually sands and cobble. Typically, these “E” stream types are very stable unless stream banks are disturbed. At this time, streambank trampling was observed and noted.

### **Stream Health**

Two sites were selected by the fisheries team as reference sites, meaning that they exemplified habitat integrity. Stream health at the sites was evaluated according to the system established in Thalweg Area Watershed Link (T-Walk) (Ohlander, 1995). At each site a 700-foot reach was walked upstream along the thalweg (deepest part of the stream). Every seven feet along the reach the substrate type and thalweg depth were

recorded, giving 100 readings for each measurement. The Tarzwell substrate list was used for classifying according to particle size, embeddedness, and aquatic vegetation types. Higher index numbers indicate better “ecosystem diversity and stability” and “long-term natural productivity.” Because these are reference sites, the values given in Table 4 may be considered the maximum possible score for optimal conditions in the San Pedro Parks. If a T-Walk survey is conducted in a comparable area, a rating can be determined as a ratio of its score to the reference reach score.

**Table 4.** Thalweg Area Watershed Link (T-Walk) survey results.

		<b>Rio Puerco</b>
Mean Tarzwell Substrate Ratio	39	34
Modal Tarzwell Substrate Ratio	35	12
Mean Thalweg Depth	1.6'-1. 8'	1.2-1.4'
Modal Thalweg Depth	0-0.5'	0.5'-1. 0'

Banks were stable for 100% of both reference reaches. Bank vegetation was not identified to species, but comprised predominantly carex and juncus. Both sites were in meadows with no shrubs or large woody debris in the immediate vicinity, although dense forest margin was approximately 25 meters away. Instream vegetation was not identified beyond the categories nested in the Tarzwell substrate list. There were bountiful deep, shaded pools and undercuts for fish habitat. Riffles were mostly absent, so riffle insects were not counted as part of this survey.

## *Recommendations*

Noticeable changes to the wilderness area can be attributed to historic grazing, recreational use and fire suppression. The following recommendations were developed by the Monitoring Team to assist in developing alternatives for adaptive management of San Pedro Parks Wilderness.

The most obvious recommendation is to develop and implement an overall San Pedro Parks Wilderness Management Plan. This plan can incorporate concerns that are noted during monitoring as well as the recommendations that follow.

Concerns for water quality, riparian and stream condition related to grazing arose during the 2001 survey for corridors along Rio Puerco (loss of undercut banks, channel shifting from a natural historic condition to a more disturbed degraded condition) and the San Pedro Parks area (loss of wetland integrity). Reviewing historic reports has shown a trend that the Vacas corridor has greater resilience for recovery versus Puerco. In addition, this resiliency could be attributed to soil types. Through discussions with soil scientist, John Phillips (personal communication, 2002), the utilization of soil type maps could assist in determining locations for long-term grazing versus areas that need rest. By utilizing the range rider, these two corridors could be rested over a period of several seasons. During that time, the Monitoring Team could study and monitor conditions in the rested versus utilized areas to determine success of this program and offer adaptive management alternatives for grazing locations.



**Photo 5.** Extensive grazing damage on Capulin Creek: Loss of riparian woody and herbaceous vegetation, decreased plant vigor, increased sediment loading, unstable banks, and increased solar radiation on stream (17 July 2002).



In 2002, the fisheries team noted concerns for water quality, riparian and stream condition as related to grazing. These areas were in the Chama Watershed portion of the wilderness, most notably in Capulin Creek (see Photo 5 and stream summary). Jemez Mountains were suffering from an extreme drought in 2002, which further complicated these conditions. Despite this, it was apparent that overgrazing was causing damage to water quality, riparian and stream conditions. We encourage that these areas be re-visited and be rested if they have not recovered from those impacts.

Baseline data was collected this year in “reference” locations to draw comparisons. In addition, Rio de las Vacas within the wilderness had a stream habitat inventory conducted in 2002 and 2003. This data will also establish com

The recreation program could benefit from a Wilderness Ranger. While the range rider has partly acted in this capacity, having a wilderness ranger would free up the range rider to focus his duties related to the San Pedro Allotment. The wilderness ranger could conduct the trails assessment, monitor general use, educate visitors, head up a trails crew and formally monitor outfitter guide use.

A general recommendation to also assist visitors as well as managers is to update the 25 year-old wilderness map. Reports from map users state that the map has gotten them lost due to trail abandonment and a shift in vegetative structure (which is referred to in the map for landmark orienteering). This recommendation appears to be heeded as a new wilderness map is slated to appear in 2005.

### **Fisheries**

The Fisheries team will continue to establish a fish distribution and composition map for San Pedro Parks Wilderness and the outlying area. While the 2001 and 2002 survey was able to map nearly all waters within the wilderness, one more year will be needed to complete this map. Once complete, the team will select transects to snorkel on an annual basis to monitor population trend.

In addition, watershed condition transects can be established in the same locations as well as additional sites to monitor streambank condition, pool development and quality as well as substrate composition. This work will be in done in coordination with the Water Quality Team.

### **Arizona Willow**

Although most of the potential habitat for Arizona willow within San Pedro Parks has been searched one or more times, additional plants continue to be located, especially with reduced grazing pressure. According to Atwood's 1998 report, the few areas not searched include the upper portion of the Rito de las Perchas and the Vega Redonda areas. In order to further assist and expedite Arizona willow monitoring, more individuals who visit the wilderness should be trained to identify the willow. The willow populations should be monitored on an annual basis.

Those plants within enclosures appear to be in better condition based on height, abundance of new leader stems and overall vigor. More of the plants need to be within enclosure, however there should be some thought given to the types of enclosures being used in the wilderness. Although the present enclosures are certainly effective (both those made from small spruce logs and wire fence with metal posts), they do not fit in with the natural character of wilderness values. Other types of enclosures could be experimented with, such as piling small trees and slash on top of willows, and allowing the willow stems to grow through the spaces in the piles.

Other uses of the enclosures might be explored. One idea is to fence in a small willow population, but extend the boundary of the enclosure significantly to see if the overall extent of the population will expand within the enclosure. Or, several areas of suitable Arizona willow habitat could be protected from browsing within enclosures, and observe

whether or not previously suppressed willow root and stem systems are growing in the soil.

Continue to use a range rider to move livestock away from Arizona willow populations to reduce impacts and increase plant vigor. Assure that any new range rider knows how to identify Arizona willow, or potential habitat, and develop a simple method for them to monitor, map and describe the willow. As more people are able to identify the willow, more plants will be located, and a greater understanding of the plant's ecology will evolve.

### **Water Quality Monitoring**

The results of the water quality monitoring show that increased bacterial levels and sedimentation are a problem in all streams surveyed. In using the Rosgen Stream Classification it was noted stream width/depth ratio are of concern. More investigation is required to determine the cause of these impairments. The reference sites may be used as a basis for comparison with future surveys. Annual surveys will continue to monitor trend of water quality and the evolution of geomorphology.

The Water Quality Team would like to extend the monitoring to include multiple sections throughout a stream corridor to gain a more resolute picture of water quality condition and change as it relates to natural and impaired conditions. To expedite and further solidify water quality testing, the team will explore partnering with NMED as a participant in the annual monitoring

## *Stream Summaries*



*Rio de las Vacas in September 2000.*

## Jemez Watershed

### Rio de las Vacas, Headwaters

#### *Fisheries*

Surveyors: Mike Bassett, Renee West

Fish Observed: Rio Grande cutthroat trout

July 10, 2001

The seepy headwaters of Rio de las Vacas was broken into isolated groundwater recharged pools. Each pool had an adult or sub-adult RGCT in it (observed from the bank). These pools were up to 2.0 feet deep, although most were 1.0-1.5 feet deep. This section of stream was narrow and set deep in stable grassy banks. This made it difficult to snorkel.



**Photo 6.** Stretches of Rio de las Vacas near Rito Anastacio had raw, unstable banks and loss of undercut habitat. (Note: Seepy banks; July 2001)

M. Bassett spot snorkeled where trail 32 crosses the Rio de las Vacas (see map). The stream is still continuous at this point.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>
Unknown Trout	0	1	0
RGCT	0	2	2

10:50, 54°F, air 74°F. Water clarity was clear (not crystal); weather was partly cloudy.



**Photo 7.** Renee West snorkels through the upper terminus of Rio de las Vacas

R. West spot snorkeled the uppermost terminus of Rio de las Vacas through a meadow (see map and Photo 7).

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>
RGCT 13:15, 49°F, air 67°F.	0	0	1

Although only one adult RGCT was observed during spot snorkeling, many were observed from the bank. Tiger salamanders (larval) and frogs (probably chorus frog) were observed. Above the meadow, the stream bends to the east and increases gradient in a conifer-dominated, riffly, rocky stretch. There were no deep pools and fish were not observed. However, fish were observed in surprisingly tiny habitats in the lower meadow area. Pools probably connect during higher flow.

In a 1974 survey (Stork and McInnis 1974), the upper one mile of the headwaters was noted as having “sparse to non-existent” vegetation along the stream with cattle grazing noted as “heavy” with a loss of undercut banks. A survey conducted in July 1978 by NMG&F and USFS (FS Files) in this same headwater stretch concluded that major focus should be given to willow plantings and noted that willow seemed to be native to this area. They also noted that while this area was grazed as heavily as Rio Puerco, it was in “better shape.” This is likely due to the resiliency of the sedimentary soils found in the

headwaters of Rio de las Vacas compared to the fragile, granitic soils in the headwaters of Rio Puerco.

### ***Arizona Willow***

#### September 2000

The survey re-located willow populations from the 1997 and 1998 surveys along a three-mile stretch of Rio de las Vacas. Five enclosures have been constructed around small plant populations in the large meadow below the confluence of Rio de las Vacas and Rito Anastacio. Plants within these enclosures are tall and vigorous as described in the introduction, although stems extending near the edges of the enclosure showed signs of browsing. Plants outside enclosures are low to the ground and often protected by overhanging vegetation, rocks or other natural obstructions.

#### July 2001

Re-visited plants within the enclosures, and located a willow in the same meadow outside an enclosure. The enclosed willows show little to no browsing on ends as in previous year. There is some potential encroachment from small spruce trees within a couple of the enclosures.



**Photo 8.** Wire enclosure along Rio de las Vacas below Rito Anastacio (September 2000).

### ***Water Quality***

The location for the Rio de las Vacas (Site #4 on map) was in an open meadow. At the time of sampling, there was evidence of recent cattle activity. The stream at this location had an average width of 2.0 ft and an average depth of 1.0 ft. The banks in this segment were in fair condition, no significant bank instability. Note: Water quality at this site was in compliance with State Standards; with the exception of DO, which was slightly

lower than the state standard. This may be attributed to time of day and very little canopy cover.

The upper Rio de las Vacas (above Rito Anastacio) was noted as very sensitive to acidification with very little buffering capacity over a period of three samplings in a 1989-90 survey (USDA Forest Service 1990).

**Rio de Las Vacas, ½ mi of Trail 32 & 51 Junction**

***Water Quality***

Surveyors: A. Jaramillo & M. Vogt

August 22, 2001

14:58 pm

	Temperature (°F)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	pH	Nitrate (ppm )	Total Coliform (Presence/Absence)	Discharge (cfs)
Rio de Las Vacas	60 degrees (water) 63 degrees (air)	4.41	9.0	6.9	0	Present	2.4
State Standard	68 degrees	25	10.0	6.6-8.8		100 colonies/100 mL Fecal Coliform	



**Photo 9.** Site #4: Rio de Las Vacas segment. Note trampled unstable banks. Fish present in this segment. Water quality sampled.





**Photo 10.** Site #4: View of Rio de Las Vacas segment looking south (downstream).



**Photo 11.** Site #4 View of Rio de Las Vacas segment looking north (upstream).

## Rio de las Vacas, Wilderness Boundary

### *Fisheries*

Surveyors: Sean Ferrell, Katrina Lund, James Simino, Mike Bassett, Renee West, Chris Luerkens, Duane Lefthand, NMED and NMG&F staff

Fish Observed: Rio Grande cutthroat trout, brown trout

August 16, September 17-18, October 2, 2001

The Santa Fe National Forest fisheries crew electrofished the upper Rio de Las Vacas above the man-made barrier just upstream from FS Road 70 into San Pedro Parks Wilderness to just below the point of diversion for Nacimiento Ditch. The barrier was built in the late 1980's. After completion of the barrier, the upstream portion was chemically treated to eradicate non-native fish species (i.e. brown trout) and was then stocked with native RGCT. Unfortunately, there has not been a monitoring program related to this barrier.

In June 2001, the fisheries crew conducted a snorkeling training in this area of stream and numerous RGCT were observed along with one brown trout above the barrier. In addition, anglers caught two adult brown trout (8") in Rio de las Vacas near the confluence with Rito Anastacio in 2001 (Jim Eaton, personal communication).



**Photo 12.** James Simino holding two spawned out brown trout, 20 to 24 inches.

The presence of brown trout above the barrier could be the result of the following: 1) People illegally introducing browns above the barrier; 2) chemical treatment did not extirpate the whole brown trout population; and 3) barrier is ineffective. This section of stream is boulder dominated, steep gradient, and confined within a tight canyon (“A2” Rosgen Stream Type).

The purpose of this project was to restore the upper Rio de Las Vacas as a native fisheries and to eradicate non-native brown trout above the barrier. On August 16, the methodology utilized two teams: 1) Snorkel and flag areas where brown trout were observed; and 2) follow with an electroshocker to remove brown trout. RGCT were placed back into the stream outside the electric field and brown trout were destroyed and buried on the banks. Staff from NMED supported this effort. For September 17 and 18, the methodology focused strictly on electrofishing. The survey stopped upstream of the wilderness boundary and downstream of Nacimiento Ditch. On October 2, J. Simino and NMG&F continued where the electrofishing had concluded on September 18, stopping downstream from Nacimiento Ditch. An additional 100 brown trout were removed in 2002.

Date	Temp	Time	BROWN TROUT CAPTURED					Total
			Juvenile (<3")	Sub-adult (3<6")	Adult (6<9")	Lg Adult (9<12")	Big Fatty (>12")	
16 Aug 01	52°	11:00	0	2	1	2	1	6
17 Sep 01	52°	11:40	0	1	4	1	0	6
18 Sep 01	51°	12:30	3	1	6	0	1	11
2 Oct 01	N/A	N/A	Yes	Yes	Yes	Yes	Yes	157
15-16 Aug 02	N/A		15	26	24	33	2	100
							<b>Total</b>	<b>280</b>

Comments:

- Fungus was found on some of the RGCT that were captured in the electrofishing process on both dates (see Photo 2).
- On 17 Sep 01, brown trout were found in first pool just upstream from barrier.
- Brown trout were not found in very steep gradient sections.
- On 18 Sept 01, cattle were trampling in the stream (first pool just upstream from barrier).
- On 2 Oct 01, the epicenter of brown trout activity was located. A spawned out pair of brown trout were removed; they were 20 to 24" in length (see Photo 12); within the vicinity of this pair was the majority of the brown trout that were removed; shortly above this pair, brown trout numbers declined dramatically.

### ***Arizona Willow***

No surveys were conducted in 2000 and 2001. Surveys should be conducted to look for potential habitat from Nacimiento Ditch point of diversion upstream.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

## Rito Anastacio

### *Fisheries*

Surveyors: Katrina Lund, Damon Goodman, Ranee Onstott

Fish Observed: Rio Grande cutthroat trout

July 11, 2001

Headwaters of Rito Anastacio consist of isolated pools located in an open meadow system surrounded by conifers. Approximately 500 feet downstream of first pool, Rito Anastacio becomes a flowing, meandering stream (“E” Rosgen stream channel type) characterized by a series of deep pools. High algal growth was observed, particularly in higher isolated pools. Approximately 0.25 miles of upper Rito Anastacio were surveyed and the upper limit of fish was determined (see map). RGCT were observed from the bank, but could not be identified from snorkeling (see Photo 13). Surveying abruptly ended due to a dangerous hail and lightning storm. There were few signs of cattle damage in the short section that was surveyed, however more analysis is recommended.



**Photo 13.** Damon Goodman snorkeling the upper limit of fish in Rito Anastacio

Also note that brown trout may also be present near the mouth. Anglers caught two adult brown trout (8") in Rio de las Vacas near the confluence with Rito Anastacio (Jim Eaton, personal communication).

**Stream Temperatures\***

Isolated Pool near headwaters	15:30	65°F
Upper Limit of RGCT	16:20	54°F

Weather: Increasing clouds

\*-see map for specific locations

**Arizona Willow**

September 2000

The entire length of Rito Anastacio was surveyed from its confluence with Rio de las Vacas to where it joins with Los Pinos. Four small willow populations have enclosures along the edge of the stream. The willows were at least two feet high, and showed new leader stems. No additional willows were observed.



**Photo 14.** Wooden enclosure along Rito Anastacio (September 2000).

***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1989-90 survey (USDA Forest Service 1990), Rito Anastacio was determined sensitive to acidification with a moderate amount of buffering capacity.

## Rio de las Vacas, Unnamed Tributaries

### *Fisheries*

Surveyors: Mike Bassett, Renee West

Fish Observed: Rio Grande cutthroat trout

July 11, 2001

Three west bank tributaries of the Rio de las Vacas were targeted for this survey. Tributaries were numbered from south (wilderness boundary) to north (Trail 32 crossing).

- **Tributary 1**

Fish Observed: None

There is no water in the southernmost tributary, Tributary 1, to Rio de las Vacas. No RGCT observed.

- **Tributary 2**

Fish Observed: Rio Grande cutthroat trout

In Tributary 2, a dense population of RGCT was observed from the bank. This tributary was deep, with nearly isolated meadow pools. Algae was noted, staining the water red, making visibility medium to poor. The upper limit of fish in Tributary 2 was approximately 400 feet below the very top of the stream. A large adult RGCT was observed here from the bank. Fish use ended due to lack of water (see map). Map indicates tributary continues from upper meadow. No sign, however, of actual water. The stock tank shown on map is an old check dam that has been breached, so no longer forms a tank. There are nice quality pools with no barrier. The meadow is intact with no recent sign of heavy livestock use.

R. West attempted to snorkel the top part of this tributary, but poor visibility made snorkeling a bust. Numbers of RGCT are represented by bank observations.

Species	Sub-Adult (3<6")	Adult (6<9")	Lg Adult (9<12")	Big Fatty (>12")
RGCT 13:42, 54°F	1	5	2	1

- **Tributary 3**

Fish Observed: None

An unexpected hail and lightning storm prevented the completion of the survey for Tributary 3 (the northernmost tributary on the west bank). This tributary was noted to have larval stages of tiger salamander but no fish were observed. Dense algal growth and undercut banks limited bank observation. Future surveys should be conducted to determine if fish utilize this meadow tributary.

### ***Arizona Willow***

No surveys were conducted in 2000 and 2001. Future surveys should look at tributaries that have open meadow conditions.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **Rito de las Perchas**

### ***Fisheries***

Surveyors: Katrina Lund, Mike Bassett

Fish Observed: Rio Grande cutthroat trout, unknown trout

July 9, 2001

A spot snorkeling survey was conducted along Trail #419 upstream from where Trail #50 crosses Rito de las Perchas. Approximately 250 feet of stream was surveyed and fish were found in pool habitats with undercut banks. Sub-adult and adult RGCT were noted as having deformed and whitish dorsal fins with a possible fungus.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>
Unknown Trout*	3	4	0
RGCT	1	1	1

12:00, 56°F

\*-suspected brown trout: fast with dark coloration

At the time of this survey, water clarity was good and there was no evidence of cows in this short section of stream. In a 1974 survey (Stork and McInnis 1974), cattle were present but did “not appear to be affecting the stability of stream banks.” However, a survey conducted in July 1978 by NMG&F and USFS noted that “cattle concentration (was) leading to the removal of overhanging grasses” and “some areas (were) used for resting areas for livestock.” Their survey concluded that streambank stabilization and willow plantings were needed to improve fisheries and riparian conditions in heavily grazed areas along Rito de las Perchas. A( )Tj0.00031 Tc -0.00031 Tw 12 0 0 12 4960.0000 246.3006 Tmfutu

## Clear Creek

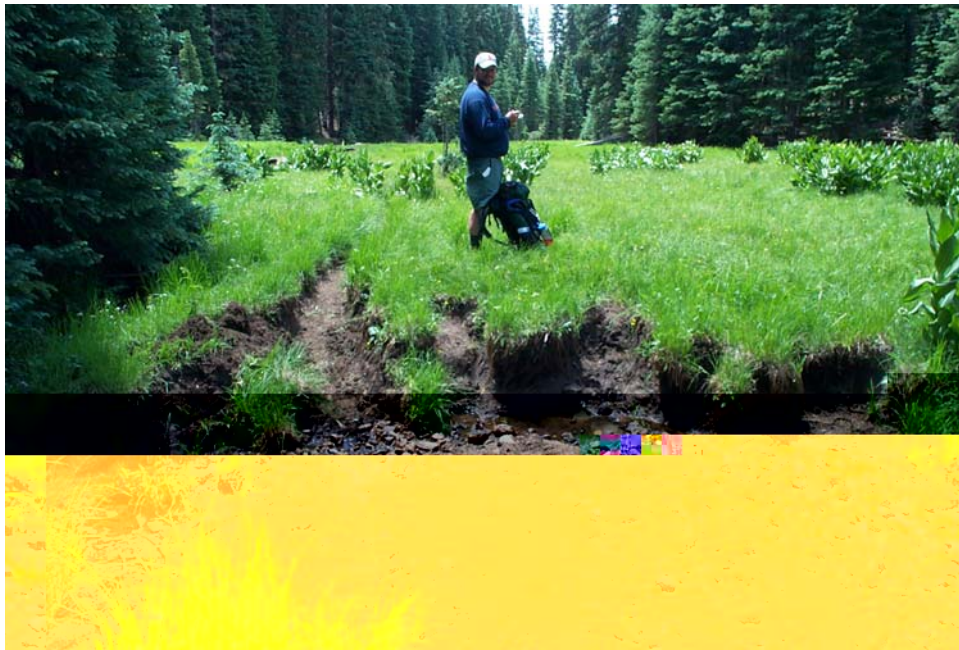
### *Fisheries*

Surveyors: James Simino, Megan Vogt

Fish Observed: Rio Grande cutthroat trout

July 11, 2001

The survey, Reach 1, began in the headwaters of Clear Creek, a tributary to Rio de las Vacas. The headwaters of Clear Creek began in a large meadow. There was evidence of cattle grazing in the headwaters. There were many cattle tracks in the wet meadow, as well as evidence of grazing on the various grass species. There was general browsing occurring in this section of the drainage. There didn't appear to be any concentrated effects of grazing yet. This reach continued for approximately 1.5 miles downstream. The grazing wasn't heavy in this area, though cattle had been in the wilderness area for approximately one month. This seepy meadow did not have a defined stream channel. No riparian vegetation was present in this reach other than the grasses. What should have been a wet meadow area was now hardened due to constant grazing pressure, preventing groundwater storage. No fish were observed.



**Photo 15.** Clear Creek, Reach 2: Noticeable loss of undercut banks and source of sediment.

Reach 2 consisted of occasional stagnant pools. There was more evidence of cattle grazing in this area as grazing pressure seemed higher in this reach. The grasses were approximately 4-6 inches shorter and there was fresh cattle excrement throughout the reach. There was extreme bank erosion caused by cattle crossing the stream and going to the stream for water. Trampling from cattle had caused the undercut banks to slough off, adding sediment to the stream (see Photo 15). The added sediment made the stream shallower and widening the stream channel, aiding in temperature increases. There were areas where 30' of bank erosion had occurred on each side of the stream. In one stretch, throughout a small meadow, the banks were 3-4 feet high (see Photo 16), and were



heavily eroded. This stretch of occasional pools continued for approximately 0.75 miles. There were some stretches where the stream flowed through a conifer riparian. In these forested areas, there was flowing water, and the gradient tended to increase. No fish were observed.

Reach 3 was extremely short, approximately 0.25 miles of stream through a conifer forest. The gradient increased and water was flowing. No fish were observed. A trail followed the stream throughout this reach. A mother grouse and 6 young ones were observed in this reach. Surveyors were unable to determine species, but speculated that it was a blue grouse.



**Photo 16.** Clear Creek, Reach 2: Continued loss of undercut bank and increased sedimentation (Note: Stubble height)

Reach 4 consisted of pools that were connected by some flowing water. The majority of this reach flowed through meadows. Heavy grazing pressure was noted in this reach. The meadow was grazed relatively short with an average grass height of 1 to 2 inches. Fresh cattle tracks and dung were visible throughout the reach. Minimal riparian vegetation consisted mostly of conifers. When fish were first sighted from the banks, M. Vogt snorkeled the pool to identify the fish as RGCT. From the upper limit of fish, mostly adult RGCT were observed. There was usually only one individual in a pool. Approximately 12 sub-adult and adult RGCT and one juvenile were observed in this reach.

Available spawning habitat and spawners are a limiting factor as well as water levels and decreased habitat quality. The reach can be characterized by a low gradient channel with

the substrate being dominated by gravels (“C4” Rosgen Stream Type). This reach lasted for approximately 0.5 miles. Trail #417 parallels the stream on the left bank through this reach.

Reach 5 showed a slight increase in gradient and flowed through a conifer forest with cobble being the dominant substrate (“B3” Rosgen Stream Type). Trail #417 parallels the stream. The survey was concluded where trail #417 crosses Clear Creek near the junction with the Rio de las Vacas trail (#51). RGCT were present in this reach. There were not as many as the previous reach and were mostly adults. There was not much water through this stretch. The grazing damage was not as severe, as there was little forage. Another blue grouse was spotted in this reach with one young chick.

**Stream Temperatures\***

Upper Limit of RGCT (Reach 4)                      13:15      58°F

\*-see map for specific location

A 1974 (Stork and McInnis 1974) survey covering the same ground as Reach 5 noted that streambanks were “solid” with “little grazing” taking place. A survey conducted across all reaches in July 1978 by NMG&F and USFS (FS Files) noted similar grazing issues as the 2001 survey with “resultant siltation, stream bank sloughing, poor vegetative cover and overheating of the stream.” They suggested “any method of resting this area should definitely be pursued.” It appears that grazing pressure has increased within this drainage in the last three decades.

**Arizona Willow**

No surveys have been conducted since Atwood in 1998. Future surveys should revisit the area.

**Water Quality**

Surveyors: A. Jaramillo & M. Vogt

August 21, 2001

13:10 pm

The location for Clear Creek (Site #1 on map) was located in an area of approximately 40% canopy cover. The stream at this location had an average width of 2.0 ft and an average depth of 0.75 ft. The banks in this segment were in good condition, not too much significant bank instability. Note: Water quality at this site was in compliance with State Standards; with the exception of DO which was slightly lower than the state standard. This may be attributed to time of day and very little canopy cover. In a 1989-90 survey (USDA Forest Service 1990), Clear Creek was determined sensitive to acidification with a moderate amount of buffering capacity.

	Temperature (°F)	Turbidity (NTU)	DO (mg/l)	pH	Nitrate (ppm )	Total Coliform (Presence/Absence)	Discharge (cfs)
Clear Creek	55 degrees (water) 70 degrees (air)	2.55	9.0	8.1	0	Present	3.0
State Standard	68 degrees	25	10.0	6.6-8.8		100 colonies/100 mL Fecal Coliform	

## *Rio Puerco Watershed*

### **Rio Puerco**

#### *Fisheries*

##### *2001 - Headwaters*

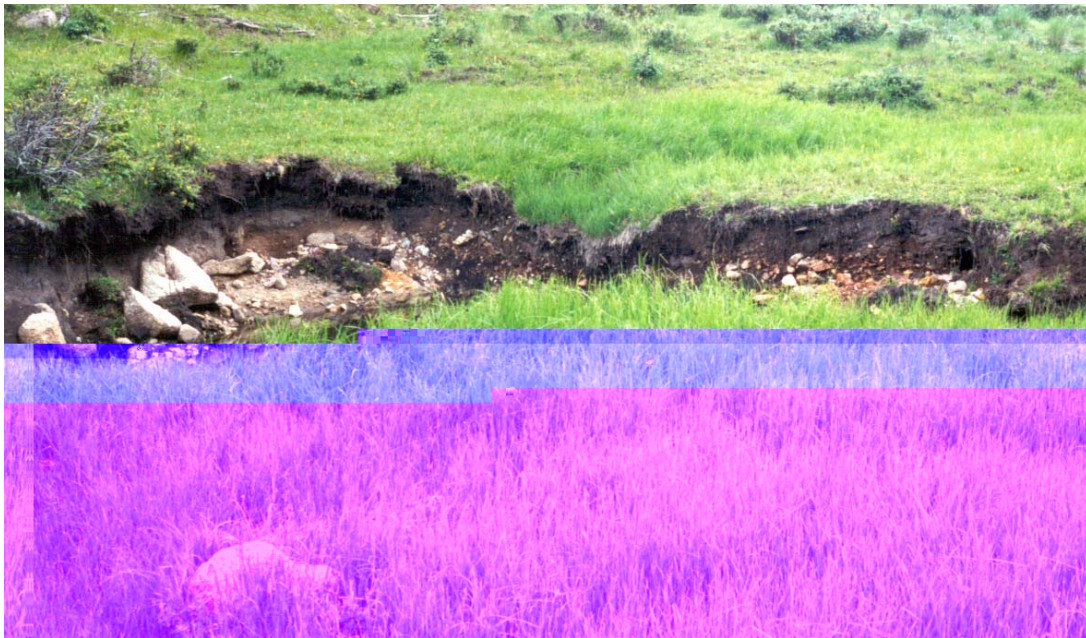
Surveyors: Sean Ferrell, Kristin Behrens

Fish Observed: Rio Grande cutthroat trout

July 10, 2001

Rio Puerco was surveyed 1000' downstream from the Anastacio Trail #435 stream crossing (T22N, R1E, Sec. 32 NW¼, 10,060' elevation) upstream to the seep source of the river in San Pedro Parks (T22N, R1E, Sec. 21 SE¼, 10,380' elevation).

Rio Puerco is noticeably dry in San Pedro Parks. This geologic feature is noted on the forest, wilderness and USGS map as a wetland. On the wilderness map (dated 1976), the wetland was specifically defined as a fishing area. In 2001, the meadow was dry and dominated by dry site species. Obviously, no fish were observed. Cinquefoil was observed throughout the meadow, which is an indicator of a meadow being converted from a wet to dry site. Large, longitudinal slumps were found in the former wetland. The slumps (or muddy trenches) in places were over 100 feet long, 12 feet across and had sunk over three feet (see Photo 17). This could possibly be explained by the conversion of a wetland to a hardened dry meadow. Wetland soil development is typically loose, fluffy and sponge-like. This creates a delicate, hummocky and seepy surface which when compacted can cause loss of soil percolation and the sponge effect, and most importantly, the loss of late summer water storage. Over time, the compaction will lead to this unique slumping in certain places where an underground channel had been. The soil compaction and loss of wetland is likely due to grazing impacts over the past century.



**Photo 17.** Rio Puerco at its headwater seep. Similar slumping is found in the dry meadow

The upper limit of Rio Grande cutthroat trout was observed approximately 500' downstream from where the channel leaves San Pedro Parks and the valley begins to confine. Wetland species are noted on the banks where groundwater seeps are recharging the stream channel, creating stagnant, disconnected pools. One stagnant pool had a baited minnow trap placed in it for seven hours. No biota was captured.



**Photo 18.** Upper limits of RGCT in Rio Puerco

Once the flow begins to connect pools, RGCT were observed. The uppermost pool is significantly deep (>3') and is quality overwintering habitat (see Photo 18). This pool and subsequent downstream pools were snorkeled, a distance of 150 feet (S. Ferrell, K. Behrens). The numbers relate to the uppermost pool.

Species	Sub-Adult (3<6")	Adult (6<9")	Lg Adult (9<12")
RGCT	0	1	1
10:30, 58°			

The pools below the upper limit pool were unpopulated unless they were significantly deep, providing winter habitat. The stream channel was entrenched running through a narrow meadow. Typical habitat was a series of pools connected by shallow, cobble riffles.

RGCT became abundant as the floodplain widened and opened up into a meadow. A series of seeps and springs began to provide ample recharge and flow to the stream. The open meadow is approximately 0.3 stream miles downstream from the upper limits and had three defined tributaries on the right bank (see map). All age classes of RGCT were noted, including fingerlings from last year's brood. In 2000, drought conditions peaked; leaving biologists concerned that fry survival rate was minimal. The abundance of fingerlings (2.5 to 3", 1 year-old fish) indicates that RGCT were able to spawn and rear successfully during drought conditions.

The small headwater tributaries with defined channels were surveyed to determine fish utilization. All tributaries between the upper limits and Cow Hump Creek were not occupied by RGCT, but our significant to recharging Rio Puerco with cool and clean water. Most tributaries' source water were wetlands.

**Stream and Tributary Temperatures\***

Rio Puerco below open meadow	12:50	51°
Tributary #1 (LB)	13:25	54°
Tributary #2 (LB)	14:05	55°
Rio Puerco @ T#2 Mouth	14:10	60°
Spring #1 (LB)	14:15	43°
Rio Puerco below Cow Hump	15:00	66°

Weather: Sunny

\*-see map for specific locations

The stretch of stream from the open meadow downstream to the mouth of Cow Hump Creek hosted a diverse age class of RGCT. Fish were also occupying riffle areas. Three large beaver dams (see Photo 19) stretched across the floodplain between T#1 and T#2.



**Photo 19.** Old beaver dam that once blocked Rio Puerco

The complex had blown out some time ago, but had left behind a rich riparian with tall grasses and sedges and resurgence of willow. This beaver dam was referred to in a 1974 survey as functional (Stork and McInnis 1974). Beaver, willow and aspen were observed as dominant fixtures in San Pedro Parks in the early 50's (FS Files). Since introduction of fire suppression and extensive livestock grazing, the ecosystem has evolved to a thick conifer forest encroaching on riparian meadows. The 1974 survey also noted some loss of undercut banks from grazing.

Cow Hump Creek provides 30% of the flow to Rio Puerco. Downstream from the confluence, population density of RGCT increases exponentially. A snorkel survey was conducted approximately 700' downstream from the confluence. The survey was not done to tabulate population or age class distribution; rather, it was conducted to watch how various age classes are interacting with their habitat.

The survey was done in an open meadow where the stream meanders, forming long pools with undercut banks. In addition, there were short pools created by large substrate as well as short cobble and boulder-dominated riffles. Riffles were typically unoccupied. Short pools were also unoccupied. If occupied, there would only be one fish. Long pools averaged 15 to 20 feet in length and 3 to 4 feet in width with residual depth greater than 1 foot. At the deepest scour, pools exceeded 24 to 30 inches in depth. This habitat type seemed very critical. All age classes occupied the long pools and did not seem to discern between each other. Each age class interacted with the other with little competition. The long pools would be occupied by 20 to 50 RGCT, including half dozen large adults. Past population surveys in this reach of Rio Puerco estimated 2,384 RGCT per stream mile. While a population survey was not conducted in 2001, this number seemed intact. The system shows evidence of being highly productive, housing a dense population despite its small volume. Rio Puerco is a significantly important stronghold of RGCT in the Jemez Mountains and should be monitored and protected.

### ***2002 – Camp Zia near wilderness***

Surveyors: Sean Ferrell, James Simino, Jim Eaton

Fish Observed: Rio Grande cutthroat trout

July 18, 2002

Rio Puerco flows through the community of Cuba where it puddles up and becomes a dry arroyo with subterranean flow. Historical data and old fishing stories detail accounts of Rio Grande cutthroat trout being captured in Cuba, most recently within the last decade. Rio Puerco is protected from large development as it leaves San Pedro Parks Wilderness due to steep unstable ground and extreme flow conditions. Despite the rugged ground, three irrigation diversions (all in disrepair) are located along Rio Puerco upstream from Camp Zia.

The survey team entered this area to determine if RGCT were still persisting in this lower section and to make certain no other species had been introduced.

The team walked approximately 1.0 mile of stream length from the Liva Lucero property (T21N, R1W, Sec. 14, elev. 7600') upstream to below the first main tributary above Camp Zia (T21N, R1W, Sec. 13, elev. 8100'). The conclusion of the survey was 5 miles downstream from the lowest part of the 2001 survey.

Rio Puerco is a Rosgen Stream Type "A" that witnesses heavy bedload movement due to its large basin size and available source material. Debris and boulder deposition was noted high on the first floodplain terrace accentuated with large log jams in the stream and naturally eroding cutbanks.



**Photo 20.** Typical habitat in Rio Puerco upstream from Camp Zia (18 July 2002).

Jim Eaton noted that he had been fishing these waters for the last twelve years and only caught RGCT (personal communication, 2002). S. Ferrell snorkeled the final 400 feet of the survey length above and below a 5-foot waterfall through boulder-formed cascade pools and found only RGCT (see Photo 20).

<b>Species</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>	<b>Lg Adult (9&lt;12")</b>
RGCT	8	5	1
13:40, 59°, Sunny			
15:10, 57°, Windy and Rain			

One sub-adult RGCT was noted to have a fungal growth on the dorsal fin, much like what has been seen in Rio de las Vacas and Cecilia Creek. Its coloration was pale while all other fish had dark coloration to blend in with the substrate. Despite the dynamic

quality habitat, fish density was sparse possibly due to low flow conditions and the unstable nature and bedload movement in this reach of Rio Puerco. On average, there were 0 to 5 fish per quality pool, significantly less from the headwater section.

The whole length from Camp Zia to the headwaters should be mapped for fish density. Permanent snorkeling transects should be established to monitor population fluctuations.

***Arizona Willow***

July 2001

Rio Puerco was surveyed for Arizona willow from the headwaters downstream to its confluence with Los Pinos. Two new populations were reported. The first had at least three base stems growing directly out of the stream bank. The second was approximately ½ mile further down stream also growing directly adjacent to flowing water. Both populations were low growing, partially covered by sedges and/or Bebb’s willow and showed no sign of being browsed.

Several additional populations from the 1997 and 1998 surveys were re-located along Rio Puerco and small stringer meadows leading into the stream. One of the populations in particular covers an extensive area dotted throughout a three-acre meadow. The plants grow as isolated stems, or in groups of 20-30. All the plants are low growing; many of the stems appear older based on thickness and dark grayish color.

***Water Quality***

Surveyors: A.Jaramillo, M.Vogt  
8/22/2001  
13:36

The site selected for Rio Puerco (Site #3 on map) was located in an area with no canopy cover. The stream at this location had an average width of 2.0 ft and an average depth of 0.6 ft. The banks in this segment were unstable, and evidence of cattle activity present at this site. Mid channel bar, indicative of heavy sediment load. Note: Water quality at this site was in compliance with State Standards; with the exception of DO which was slightly lower than the state standard. This may be attributed to very little canopy cover and time of day sample was taken.

In a 1989-90 survey (USDA Forest Service 1990), Rio Puerco was determined well-buffered from acidification.

	Temperature (°F)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	pH	Nitrate (ppm )	Total Coliform (Presence/Absence)	Discharge (cfs)
Rio Puerco	58 degrees (water) 70 degrees (air)	2.33	9.0	7.3	0	Present	2.0
State Standard	68 degrees	25	10.0	6.6-8.8		100 colonies/100 mL Fecal Coliform	





**Photo 21** Site #3: Rio Puerco segment sampled for water quality. (13S 0334106, 3997584) Note: Unstable banks. Point bar (in foreground) is indicative of increased sediment load. Stream is not able to transport high sediment load.



**Photo 22.** Site #3: Up close view of point bar from previous photo (Rio Puerco). Stream is embedded with fine sand and silt. Fish were present in this stream.

## “Cow Hump” Creek

*(unnamed tributary to Rio Puerco that follows Anastacio Trail)*

### ***Fisheries***

Surveyors: Katrina Lund, Damon Goodman, Ranee Onstott

Fish Observed: Rio Grande cutthroat trout

July 11, 2001



**Photo 23.** Typical deep pool formation in lower reach of Cow Hump Creek

“Cow Hump” Creek was surveyed from the confluence with Rio Puerco to the headwaters (approximately 1.13 miles). The stream meanders through a meadow with many horseshoe-shaped bends (E Rosgen stream channel type) (see Photo 24). Many seeps were present throughout the meadow.



**Photo 24.** Meander that characterizes the lower reach of Cow Hump Creek

Near the mouth, stream habitat appeared to be in good condition and few signs of cattle damage were observed. Banks were stabilized by grasses and the stream had many undercut banks and deep pools (see Photo 23).

A large RGCT population resides in Cow Hump Creek and surveyors observed more adults than juveniles. The upper limit of fish was approximately 0.38 miles from the mouth where the stream was becoming a series of isolated pools with high quantities of algae. Surveyors noted that the color of algae was changing as they moved upstream: green with patches of red downstream of upper fish limit, and becoming reddish-orange algae upstream. Snorkeling was difficult due to low visibility associated with thick algal growths, undercut banks, and deep pools.

Several hundred feet upstream of the upper limit of fish, the main channel of “Cow Hump” Creek becomes a series of seeps. This section of the meadow has no distinct flowing water but there are signs of previous channels (i.e. cut-banks). Evidence of cattle activity was present in this area with dried up cow pies near the stream and a small area of previous trampling.

**Stream Temperatures\***

Upper Limit of RGCT	13:45	47°F	(air 90°F)
Mouth	12:10	53°F	

Weather: Partly Cloudy

\*-see map for specific locations

**Arizona Willow**

No surveys were conducted in 2000 and 2001. Future surveys should be conducted to locate populations.

**Water Quality**

Surveyors: A.Jaramillo, M.Vogt

August 22,2001

11:18 am

The site selected for Cow Hump Creek (Site #2 on map) was located in an area with no canopy cover. The stream at this location had an average width of 2.0 ft and an average depth of 0.5 ft. The banks in this segment were in good condition, not too much significant bank instability. Arizona willow enclosure was present on the right bank. Note: Water quality at this site was in compliance with State Standards; with the exception of DO which was slightly lower than the state standard. This may be attributed to no canopy cover at location.

	Temperature (°F)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	pH	Nitrate (ppm )	Total Coliform (Presence/Absence)	Discharge (cfs)
Cow Hump Creek	57 degrees (water) 61 degrees (air)	3.92	8.0	7.1	1	Present	1.5
State Standard	68 degrees	25	10.0	6.6-8.8		100 colonies/100 mL Fecal Coliform	



**Photo 25.** Site #2: Cow Hump Creek. Trail 435 marker in background. Water quality sampled at this location. Arizona willow exclosure to right in background. (13 S 0332577, 3996369).

## Cañon Madera

### *Fisheries*

#### *2001 – Headwaters*

Surveyors: Sean Ferrell, Kristin Behrens

Fish Observed: None

July 11, 2001

No fish were observed from the headwater seep in the wet meadows down to the wilderness boundary. The survey concluded that there is a series of migration barriers from the wilderness boundary downstream to somewhere near the mouth with La Jara Creek. The lower portion outside of the wilderness needs to be surveyed to determine if fish are present. This area receives little grazing pressure due to topography. The headwater source receives the heaviest grazing.

The tributary that meets with Cañon Madera as it turns northwest near the wilderness boundary provides 30% of the flow (see map).

#### **Stream and Tributary Temperatures\***

Cañon Madera above main trib	15:00	52°
Main Trib	15:00	50°
Cañon Madera below main trib	15:00	52°

Weather: Increasing clouds

\*-see map for specific locations



**Photo 26.** Cañon Madera near wilderness boundary

### ***2002 – Mouth***

Surveyors: Sean Ferrell, James Simino

Fish Observed: None

July 17, 2002

A seep was located at the mouth of Cañon Madera, but the survey noted only a dry channel upstream from that. Approximately 0.2 miles was surveyed. The dry channel had a defined scour with large substrate. The riparian was dominated by alder, cottonwood and wet site species common to the temperate rainforest in the Pacific Northwest.

Due to the drought condition anomaly, future surveys should be conducted from the mouth to the wilderness boundary to determine if the stream supports fish.

### ***Arizona Willow***

#### July 2001

Cañon Madera was surveyed from the headwaters, down stream approximately one and one half miles to where the canyon narrows and the grade starts to drop off considerably. Atwood's original Arizona willow population was re-located on the eastern end of Cañon Madera. The willows are growing in a wet meadow with water flowing through small

seeps or springs covering a 400-foot square area. The plants are slightly browsed, and there is ample evidence of recent cows in the area.



**Photo 27.** Arizona willow habitat along Cañon Madera (July 2001).

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **La Jara Creek**

### ***Fisheries***

Surveyors: Sean Ferrell, James Simino

Fish Observed: Rio Grande cutthroat trout

Date: July 17, 2002

La Jara Creek was surveyed from the confluence with Cañon Madera near the end of FS Road 28 (T22N, R1W, Sec. 13 SW $\frac{1}{4}$ , elev. 8240') upstream 1.5 miles and beyond the

limits of fish presence and ¼-mile below the forks confluence (T22N, R1E, Sec. 19 NE¼ of the NW¼, elev. 9350’).

La Jara Creek is classified as a Rosgen Stream Type “A” channel with loose substrate. The Nacimiento Uplift defines the eastern watershed boundary of La Jara Creek (Larry Gore, personal communication, 2002). This uplift has possibly catalyzed large bedload movement during spring run-off and other significant flow events. Large angular rock was common stream bottom substrate and was noticeably loose. Bedload movement in La Jara Creek is characterized by large depositional areas of cobble and gravel pinned at stream bends or the channel aggraded several feet at debris jams.



**Photo 28.** Boulder plunge barrier on La Jara Creek. No fish were found above this point (17 July 2002).

The high energy and unstable nature of the bedload may be a limiting factor to Rio Grande cutthroat trout distribution. It is likely that the upper limits are in a generalized area and will vary depending on annual bedload movement and temporary barrier formation. No permanent barriers were located, but at the time of the survey fish presence was terminated at a minimal boulder plunge approximately 0.3 miles below the wilderness boundary (see Photo 28). Large pool formation continued above the upper limits with adequate habitat for fish survival (see Photo 29). Snorkeling observations above fish presence noted abundant macroinvertebrate populations that were freely swimming without any threat from predators. The survey continued approximately 0.8 miles above the upper limits through a confined canyon.



**Photo 29.** Typical habitat above upper limits (17 July 2002).

La Jara Creek has a user-created trail that paralleled the length of the survey. The trail and area receives minimal use from recreators and cattle. FS Road 28 and its logging spurs cause the most resource damage to the system due to an infrequent maintenance schedule and poor drainage design. The district is currently exploring the possible closure and/or elimination of this road.

Pool formation, woody debris loading and other stream channel dynamics were prevalent and appeared to be a function of its remote location and the naturally unstable nature of the watershed. Unstable banks were common but were mostly related to natural conditions. A few unstable areas could be attributed to the user-created trail.

Three tributaries were noted during the survey. The first two were at the beginning of the survey, the second being a 10' long seep at the mouth of Cañon Madera. The final tributary was located beyond road's end and 500' downstream from a talus landslide depositional area. All tributaries were non-fish bearing and provided cool, clear water.

**Stream and Tributary Temperatures\***

Tributary #1 (RB)	10:00	50°
Madera Cañon seep (T#2)	09:40	48°
La Jara Creek above Madera	09:35	52°
La Jara Creek at Road's end	10:45	53°
Tributary #3 (LB)	11:15	50°
La Jara Creek at upper limits	12:20	54°
La Jara Creek below forks	15:05	57°

Weather: Sunny

\*-see map for specific locations



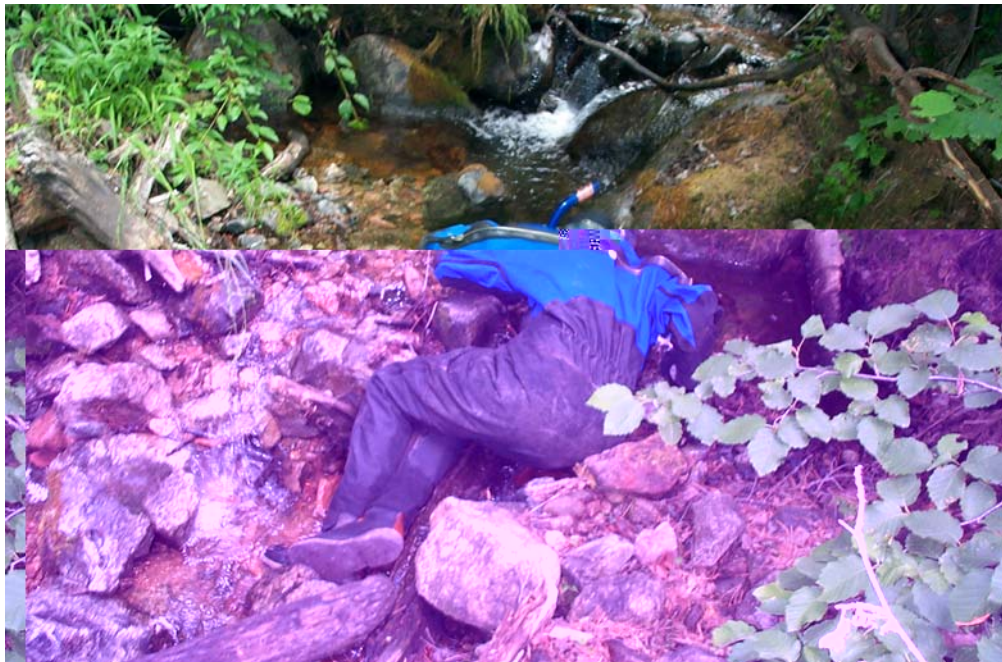
Surveyors observed fish through minnow trap deployment, spot snorkeling and visually from the bank.

Two minnow traps were deployed in quality pools near the confluence with Cañon Madera and the starting point of the survey. Trap #1 was placed 20' upstream from Madera while Trap #2 was placed approximately 600' upstream (100' downstream from FS Road 28's terminus). RGCT were observed throughout this section in quality pools.

Trap	Deployed	Retrieved	Coordinates (T,R,S, ft.)	Fish Captured
1	0935, 52°F	1645, 58°F	T22N, R1W, S13, 8250	1 – 6" RGCT
2	1045, 53°F	1630, 57°F	T22N, R1W, S13, 8320	1 – 4" RGCT

Snorkeling was conducted approximately 0.25 miles above the landslide depositional area as the gradient began to steepen. Spot snorkeling was conducted in quality pools. This snorkeling located the upper limits of RGCT distribution. General observations noted a very sparse population of fish, average 0 to 2 fish per quality pool. In addition to the 6 RGCT observed, 3 unidentified fish were also noted and were assumed to be RGCT (but are not included in the table as sizes were not obtained).

Species	Sub-Adult (3<6")	Adult (6<9")	Lg Adult (9<12")
RGCT 12:20, 54°	3	2	1



**Photo 30.** S. Ferrell snorkeling La Jara Creek. 6 RGCT were observed during spot snorkeling (17 July 2002).

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **Rito de los Pinos**

### ***Fisheries***

Surveyor: Sean Ferrell

Fish Observed: Rio Grande cutthroat trout, Eastern brook trout

Date: July 15, 2002

Rito de los Pinos was surveyed from its point of diversion into an irrigation ditch (T22N, R1W, Sec. 25/26 Boundary, elev. 8260') upstream to its terminus (T22N, R1E, Sec 31 NE ¼, elev. 10,000') approximately 2.3 miles.

The irrigation ditch diverts all the water (see Photo 31) for agricultural purposes to ranches outside of Cuba. There is no headgate or fish screen, which is allowing escapement of non-native brook trout from ranch ponds. Eastern brook trout were captured in minnow traps but not observed during snorkeling.

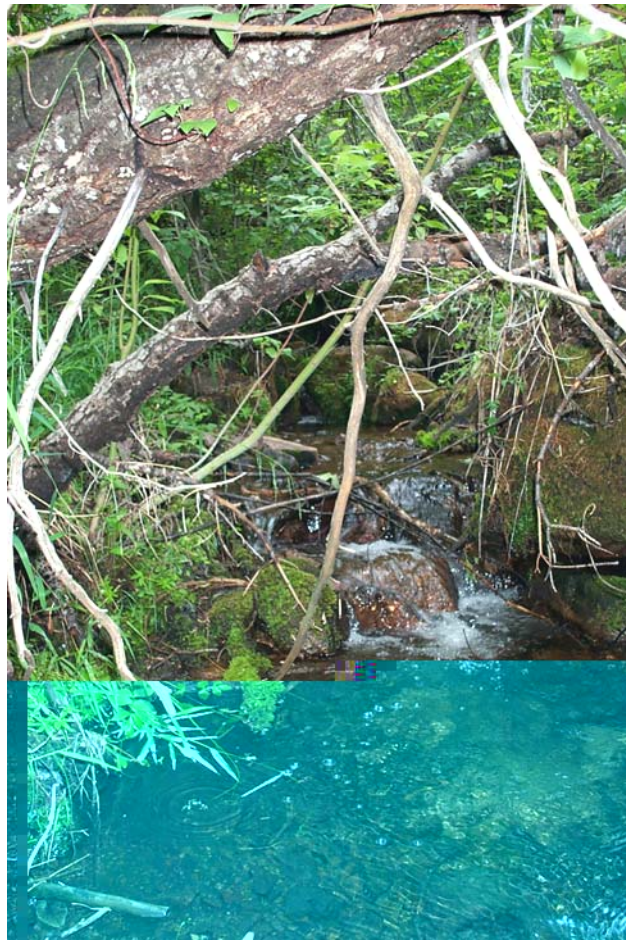


**Photo 31.** Rito de los Pinos is 100% diverted into this ditch,

the likely source of the brook trout invasion (15 July 2002).

Rito le los Pinos carves through a steep valley, noted as a Rosgen Stream Type “A”. The steep gradient and confined valley widens near the headwaters where the stream is formed by a series of seeps under the canopy of a spruce forest. The seep complex has been damaged by cattle grazing. A 1974 survey (Stork and McInnis 1974) noted that cattle grazing was “non-existent” on Rito de los Pinos from the wilderness boundary upstream one mile. Minimal cattle impacts were noted until the seepy area, which is beyond the fish-bearing portion of the stream.

Rito de los Pinos hosts fish nearly all the way to its terminus. Rio Grande cutthroat trout were observed within ¼-mile of the seep complex (T22N, R1E, Sec. 31 NW¼ of the NE¼ , elev. 9720’). A combination of low base flow, steep gradient and a series of three cobble cascades with no jump pool eliminates fish passage. After this point, the headwaters shortly begin, dividing up base flow to uninhabitable portions.



**Photo 32.** Typical habitat occupied solely by RGCT near wilderness boundary (16 July 2002).

FS Trail #46 parallels Rito de los Pinos for the duration, crossing the stream four times. The trail is used mostly by stock. Much of the resource damage, albeit minimum, to Pinos is related to the proximity of the trail.

Eight (8) tributaries were noted during the survey. Three tributaries were located outside the wilderness, the most significant located near the trailhead. This tributary (called T#1) provided 15% of the base flow and appeared to have an influence on the main stem temperature. The final non-wilderness tributary, T#3, contributed 10% of the flow. Five tributaries were located within the wilderness. Three were seepy complexes. The upper limits of RGCT distribution is located 300' upstream from Tributary #5B, which provided 5% of the flow. The final tributary, T#7, contributed 20% of the flow and was the beginning of the headwater seeps. All tributaries were non-fish bearing and provided cool, clear water. Main stem stream temperatures were consistently cool throughout survey area.

**Stream and Tributary Temperatures\***

Point of Diversion	08:45	52°
Rito de los Pinos below T#1	10:00	51.5°
Tributary #1(LB)	10:00	52°
Rito de los Pinos above T#1	10:00	51°
1 <sup>st</sup> Trail Xing, Minnow Trap #2	10:30	50°
Tributary #2 (seep, LB)	12:05	49°
Rito de los Pinos below T#3	13:00	53°
Tributary #3 (LB)	13:00	54°
Rito de los Pinos above T#3	13:00	53°
Rito de los Pinos seepy SC	13:25	52°
Tributary #4 (seep, LB)	13:40	56°
Tributary #5 (seep complex lower)	14:00	57°
Tributary #5 (seep complex upper)	14:00	53°
Tributary #5B (RB)	16:40	52.5°
Tributary #6 (seep, LB)	14:35	53°
Tributary #7 (LB)	14:45	55°
Rito de los Pinos, headwaters	15:50	48°

Weather: Sunny

\*-see map for specific locations

Fish were observed through minnow trap deployment, spot snorkeling and visually from the bank.

Two minnow traps were deployed overnight in the non-wilderness portion of the survey. Trap #1 was placed in the irrigation ditch immediately below the point of diversion (noted as a black flex pipe; see Photo 31). Sub-adult brook trout were observed in the pool below the flex pipe. Trap #2 was placed upstream from the first official trail crossing (Note: the trail does cross irrigation ditch). RGCT and eastern brook trout were noted from the point of diversion to the first trail crossing.

Trap	Deployed	Retrieved	Coordinates (T,R,S, ft.)	Fish Captured
1	1855, 54°F (15 July)	0845, 52°F (16 July)	T22N, R1W, S25/26, 8260	3 – 4" brook trout
2	1925, 53°F (15 July)	1720, 55°F (16 July)	T22N, R1W, S26, 8700	1 – 4" brook trout

Snorkeling took place around the 2<sup>nd</sup> trail crossing where a debris jam had been noted as a barrier to upstream migration for brook trout by past surveys (Y. Paroz, personal communication, 2002). The snorkeling transect was located several hundred feet upstream from Trap #2. Two sections were snorkeled. In a 100' section below the trail

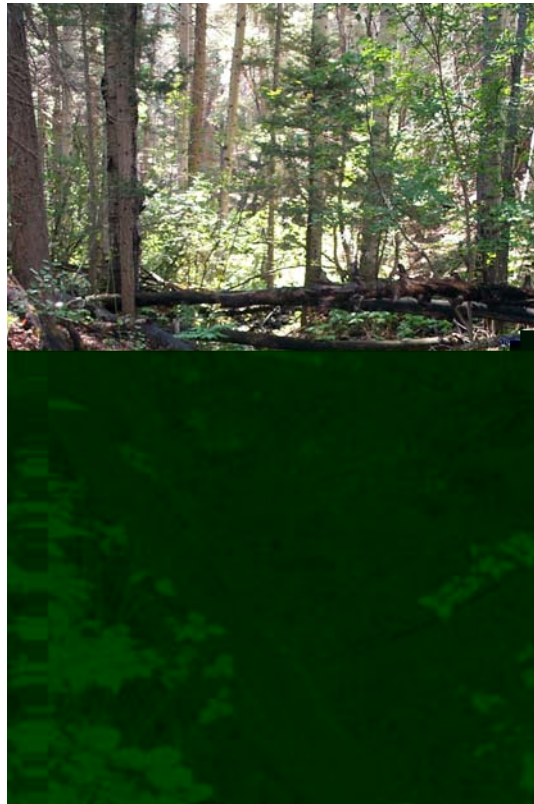
crossing, snorkeling took place in small habitat that had limited pool development, most of which were pocket pools, and tumbled through a steep grade. Only two fish were observed. An additional 150' were snorkeled above the trail crossing. Habitat improved with larger pool formations created by woody debris jams but was still relatively unproductive. The deepest pool was noted at approximately 15". Only 5 RGCT were observed. This very sparse population averaged 0 to 2 fish per pool.

Species	Sub-Adult (3<6")	Adult (6<9")	Lg Adult (9<12")
RGCT	6*	0	1

12:20, 54°

\* - 1 fish below the trail crossing was not identified but appeared to be RGCT

An intriguing fish behavior was witnessed while snorkeling. A 4" RGCT buried itself in pea-size gravel substrate when it became threatened by the snorkeler's approach. At first, the fish was spooked by a splash caused by snorkeler's hand, and it hid under a cobble alcove. In a short burst of two twitches, the fish was buried. All that could be seen was one eye.



**Photo 33.** Typical habitat upstream from trailhead occupied by RGCT and brook trout (16 July 2002).

Visual surveys for the remainder of the survey determined upper limits. Fish density continued to be low, but young-of-the year were noted, a positive sign despite the drought conditions. Large fish were also noted despite the small habitat. The last RGCT observed at the upper limit barrier was 7" in length.

Future surveys should monitor the infiltration of the brook trout population. Stream crossings should be improved to avoid stream widening.

### ***Arizona Willow***

#### September 2000

Two willow enclosures were re-visited along Rito de los Pinos; these populations were first identified by Atwood in 1997. The willows in the enclosures showed no signs of being browsed, stood up to five feet in height, and displayed new growth. Numerous cows were present in the meadow, and the vegetation surrounding the willow appeared significantly grazed. The enclosures are having a positive effect on the growth of the willows.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1989 survey (USDA Forest Service 1990), Rito de los Pinos was determined sensitive to acidification with a moderate amount of buffering capacity.

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## **Rito Leche**

### ***Fisheries***

No fisheries surveys were conducted. Although it is unlikely due to high gradient, surveys need to be conducted to determine if fish are present within the wilderness.

### ***Arizona Willow***

No surveys have been conducted. It is unlikely to be present due to steep terrain but should be investigated to confirm.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **San Jose Creek**

### ***Fisheries***

No fisheries surveys were conducted. Although it is unlikely due to high gradient, surveys need to be conducted to determine if fish are present within the wilderness.

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## *Chama Watershed*

### **Rio Gallina**

#### *Fisheries*

##### *2001 – Upper Gallina*

Surveyors: Katrina Lund, Damon Goodman, Rane Onstott

Fish Observed: None

July 10, 2001

Weather: Overcast

Approximately 3 miles of Rio Gallina was surveyed from its source downstream through steep terrain and ended at a tributary north of Cave Creek. The upper section of the Rio Gallina is mostly dry with occasional areas of flowing water. Once water is flowing consistently, the channel is slightly incised and down cut (see Photo 34). The stream quickly becomes an A channel that is confined in a steep canyon with boulder dominated substrate and plentiful large woody debris (see Photo 35). Progressing downstream, Rio Gallina has a reach with numerous possible barriers. Most have been created by large woody debris capturing large boulders. Some change the elevation of the stream by as much as 8 feet.

No fish were found during the 2001 survey of upper Rio Gallina. A minnow trap was placed in Rio Gallina approximately 150 feet downstream from the first tributary/spring that enters the main channel from the east. The trap was placed in the first perennial pool and no biota was found. It is suspected that a barrier is present somewhere upstream of the wilderness boundary and downstream of where the survey ended.



**Photo 34.** Typical habitat in Rio Gallina through "A" Rosgen Stream Type (July 2001)





**Photo 35.** Steep gradient and large woody debris creates complex habitat through Rio Gallina canyon.

**Stream Temperatures\***

Spring source	11:45	44°F
Minnow Trap	11:55	46°F
Minnow Trap	16:15	48°F
End of Survey	15:00	52°F

Weather: Overcast

\*-see map for specific locations

A survey in August 1978 conducted by USFS and NMG&F found only rainbow trout at the wilderness boundary, but recommendations made note that “a barrier will be required below the wilderness boundary to prevent upstream migration of stocked rainbows.”

In July 2001, snorkel surveys were conducted near the wilderness boundary. The snorkel survey was performed by J. Simino, M. Vogt and D. Goodman from the FS Road 76 to the wilderness boundary, covering 1.5 miles of stream. Stocker rainbows were found as well as possibly a few remaining RGCT mixed with cutbow hybrids. A pure population of RGCT is likely extirpated. Genetic sampling needs to be conducted to determine genetic viability of RGCT. The high numbers of rainbow trout were mostly concentrated around the area where the state stocks hatchery rainbows.

Species	Juvenile (<3")	Sub-Adult (3<6")	Adult (6<9")	Lg Adult (9<12")	Big Fatties (>12")
RGCT	3	5	2	0	0
Rainbow Trout	108	74	31	20	4
Cut/bow Hybrid	1	2	2	0	0
Unknown Trout	1	3	1	1	0

Start: 11:45, 51°F, air 74°F, weather: sunny; water clarity to 5'

End: 15:30, 55°F, air 84°F, weather: partly cloudy

## **2002 – Lower Gallina**

Surveyors: Damon Goodman, Sarah Eddy

Fish Observed: Rainbow Trout

July 15-16, 2002

Weather: Sunny with afternoon showers

Approximately 2.5 miles of the Rio Gallina was surveyed from the beginning of Forest Service Trail 12 (T23N, R1E, Sec. 33, elev. 8300') near the wilderness boundary moving upstream and ending 0.7 miles above the confluence with Cave Creek (T22N, R1E, R1E, Sec. 9/16 boundary, elev. 9560'), tying in with the conclusion of the 2001 survey.

Rio Gallina cuts through a “U-shaped” canyon with alternating wide and narrow sections. In the lower reaches, the channel contains areas of undercut banks as well as erosion from cattle access trails. Upstream, the river becomes increasingly steep with numerous large woody debris jams and decreasing flow. In the last reach of the survey, the channel becomes a complex of highly braided secondary channels with little to no flow. Five tributaries were observed: 3 were streams (two contributed 10% of flow; Cave Creek contributed 15%); and two were springs. There was one dry tributary.



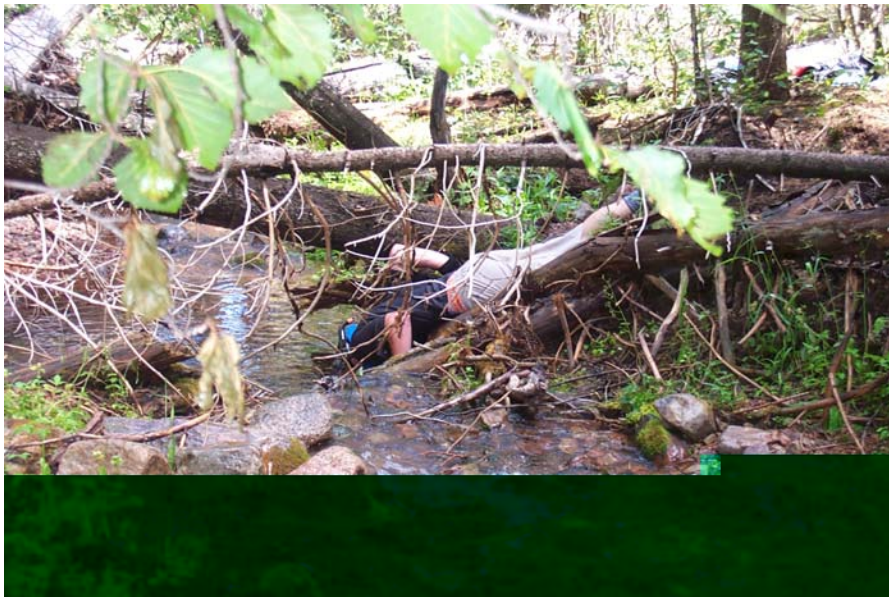
**Photo 36.** Minnow trap 1 on Rio Gallina above end of FS Road 14. Two juvenile and one sub-adult rainbow trout were found in the trap (16:30 July 15 through 8:45 July 16, 2002).

Rainbow trout were the only fish observed in the 2002 Rio Gallina survey. One minnow trap was placed in a pool (see Photo 35) at the beginning of the survey just above the end of FS Road 14 (T23N, R1E, Sec. 33, elev. 8300'). The trap was placed at 16:30 July 15<sup>th</sup>, 2002 and retrieved at 08:45 on July 16<sup>th</sup>. Three rainbow trout were found in the trap (see Table 5).

**Table 5.** Summary of fish population survey on the Rio Gallina, July 15<sup>th</sup>–16<sup>th</sup> 2002 (see map for GPS locations).

Survey Method	Time	Temperature (°F)	Fish: Rainbow Trout		
			Juvenile	Sub-adult	Adult
Minnow Trap 1	16:30-08:45	50° at 08:45	2	1	0
Snorkel Pool 1	10:08	49°	2	3	0
Snorkel Pool 2	N/A	48°	0	1	0
Snorkel Pool 3	11:10	47°	4	22	0
Snorkel Pool 4	12:08	49°	4	3	1
Snorkel Pool 5	13:23	50°	3	6	0
Snorkel Pool 6	14:10	51°	5	6	0
<b>Total Fish</b>			<b>20</b>	<b>41</b>	<b>1</b>

Upstream from the minnow trap, fisheries populations were surveyed by spot snorkeling pools where fish were seen or suspected (see Photo 37). Six pools were snorkeled finding only rainbow trout ranging in size from juvenile to adult (see Table 1). Approximately 0.5 miles above the confluence with Cave Creek the last fish was observed (T22, R1E, Sec 9 NE¼, elev. 9350'). At this point in the survey, substrate size increased. In addition, gradient increased to a point at which it became inhabitable to fish. The survey continued for an additional 1000' but did not see fish.



**Photo 37.** D. Goodman spot snorkeling under large woody debris in Pool 3 on Rio Gallina. Twenty-six rainbow trout were observed in Pool 3 (16 July 2002).

Some cattle impacts were witnessed in the 2002 Rio Gallina survey. Cattle trailing to access water was the most common impact caused in the riparian zone. Grazing impacts include increased stream sedimentation and decreased shading, negatively affecting the fisheries habitat of Rio Gallina. Similar cattle impacts were noted on tributaries to the Gallina (see Photo 39). Heavy traffic on these tributaries contributes to increased sediment content of Rio Gallina.



**Photo 38.** Typical habitat along Rio Gallina. Note: the density of the large woody debris component (16 July 2004).

A previous survey of Rio Gallina conducted by Katrina Lund, Damon Goodman and Raneé Onstott on July 2001 found no fish in the upper reaches. The river becomes increasingly steep with multiple wood-created barriers near the headwaters. The July 2001 survey was conducted from the headwaters down ending at the upper limit of the July 2002 survey.



**Photo 39.** Cattle trailing through a streamside seep has caused an increase in sedimentation to Rio Gallina (16 July 2002).

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1990 survey (USDA Forest Service 1990), upper Rio Gallina was determined to be well-buffered from acidification.

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## **Clear Creek de Gallina**

### ***Fisheries***

No fisheries surveys were conducted. Surveys need to be conducted to determine if fish are present.

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **Dove Creek**

### ***Fisheries***

Surveyors: Damon Goodman, Sarah Eddy

Fish Observed: None

July 15, 2002

Weather: Overcast

The survey of Dove Creek began at the confluence with Rio Gallina (T23N, R1E, Sec. 33, elev. 8300') and working upstream and ended below the wilderness boundary approximately .25 mi upstream (T22N, R1E, Sec. 4, elev. 8500'). The geomorphology of Dove Creek alternated between a steep "v-notch" canyon and open meadow. Very little human use was observed while heavy cattle use was noted.

The mouth of Dove Creek was completely dry, with no isolated pools. The dry condition was probably due to the drought conditions in New Mexico during the winter and spring of 2002. Upstream from the mouth, low flow conditions in Dove Creek made the creek uninhabitable to fish. Stream substrate was dominated by sediment, possibly due to heavy grazing impacts that dominated the upper reaches of the survey (see Photo 40). Temperatures varied between 57-62°F in Dove Creek. Continuing upstream, the low flow condition did not change, with too little water to support a fisheries population. Another more intensive survey should be conducted during wetter times to determine if creek is utilized by fish.



**Photo 40.** Cattle damage due to grazing and trailing in the upper riparian zone of Dove Creek (15 July 2002).

Reduction in cattle access to the stream would improve stream habitat and riparian condition. This could be accomplished by re-assessing timing, intensity and a deferred rotation as well as possible riparian exclosures.

### ***Arizona Willow***

No surveys have been conducted. It is unlikely to be present due to steep terrain but should be investigated to confirm.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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## **Cave Creek**

### ***Fisheries***

Surveyors: Damon Goodman, Sarah Eddy

Fish Observed: Rainbow trout (observed but not confirmed to species)

July 16, 2002

Weather: Sunny with afternoon showers

A short section of Cave Creek was surveyed from the confluence with Rio Gallina upstream approximately 1000'. Cave Creek contributes 15% of the flow to Rio Gallina and steeply climbs accentuated by high gradient cascades, riffles and step pools, eliminating fish presence after the first 500 feet of stream. One sub-adult was observed in the first pool. A follow-up survey is needed to confirm the species. It is assumed that Cave Creek is occupied by fish recruited from Rio Gallina, which is occupied by introduced rainbow trout.



**Photo 41.** Typical riffle habitat in Cave Creek. Note: moss along stream's margin and covering substrate (16 July 2002).

The team noted a high content of woody debris during their survey. The stream was well intact with heavy concentrations of moss on the banks and stream substrate (see Photo 41). Much of the substrate comprised of gravel and cobble. A single stream temperature reading was taken, 46°F (12:20 on 16 July 2002). The high gradient system created naturally unstable banks in some areas but some cattle trailing was noted.

### ***Arizona Willow***

No surveys have been conducted. It is unlikely to be present due to steep terrain but should be investigated to confirm.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1990 survey (USDA Forest Service 1990), a tributary to Cave Creek was determined sensitive to acidification with a moderate amount of buffering capacity.

## Capulin Creek

### *Fisheries*

#### *2001 – Upper Capulin*

Surveyors: James Simino, Megan Vogt

Fish Observed: None

July 10, 2001

Capulin Creek is located in the northeast quarter of San Pedro Parks Wilderness. Surveyors accessed the area via the Continental Divide Trail. The watershed is mostly comprised of a mixed conifer forest with occasional patches of aspen. The upper part of the watershed is extremely steep. There was some evidence of fire history in this area, as charcoal was noted mixed in with the forest litter.

The creek was mostly dry in the upper section, Reach 1. There were some visible seeps and wet areas, but the majority of these didn't amount to sustainable flow. The stream channel in the dry upper section was primarily an "Aa+" Rosgen Stream Type. There was no water in this reach; thus no fish were found.

After hiking down Reach 1 for approximately 0.75 miles, running water began to emerge (see map). Once the water began to pick up, Reach 2, the gradient decreased and the channel became more of an "A" Rosgen Stream Type. Reach 2 mostly ran through small grassy, meadow areas and some conifer forest. There were several bedrock chutes that were approximately 50 feet long and were fish barriers. There was some large woody debris found, creating high quality habitat with large deep pools and cover. No fish were found in this reach. There were some aquatic invertebrates present in this section. Caddisfly larvae were observed as well as some adult mayflies. The water was clear with no turbidity.

Reach 3 was characterized by a slight decrease in gradient, forming more of a "B" Rosgen Stream Type (see map). The amount of instream flow increased with the majority flowing through a conifer forest. Blowdown was prevalent, which resulted in high amounts of large woody debris in the stream. This created excellent fish habitat; although, no fish were found.

Reach 3 had evidence of cattle grazing but did not appear to have a detrimental effect on the riparian habitat or the stream banks. Very little forage was available, but there were defined cattle paths as well as cattle excrement found in the riparian areas.

Reach 4 ran through a very steep canyon area where the gradient increased. This area was inaccessible due to steep canyon walls.

After the small canyon reach, Reach 5 was quite similar to Reach 3. Blowdown continued to dominate the landscape, providing large woody debris and creating excellent fish habitat. No fish were seen. The survey was concluded approximately 1.3 miles upstream from the wilderness boundary.



### **Stream Temperatures\***

Reach 2 13:45 54°F

\*-see map for specific location

A survey conducted in August 1978 by USFS and NMG&F concluded that there is “insufficient flow to maintain” a fish population.

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### ***2002 – Lower Capulin***

Surveyors: Damon Goodman, Sarah Eddy

Fish Observed: Rainbow Trout, Cutthroat Trout and Rio Grande Cutthroat Trout

July 17 to 18, 2002

Weather: Sunny with afternoon thundershowers

Approximately 1.5 miles of Capulin Creek was surveyed from near the intersection of FS Road 1161 and 163A (T23N, R1E, Sec. 27, elev. 8240') up to downstream of the first tributary on the USGS Quadrangle Map (T23, R1E, Sec. 34, elev. 8750').



**Photo 42.** Sarah Eddy with a pool on the lower Capulin Creek. Slumping banks and low grass height are due to intense grazing. Pool substrate is 100% sediment. Two sub-adult rainbow trout were observed in the pool (17 July 2002)

The lower section of Capulin Creek is a highly sinuous open valley system. The team called the open valley system “Reach 1.” Reach 1 contains a sediment-dominated substrate (approximately 90% sediment) with sparse alder riparian vegetation (see Photo 42). Progressing upstream the stream enters a canyon-type system, called Reach 2. Riparian vegetation, large woody debris content, and stream gradient increased within the canyon and substrate shifted to dominant gravel and cobble substrate composition. Upstream from Reach 2, the geomorphology mixes between steep “v-notch” canyons and sinuous valley systems, forming Reach 3. The steep canyon sections of Reach 3 are dominated by high concentrations of conifer and alder riparian vegetation and plunge-pool habitat types (see Photo 43). The open valley systems of Reach 3 contain a

decreased gradient, multiple secondary channels and debris jams. The riparian vegetation is composed of willow and alder in the open valleys (see Photo 44).



**Photo 43.** Looking downstream on a typical canyon riffle in the upper reaches of Capulin.

Fish populations were surveyed with minnow traps, visual evaluations and spot snorkeling. Due to high sediment in the lower reaches of Capulin Creek, minnow traps were the key survey method (see Table 2). Minnow Trap #1 was set at the beginning of the survey in Reach 1 (see Photo 42). Trap #2 was placed upstream near the end of Reach 1 (see Photo 45). Trap #3 was set at the end of FS Road 163A in a boulder-formed logjam and Trap #4 was set below a logjam in a steep canyon section in Reach 2 (Photo 47). Visual surveying began in Reach 1 near minnow traps 1 and 2 (see Table 6). In the upper reaches of the Capulin survey, 3 more habitats were surveyed through both visual (Reach 3) and snorkeling (Reach 2) techniques.



**Photo 44.** S. Eddy with a typical open meadow system in the upper reaches of Capulin.  
 Note: Lack of woody riparian vegetation (17 July 2002).

Reach 1 were dominated by rainbow trout. Reach 2, above the end of FS Road 163A, more rainbow trout were observed (see Photo 45). Above Minnow Trap #4, rainbow trout were observed with cutthroat trout characteristics (possible cutbows). The fish exhibited spotting throughout (rainbow trout characteristic), with larger spot size and pattern (cutthroat trout-type). At the upper limits of the survey in Reach 3, Rio Grande cutthroat trout (RGCT) characteristics were observed on all fish.

**Table 6.** Minnow traps set in Capulin Creek between July 17-18, 2002.

Trap	Reach	Temperature (°F)/Time	Time	Coordinates (T,R,S, ft.)	Fish: Rainbow Trout
1	1	68/17:32	17:32-18:10	T23N, R1E, S27, 8240	0
2	1	62/18:10	18:15-08:55	T23N, R1E, S27, 8260	2 Juvenile
3	2	57/10:10	16:30-10:10	T23N, R1E, S34, 8400	1 Sub-Adult
4	2	57/10:50	10:48-14:30	T23N, R1E, S34, 8500	0



**Photo 45.** Naturalized rainbow trout in Capulin Creek captured by minnow trap (18 July 2002).

**Table 7.** Visual survey of Capulin Creek fisheries populations (All survey areas are mapped with GPS)

Area	Reach	Survey Method	Fish Species and Size			
			Rainbow	Cutbow	RGCT	Unknown
Beginning of Survey	1	Visual	7 Juvenile	0	0	0
Pool near end of FR 163A	2	Snorkel	0	0	0	1 Sub-Adult 1 Juvenile
Above Minnow Trap 4	3	Visual	0	1 Adult 4 Juvenile	0	2 Sub-Adult
Near upper limit of survey	3	Visual	0	0	1 Sub-adult 2 Juvenile	0

No fish passage barrier was observed between the rainbow trout/cutbow and the RGCT population. The lack of distinct barrier creates the possibility that the RGCT population is not a genetically pure population and has hybridized with rainbow trout. Genetic testing is necessary to identify the purity of this population of RGCT.



**Photo 47.** S. Eddy with Trap #2 at the end of Reach 1 on Capulin Creek. Two juvenile rainbow trout were found in the trap but 10 additional fish were observed in the pool upon collection (17 July 2002).

Reach 1 was heavily impacted by recreational use and grazing. FS Road 1161 parallels Capulin Creek with multiple spurs creating recreation access to the creek. One user created spur (possibly more) of FS Road 1161 crosses Capulin Creek creating bank erosion, increasing sediment content and increasing wetted width (See Photo 47). Heavy cattle impacts were also affecting stream and riparian habitat (see Photos 42, 44 and 48). Intensive grazing produced bank instability and increased sediment loading in Reach 1. Reaches 2 and 3 showed impacts from grazing with bank slumping and other types of erosion. The upper reaches were much less affected by grazing compared to Reach 1.



**Photo 47.** A user-created spur from FS Road 1161 increases the wetted width as well as erodes the banks increasing the already sediment-dominated substrate (17 July 2002).



**Photo 48.** Bank instability on Capulin Creek caused by heavy grazing and recreation on a spur of FS Road 1161 (17 July 2002).

Although there are multiple attempts to close FS Road 1161, it is obvious that they are ineffective. Many signs of recent traffic and camping were observed along the road. A more secure method of road closure should be implemented to insure that this road is no longer used. A road closure sign should be placed at the entrance to the road to further

reinforce the closure. Eliminating vehicle recreation to this area would improve stream and riparian habitat conditions in lower Capulin Creek. Decreased grazing pressure would also improve stream and riparian condition. Riparian vegetation is lacking through much of the corridor. Through a deferred rotation, rest and/or a series of riparian exclosures, the riparian would be able to recover. Native willow planting could help contribute to the speed of recovery.

The 2001 Forest Service fisheries survey of Capulin Creek began at the headwaters and worked down to approximately 1.3 miles upstream of the wilderness boundary. This survey did not find any fish.

***Arizona Willow***

No surveys were conducted in 2000 and 2001. There is potential habitat in the “parks” area that should be investigated; otherwise, the terrain is too steep.

***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

**Cecilia Creek**

***Fisheries***

***2001 – Non-wilderness Cecilia (lower)***

Surveyor: Megan Vogt, Jose Marfin

Fish Observed: Rainbow trout, rainbow/cutthroat trout hybrids, brown trout  
June 27, 2001

The survey on Cecilia Creek started at the property line boundary and ended at the wilderness boundary, covering nearly 2 miles of stream. The beginning of the snorkel survey started in an exclosure. Cattle tracks and dung were observed within the exclosure, and the fence had been cut to allow cattle to access the riparian vegetation. The stream has high sedimentation. There were no pools present. The stream was characterized as one long riffle with some marginal pocket pools at best.

<b>Species</b>	<b>Juvenile (&lt;3”)</b>	<b>Sub-Adult (3&lt;6”)</b>	<b>Adult (6&lt;9”)</b>
Rainbow Trout	4	22	7
Cut/bow hybrid	0	6	0
Brown Trout	1	0	0

10:11, 54°F, air 66°F, weather: sunny to partly cloudy; water clarity is clear

***2002 - Wilderness Cecilia (upper)***

Surveyors: Damon Goodman, Sarah Eddy

Fish Observed: Rio Grande Cutthroat Trout  
July 16-17, 2002

Weather: Sunny with afternoon showers

Approximately ½-mile of Cecilia Creek was surveyed from the end of FS Road 171 (T23N, R1E, Sec. 36, elev. 8400') to the first mapped ephemeral tributary (T22N, R1E, Sec. 1, elev. 8800'). The short section of Cecilia Creek surveyed below the wilderness boundary contains very little flow with the occasional isolated pool. The creek is spread out between multiple secondary channels on a wide canyon floor. The canyon walls tighten upstream of the Wilderness Boundary Fence (T23N, R1E, Sec. 36 boundary with T22N, R1E, Sec. 1, elev. 8420'), creating a more defined, single channel and increasing flow (see Photo 49). Cecilia Creek is dominated by steep riffles connecting plunge-type pools, with a high concentration of large woody debris. At the upper limit of the survey, the canyon becomes extremely tight and the gradient increases significantly, creating multiple bedrock barriers to fish passage (see Photo 43). The survey continued above the barriers with no sign of fish, and ended at a tributary where the steep gradient and low flow made the stream uninhabitable to fish.



**Photo 49.** Looking upstream, a typical riffle-pool complex on Cecilia Creek above the Wilderness Boundary (17 July 2002).

RGCT were the only fish observed in Cecilia Creek. A total of 50 fish were observed and identified by trapping, visual and snorkel surveys (see Table 4). A minnow trap was set near the start of the survey in an isolated pool (T22N, R1E, Sec. 1, elev. 8450'). Despite an overnight deployment, no fish were caught in the minnow trap. Upstream from the minnow trap, where Cecilia Creek's flow increased, spot snorkeling protocol was used to survey for fish.



**Photo 50.** RGCT observed in Cecilia Creek above wilderness boundary (18 July 2002). Note: white fuzzy fungal growth on dorsal fin.



**Photo 51.** One of several bedrock fish passage barriers on Cecilia Creek (17 July 2002).

Above the Wilderness Boundary Fence multiple RGCT were observed (See Photo 50, Table 8). The larger RGCT observed in the first snorkeled pool contained fungus on dorsal and caudal fins, caused by stress related to high water temperatures and drought conditions (as noted in earlier surveys). The upper limit of fish was observed at a landslide caused by a cattle trail above Cecilia Creek, which dumped high amounts of



sediment and large woody debris into the stream (see Photo 53). Bedrock chutes were above this, which were likely barriers as well (see Photo 51). The survey continued for approximately 0.3 miles above the last observed fish.

**Table 8.** Survey methods and fish observed in the Cecilia Creek fisheries survey (July 16-17, 2002).

Survey Method	Fish: Rio Grande Cutthroat Trout		
	Juvenile	Sub-adult	Adult
Minnow Trap 1	2	1	0
Minnow Trap 2	0	0	0
Snorkel Pool 1	2	2	0
Visual Survey Up From Pool 1	9	6	0
Visual Survey Below Pool 1	19	8	1
Total Fish	32	17	1

**Table 9.** Water temperatures in Cecilia Creek from the fisheries survey (July 17, 2002). Temperatures arranged from lowest to highest elevation in Cecilia Creek.

Area in Cecilia Creek	Time	Water Temperature (°F)
Minnow Trap 1	10:26	50°
Wilderness Boundary Pool	14:45	57°
Wilderness Boundary Riffle	15:37	58°
Snorkel Section 1	11:00	51°
Minnow Trap 2	11:31	52°
Highest observed fish	14:25	58°
First fish passage barrier	11:53	53°
Top of survey	12:30	50°

A previous USDA Forest Service fisheries survey of Cecilia Creek on June 27, 2001 began at a property line boundary and ended at the wilderness boundary (where this survey began). The previous survey covered approximately 2 miles of the creek. Spot snorkel protocol was used to survey the fisheries population. Rainbow trout, cutthroat/rainbow hybrids, and brown trout were observed.



**Photo 52.** Sarah Eddy observed 4 Rio Grande Cutthroat Trout. White fungus from stressed conditions was found on several fins of the cutthroat in this pool (July 17<sup>th</sup>, 2002).

The findings of the previous survey along with the lack of a major fish passage barrier near the wilderness boundary compromises the cutthroat trout population in Cecilia Creek. Drought conditions combined with the low summer flows have created a temporary barrier near the wilderness boundary. The braided low flow and isolated pools at the time of survey made this section of the creek impassable to fish, but this barrier is temporary. This temporary barrier does not isolate RGCT from the other fish species found in the previous survey. Genetic testing is necessary to determine purity of RGCT in Cecilia Creek.



**Photo 53.** Cecilia Creek buried by a landslide caused by a cattle trail. No fish were observed above this landslide (July 17, 2002).

Cattle impacts were significant on Cecilia Creek. Cattle had numerous trails along and crossing the creek. Damage was most considerable on the steep canyon sides where cattle trails caused numerous landslides into the river. The largest landslide (see Photo 53) coincided with the highest observed fish in Cecilia Creek (possibly related to the large woody debris loading). It is possible that this landslide created a fish passage barrier but permanent barriers are located shortly upstream from this point.

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

## Oso Creek

### *Fisheries*

#### *2001 – Headwaters*

Surveyors: Mike Bassett, Renee West

Fish Observed: None

July 10, 2001

The headwater channel was dry (see map). The dry streambed had red algae growing on the rocks. No fish were found, or any section of creek with running water. Oso Creek is a tributary to Rito Resumidero, which has RGCT.

Oso Creek was surveyed in August 1978 by USFS and NMG&F. Peak flow events caused “severe scouring”. There was no mention of fish being observed but did recommend encouraging beaver populations to inhabit this area.

#### *2002 – Mouth*

Surveyor: Hugo A. Magaña and Amos Corrales

Fish observed: Rio Grande cutthroat trout

July 16, 2002

Oso Creek and Corralitos Creek converge to form Rito Resumidero. Oso Creek provides 100% of the flow during low flow conditions. Oso Creek was last surveyed in 1978 by USFS and NMG&F. At that time there was no mention of fish in Oso Creek, however, peak flow events had caused severe scouring. There was no evidence of scouring during the 2002 survey.



**Photo 54.** Typical pool formation associated with boulder cascades in Oso Creek (16 July 2002).

Oso Creek is separated from Rito Resumidero by a four-foot boulder plunge that likely prevents seasonal migration of RGCT. Oso Creek is characterized as a series of step pools separated by boulder cascades (see Photo 54). The first several pools contained no fish, however, subsequent pools had RGCT present. A total of 66 fish representing all ages were observed. Further surveys are needed to establish the upper limit of this creek.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>	<b>Lg Adult (9&lt;12")</b>
RGCT	27	19	15	5

09:30, 53°F, weather: sunny; water clarity to 6'

***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1990 survey (USDA Forest Service 1990), Oso Creek was determined very sensitive to acidification with a very little amount of buffering capacity.

**Corralitos Creek**

***Fisheries***

Surveyor: Hugo A. Magaña and Amos Corrales

Fish Observed: None

July 15, 2002

Corralitos Creek as dry at the confluence with Oso Creek. Water appeared approximately 600 feet upstream then disappeared again. There was a man-made diversion in Corralitos Creek approximately 300 feet upstream from confluence with Oso Creek. The diversion had been made with boulders and black plastic. It was unclear if this was a legal diversion or not. It is possible that water flows higher up the creek, but further surveys are needed to verify this.

Corralitos Creek was surveyed in August 1978 by USFS and NMG&F. The stream was dry at the time of the survey and is assumed to be non-fish bearing throughout the year (excluding the first 300 feet of stream which is occupied by RGCT).

***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

## Rito Resumidero

### *Fisheries*

#### **2001**

Surveyors: James Simino, Mike Bassett, Sean Ferrell, Katrina Lund

Fish Observed: Rio Grande cutthroat trout (rainbow trout below barrier)

September 6, 2001

No fisheries surveys were conducted inside the wilderness.

A snorkel survey began about a quarter mile above the Herrera Ditch. This Ditch is located approximately 0.5 miles below the wilderness boundary and withdraws all stream flow (see Photo 46). From the habitat containing the first observed fish (0.25 miles above point of diversion), J. Simino began snorkeling and continued up to the wilderness boundary. During the survey, all age classes of RGCT were observed.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>	<b>Lg Adult (9&lt;12")</b>
RGCT	20	20	13	2

12:45, 54°F, air 70°F, weather: sunny; water clarity to 5'

Rainbow trout were observed by a spot snorkel survey conducted by S. Ferrell below Resumidero Falls at the confluence with Rito Redondo (outside of San Pedro Parks Wilderness). Rito Resumidero is recharged by a spring 0.1 miles above the falls.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>	<b>Lg Adult (9&lt;12")</b>	<b>Big Fatty (&gt;12")</b>
Unknown Trout	2	0	7	0	1
Rainbow Trout	1	6	1	0	0

15:30, 57°F, water clarity was cloudy (2 feet)

#### **2002**

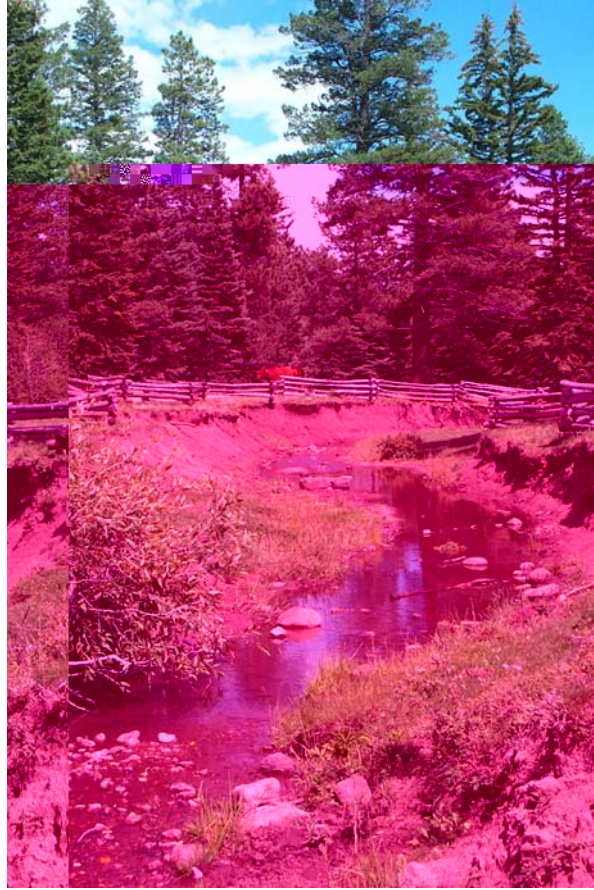
Surveyor: Hugo A. Magaña and Amos Corrales

Fish observed: Rainbow trout and Rio Grande Cutthroat trout

July 15, 2002

Rito Resumidero was dry from Herrera Ditch to the San Pedro Parks Wilderness boundary. The snorkel survey commenced at the San Pedro Parks Wilderness boundary where water was flowing. This reach of Rito Resumidero was characterized as a high gradient stream with a series of step pools (see Photo 57) separated by log and boulder plunges ranging in size from 4 to 8 feet in height. These appeared to be seasonal barriers.

Steep slopes along Rito Resumidero dropped to the stream margins, and the angle of slope averaged 45-60°, and in some instances it was greater. Pool sizes were small and ranged from 25-40 square feet. Elk tracks were observed in several locations leading down to the stream margin. Unstable right bank (100') was observed 30' below Oso Creek/Corralitos Creek confluence. During this part of the survey rain runoff was causing red sediment to leach into the stream.



**Photo 55.** Herrera Ditch as it flows through Resumidero Campground, September 2001.



**Photo 56.** Herrera Ditch as it flows through Resumidero Campground, July 2002. Note, lack of flow and reduced stubble height.



**Photo 57.** Typical pool in step pool section. Fish were found in this reach (15 July 2002).

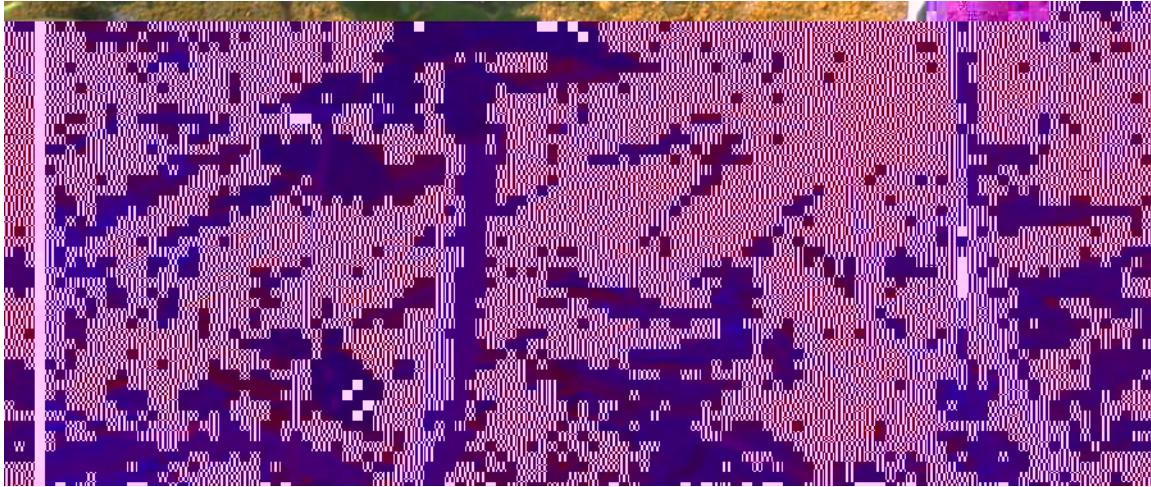
A series of beaver dams (3) were observed along this reach of Rito Resumidero. A huge beaver dam was observed above these dams (see Photo 58). This dam had a face approximately 15' high with an extensive amount of impounded water. Beaver burrows were observed on the east side of this pond. Towards the end of this survey rain and cloud cover reduced visibility, and water became very turbid.



**Photo 58.** Large beaver dam (15' height) with substantial pool. Fresh beaver activity was noted. Note: Turbidity is due to a recent rain event (16 July 2002).



The snorkel survey findings were inconclusive due to limited water clarity during the sampling. The observer suggested that he saw rainbow trout mixed in with the population. No rainbow trout have ever been documented in this section of Rito Resumidero (above Resumidero Falls). Further sampling needs to be conducted to determine fish composition as well as monitor effects of the drought. A total of 25 fish representing all age classes were visually observed from the bank (see Photo 59).



**Photo 59.** Large RGCT found in pool above beaver dam in Rito Resumidero (15 July 2002).

### ***Arizona Willow***

No surveys have been conducted. While most of the terrain is steep, there are open stretches along Rito Resumidero that should be investigated.

### ***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1990 survey (USDA Forest Service 1990), Rito Resumidero was determined very sensitive to acidification with very little amount of buffering capacity.

## **Rito Redondo**

### ***Fisheries***

#### ***2001 – Mouth***

Surveyors: Sean Ferrell, Katrina Lund

Fish Observed: Rainbow trout

September 6, 2001

No fisheries surveys were conducted inside the wilderness. Downstream from the wilderness boundary at FS Road 93 crossing, a snorkel survey was conducted by S. Ferrell from the culvert to the mouth, approximately 500 feet. Rainbow trout were observed below the culvert. No fish were observed above. It appears that the culvert is a barrier.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>
Rainbow Trout	3	7	2

Culvert: 15:00, 52°F, water clarity was cloudy (3 feet); Mouth: 15:45, 55°F, water clarity was cloudy (2 feet)

**2002 – Above FS Road 93 crossing**

Surveyor: Hugo A. Magaña and Amos Corrales

Fish observed: None

July 16, 2002

Approximately 0.2 miles of Rito Redondo was surveyed from FS Road 93 upstream towards the wilderness boundary. No fisheries surveys were conducted inside the wilderness.



**Photo 60.** Minnow trap deployed in the only quality pool located above FS Road 93 (15 July 2002).

Very little flow was observed. Only one pool was observed and a minnow trap was set overnight, but there was no evidence of fish (see Photo 60). Areas of the creek that had sufficient water had a high sediment substrate. No fish were observed during the survey. Rito Redondo is characterized as a low gradient stream with little flow. Several springs were found along this reach of the creek, but recharge of the creek was minimal.

***Arizona Willow***

No surveys have been conducted. There is potential habitat in the headwaters that should be surveyed, but the remainder of the drainage is too steep.

***Water Quality***

This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned. In a 1990 survey (USDA Forest Service 1990), Rito Redondo was determined to be well-buffered from acidification.

## Rio Puerco de Chama

### *Fisheries*

Surveyors: Sean Ferrell, Katrina Lund  
Fish Observed: Rainbow trout, brown trout  
September 6, 2001

No fisheries surveys were conducted inside the wilderness.  
Snorkel surveys were conducted by K. Lund below the confluence with Rito Resumidero down to Rio Puerco Campground, covering 0.2 miles. No RGCT were observed, only non-native rainbow trout and brown trout.

<b>Species</b>	<b>Juvenile (&lt;3")</b>	<b>Sub-Adult (3&lt;6")</b>	<b>Adult (6&lt;9")</b>
Brown Trout	0	1	6
Rainbow Trout	20	7	4
Unknown Trout	2	0	1

12:30, 51°F, air 70°F, weather: sunny

There is a natural barrier near the mouth of Rito Resumidero. Surveys need to be conducted above this to determine species presence below and within the wilderness. A complex of beaver dams exist around the FS Road 93 crossing (see Photo 61).



**Photo 61.** An active beaver complex is located above and below FS Road 93 and is protected by fencing (17 July 2002).

### **2002 – Above FS Road 93**

Surveyor: Hugo A. Magaña and Amos Corrales

Fish observed: Unidentified trout

July 17, 2002

Rio Puerco de Chama, above FS road 93, is characterized as a low gradient stream with a series of beaver dams for approximately the first 1000 feet. The beaver dams and associated wetlands are protected by a fence enclosure (see Photo 61). Two adult beavers were observed in the ponds in the evening.



**Photo 62.** Typical habitat immediately above beaver ponds. Note: heavy sediment loading on stream bottom (17 July 2002).

Due to recent storms, the water was too turbid to identify fish from the bank or snorkeling. Minnow traps were not deployed. Upstream from the beaver dams, Rio Puerco remained low gradient and sinuous with a heavy sediment load (see Photo 62). No pools were observed except for beaver ponds. The survey concluded at the fence line (prior to forks confluence). Further surveys need to be conducted to determine fish species composition and the upper limits.

### ***Arizona Willow***

No surveys have been conducted. There is potential habitat around Vega Redonda that should be investigated; otherwise, the terrain is too steep.

### ***Water Quality***

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This segment was not sampled for water quality at this time. Future sampling and stream condition assessment is planned.

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