Jemez River

Stream Inventory Report

Santa Fe National Forest
Jemez Ranger District
Surveyed July to September 2006
Forest Fisheries Crew

Report By
Rene Galindo
Fisheries Biologist

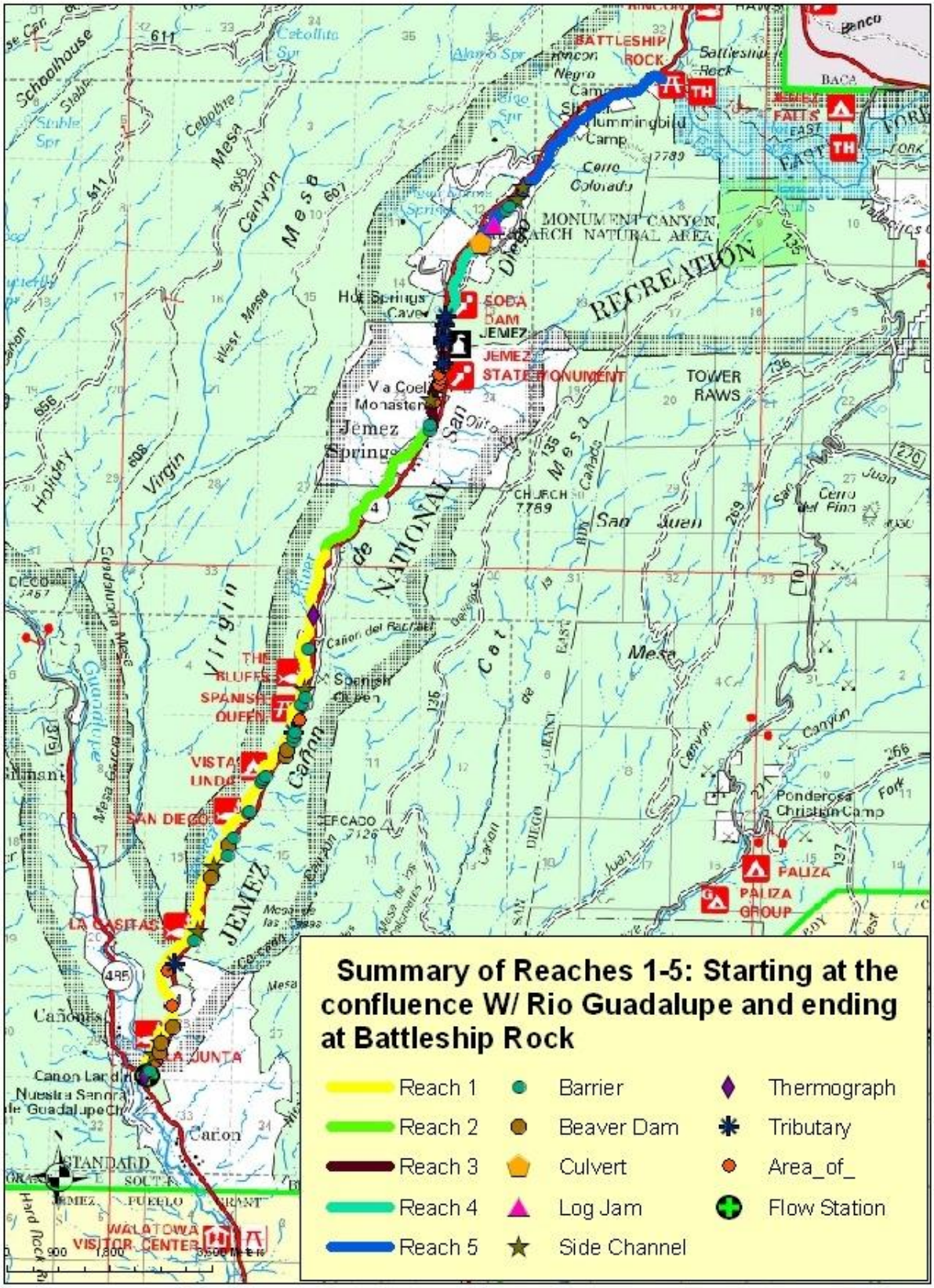
Reviewed By
Chantel Cook
Forest Fisheries Biologist

Santa Fe National Forest
August 2010

Table Of Contents

Section	Page Number
Introduction	3
Basin Summary	5
Executive Summary	6
Habitat Characteristics	6
Reach by Reach Comparison	9
Land Use	
Cultural Resources	10
Geologic History	11
Timber Harvest	12
Recreation	13
Reach Summaries	
Reach 1: Confluence with Rio Guadalupe to Desert Willow Bed and Breakfast in Jemez Springs	15
Reach 2: Private Land (Desert Willow Bed and Breakfast to Handmaidens of the Precious Blood Catholic Monastery in Jemez Springs)	20
Reach 3: Handmaidens of the Precious Blood Catholic Monastery to Soda Dam Recreational Area	23
Reach 4: Soda Dam Falls Recreational Area to the Start of San Diego Loop	28
Reach 5: San Diego Loop to Battleship Rock	33
References	37

Map of Upper Jemez River Surveyed 2006



Introduction
Upper Jemez River 2006 Stream Survey

The Santa Fe National Forest Fisheries Crew conducted a stream survey on the Upper Jemez River during the summer of 2006. A total of 12.79 miles of stream were surveyed, from the mouth (Township 17N, R2E, Sec. 28, elev. 5660') to the confluence of San Antonio creek and East Fork (elev. 6760') where the Upper Jemez River starts at the at Battleship Rock. The Jemez River is a 5th order tributary to the Rio Grande.

The USDA Forest Service Region 3 stream survey protocol is a modified version of the Hankins/Reeves survey used in the Pacific Northwest Region. Under this protocol, streams are surveyed from the mouth upstream and the river is separated into riffle, pool, side channel, dry channel, culvert, and falls habitat types by specific attributes (USFS 2005). Different habitat types require specific measurements relevant to evaluating the habitat (Appendix A, Table 1). In addition to the habitats located in the primary stream, tributary mouths are also surveyed and classified as a seep, spring, or stream (Appendix C). All habitat types are assigned a Natural Sequence Order number (NSO) in the order that they are surveyed. The stream, as a collection of NSOs, is further organized by homogeneous sections and grouped into a sequence of reaches. Each reach is assigned a number in the order that it is surveyed and analyzed separately, as well as together for a holistic overview of the system.

A matrix of factors and indicators was developed to relate stream habitat information into an easily understood habitat condition classification of properly functioning, at risk, or not properly functioning. The matrix originally was developed in the Pacific Northwest by US Fish & Wildlife Service and National Marine Fisheries Service, but was modified for mountain streams in the intermountain west and relates to regulations determined by New Mexico Environment Department (NMED). The matrix was further refined to incorporate geology of streams historically occupied by Rio Grande cutthroat trout (see Table 1).

Global positioning system (GPS) units are utilized for survey data collection. Trimble GeoExplorer 3 units are used to identify specific features throughout the survey. The GPS feature locations are then transferred into a geographical information system (GIS) layer and used to provide graphical representations and spatial analysis of river attributes.

The features of interest that were logged were:

- Reach Breaks
- Woody Debris Jams (of 3 or more pieces)
- Areas of Concern (major erosion, road crossings, etc…)
- Beaver Dams (if active and over 1' in height)
- Tributary Mouth
- Barriers to Fish Passage
- Snorkel Survey Transect Locations
- Thermograph Stations

The primary objectives of the Region 3 Hankins/Reeves survey include the compilation of historical information and in-stream habitat data to assist in proper management decisions of the surveyed stream and its watershed. The historical information provides a background of land use and management techniques collected from the Forest Service and a variety of other sources. Previous land use and management practices reflect on the current condition of environmental systems. Historical information helps explain the current condition of the river and is incorporated into the survey. Understanding events that formed the habitat condition enhances

decision-maker options. In-stream survey data is collected to provide an overview of the current condition of a stream.

Table 1. Matrix of Factors and Indicators of Stream Health Condition for Historic and Occupied Rio Grande Cutthroat Trout Streams as Related to R3 Stream Habitat Inventory.

FACTORS	INDICATORS	Properly Functioning	At Risk	Not Properly Functioning
Water Quality	***Temperature – State of New Mexico Standards***	<20°C (68°F) (3 day avg. max)	≥20°C (68°F) <23°C (73.4°F) (3 day avg. max)	≥23°C (73.4°F) (3 day avg. max)
	Temperature – Salmonid Development	≤17.8°C (64°F) (7 day avg. max)	>17.8º (64ºF) < 21.1º (70ºF) (7 day avg. max)	≥21.1ºC (70ºF) (7 day avg. max)
Habitat Characteristics	**Sediment**	<20% fines (sand, silt, clay) in riffle habitat. Fine sediment within range of expected natural streambed conditions		≥20% fines (sand, silt, clay) in riffle habitat. Fine sediment outside of expected natural streambed conditions.
	Large Woody Debris[1]	>30 pieces per mile, >12" diameter, >35 feet in length	20-30 pieces per mile, >12" diameter, >35 feet in length	<20 pieces per mile, >12" diameter, >35 feet in length
	Pool Development[2]	≥30% pool habitat by area		<30% pool habitat by area
	Pool Quality	Average residual pool depth ≥1 foot		Average residual pool depth <1 foot
Channel Condition and Dynamics	**Width Depth Ratios by Channel Type** *(utilize Rosgen type and range given if applicable)*	Width/depth ratios and channel types within natural ranges and site potential		Width/depth ratios and channel types are well outside of historic ranges and/or site potential
		Expected range of bankfull width/depth ratios and channel type	***Rosgen Type*** A, E, G B, C, F D	***W/D Ratio*** <12 12-30 >40
	Streambank Condition[3]	<10% unstable banks (lineal streambank distance)	10-20% unstable banks (lineal streambank distance)	>20% unstable banks (lineal streambank distance)

[1] Large Woody Debris numeric are not applicable in meadow reaches
[2] Pool Development numeric are applicable to 3rd order or larger streams
[3] Streambank Condition numeric are not applicable in reaches with > 4% gradient

The main objectives of this survey were to: 1) collect historical information that outlines effects on stream and watershed condition; 2) collect baseline data to determine the quality of habitat and floodplain condition and sources of habitat loss in Jemez River; 3) identify areas for possible migration barrier construction; 4) identify restoration needs; and 5) determine fish species and distribution.

Other Measurements and Estimations Recorded

Measurements	Estimations
• Maximum depth of pools, riffles, and side channels	• Average depth of riffles
• Depth of pool tail crest	• Substrate percentages of bankfull width (Fines, Gravel, Cobble, Boulder, Bedrock)
• One bankfull width/depth per reach	• Average wetted width of riffles and pools (Each reach a factor of error was calculated by measuring one NSO width every ten)
• Number of large woody debris within bankfull	• Length of bank instability
• Water temperature during survey	• Total length, wetted width, and maximum depth of side channels
• Water temperature of tributaries	• Length of first habitat unit of tributaries and percent of stream flow contribution (Springs, Seeps, and Streams)
• Water temperature at thermograph sites (Recorded every four hours)	

Basin Summary

Table 2. Stream Summary Table for Upper Jemez River.

SURVEYORS: Emily Woolsey, T. Lite, Sean Ferrell, and Chuck Dentino			
FIELD ASSISTANTS:			
SURVEY DISTANCE:	67,559 feet	12.79 miles	
LOCATION:			
County:	Sandoval		
Forest:	Santa Fe National Forest		
District:	Jemez Ranger District		
Drainage:	Upper Jemez River		
Tributary to:	Rio Grande		
Mouth Location:	T17N, R2E		
WATERSHED:			
HUC Code:	1302020202		
Watershed Area:	11,950 acres	18.67 square miles	
Stream Order:	5		
Stream Length:	77539 feet	14.68 miles	
AQUATIC BIOTA:			
Fish Species:	rainbow trout, brown trout, cuttbow, Rio Grande chub, Rio Grande sucker, fathead minnow, and longnose dace		
Amphibian Species:			

Executive Summary

The Upper Jemez River is a 5th order stream starting from the confluence at Battleship Rock where the San Antonio Creek joins the East Fork Jemez River and flows into the Rio Grande. From Battleship Rock, the Jemez flows 14.68 miles to its confluence with Rio Guadalupe. The Upper Jemez River is comprised of approximately 11,950 acres located on the Jemez Ranger District (Santa Fe National Forest), in Sandoval County, New Mexico.

The Upper Jemez River was broken into 5 different reaches, based on stream and valley morphology and dramatic changes in stream flow. The survey began at the confluence of the of the Guadalupe and Jemez rivers and worked its way upstream. The stream reaches were numbered in an upstream progressive order.

Overall, the gradient on the Upper Jemez River is variable, ranging from 1.0% in the confluence with Rio Guadalupe to 2.1% in Reach 5.

Table 3. Description and Length of Stream Reaches on the Upper Jemez River.

Reach	River Miles	Landmark at Beginning and End	Land Owner
1	0-6.98	Confluence to Desert Springs Bed & Breakfast.	Santa Fe National Forest
2	6.98-8.87	Desert Springs B&B to Handmaidens of the Precious Blood Catholic Monastery	Private Land
3	8.87-10.32	Handmaidens of the Precious Blood Catholic Monastery to Soda Dam Recreational Area	Private Land and Santa Fe National Forest
4	10.32-11.18	Soda Dam Recreational Area to the Start of San Diego Loop	Private land
5	11.18- 14.68	San Diego Loop to confluence at Battleship Rock	Santa Fe National Forest

Habitat Characteristics

Table 4. Overall Stream Survey Summary for the Upper Jemez River.

ENTIRE STREAM					
Stream Length Surveyed:		67,559 feet		12.79 miles	
Habitat Type	**Total Number**	**Total Feet of Stream Habitat**	**% Stream Length**	**% Stream Habitat**	**Properly Functioning Indicators**
Pool	99	6,338	9.72	9.42	>30%
Riffle	118	58,895	90.27	87.56	-
Culvert	-	-	-	-	-
Tributary	3	-	-	-	-
Falls	1	5	0.01	0.01	-
Side Channel	19	2021	-	3.0	-
Total	240	67259	100.0	100.0	-

Red – Not Properly Functioning

During the habitat survey conducted on the Upper Jemez River, the river was broken up into 240 total NSOs (Habitat Units), which measured a total of 67,259 feet in length (Table 4). Of these 240 NSOs, there were 99 pools, 118 riffles, 1 culvert, 3 tributaries, 1 falls, and 19 side channels. There were no stream length measurements for tributaries, as they did not contribute to the habitat in the main stem of the river.

Table 5. Stream Conditions on the Upper Jemez River

Factors	Indicators	Jemez Conditions
Water Quality	Temperature - 3 Day Average	**Not Recorded**
	Temperature - 7 Day Average	**Not Recorded**
Habitat Characteristics	Sediment	**Not Properly Functioning**
	Large Woody Debris	**Not Properly Functioning**
	Pool Development	**Not Properly Functioning**
	Pool Quality	**Properly Functioning**
Channel Condition and Dynamics	Streambank Condition	**Properly Functioning**

Red= Not Properly Functioning

When compared to the matrix of factors and indicators of stream condition for historic and occupied Rio Grande cutthroat trout streams, the Jemez River contains not properly functioning and properly functioning characteristics (Table 5). The parameters that are **not properly functioning** include sediment, density of large woody debris (LWD), and pool development. **Properly functioning** characteristics include pool quality, stream bank condition, and width-to-depth ratio.

Table 6. Summary of Habitat and Substrate Percentages for Riffles in the Upper Jemez River.

Riffle Habitat Summary						
Reach	# Riffles	Avg. Length	Avg. Width	Avg. Depth	Avg. Max. Depth	
Entire River	118	499.1	19.3	1.1	2.1	
Substrate Summary						
Reach	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	Total
Entire River	24.7	20.2	30.8	22.5	1.8	100.0
Properly Functioning Indicators	<20.0	-	-	-	-	-

Red – Not Properly Functioning
Orange= Dominant Substrate

The riffle habitat in the Upper Jemez River is the dominant habitat, comprising 88.7% of all stream habitat types. The high relative quantity of riffle habitat reflects the lack of pool habitat. Sediment content in riffle habitat (24.7%) was determined to be **not properly functioning** (Table 6). The dominant substrate type is cobble followed by sand.

Table 7. Summary of Pool Habitat and Substrate Percentages in the Upper Jemez River.

Pool Habitat Summary											
Reach	# Of Pools	Avg. Length	Avg. Width	Avg. Max Depth	Avg. PTC	Avg. Residual Depth	Pools/Mile	# of Pools w/ Residual Depth >1'	Pools w/ Residual Depth >1'/Mile	# of Pools w/ Max. Depth >3'	# of Pools w/ Max. Depth >3'/Mile
Entire River	99	64.02	17.74	2.83	0.86	1.96	7.8	89	7.0	31	2.4
Properly Functioning Indicators	-	-	-	-	-	>1'		-	-	-	-

Substrate Summary							
Reach	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	Total	
Entire River	48.3	15.7	21.5	10.9	3.6	100.0	

Orange= Dominant Substrate

Pool habitat is important over wintering, resting, and feeding habitat for fish. Pool habitat is evaluated by both quality or residual depth and area of pool habitat (by length). Pool quality is **properly functioning** in the Jemez River with 90% of the pool habitats with at least a 1-foot residual depth. Residual depth is calculated by subtracting the maximum depth from the pool tail crest depth to determine the depth of water that would remain in the habitat if flow ceased. The average residual pool depth is almost twice the properly functioning indicator (Table 7). The relative quantity of pool habitat (9.42%) is **not properly functioning** (Table 4). Making certain there is adequate pool habitat in the Jemez River should be a priority in the river's management.

Table 8. Habitat Characteristics for the Jemez River.

Reach	Pool:Riffle Ratio	Avg. Riffle Width:Avg. Riffle Depth	Pieces of LWD per Mile	Total Unstable Banks	Percentage of Unstable Banks
Entire River	1:1.2	16.8:1	2.6	7117 feet	5.5
Properly Functioning Indicators	-	-	>30	-	<10

Red – Not Properly Functioning

Large woody debris (LWD) is related to habitat complexity and the health of fish populations in stream habitats (Fausch and Northcote 1992). LWD density is **not properly functioning** in the Upper Jemez River. The LWD density is 2.6 pieces per mile, far below the standard (Table 8). The Upper Jemez River had 5 pieces of wood classified as medium and large sizes. Wood classified as medium LWD must be greater than 12 inches in diameter at a length of 35 feet from the large end. Large pieces of LWD have a diameter of greater than 20 inches at a length of 35 feet from the large end. Increasing the LWD density should be a focus in the management of the Jemez River. Increasing LWD may also improve other degraded factors in the stream habitat including pool development. Bank stability (5.5% instability) is **properly functioning** when analyzed by the length of the entire surveyed section of stream. Although the length of bank

instability is **properly functioning**, several areas could use mitigation. Areas of instability in need of management are primarily in Reach 1 near the developed recreation/fishing access areas.

Reach by Reach Comparison

Table 9. Reach by Reach Summary for Habitat Characteristics for the Jemez River.

Reach	Total Length (Miles)	% Gradient	Rosgen Channel Type	% Pool Habitat	% Riffle Habitat	% Side Channel Habitat	Dominant Substrate in Pools	Dominant Substrate in Riffles	LWD Per Mile	Bankfull W:D Ratio	% Unstable Banks
1	6.98	0.99	C3	9.65	89.39	0.96	Sand	Cobble	2.9	16.8:1	12.9
* 2	1.89	1.2	C	*	*	*	*	*	*	*	*
3	1.45	1.9	C2	12.11	87.83	0	Sand	Boulder	3.45	19.6:1	5.58
4	0.86	2.1	C2/3	4.13	95.87	0	Sand	Cobble/Boulder	4	68:1	1.1
5	3.51	2.5	C	13.5	77.1	9.4	Sand	Boulder	1.5	15.6:1	3.79
Entire River	14.69	-	-	39.39			Sand	Boulder			
12Properly Functioning Indicators	-	-	-	>30	-	-	-	-	>30	A,E,G: <12 B,C,F: 12-30 D: >40	<10

Red = Not Properly Functioning
* = Reach not surveyed; private lands

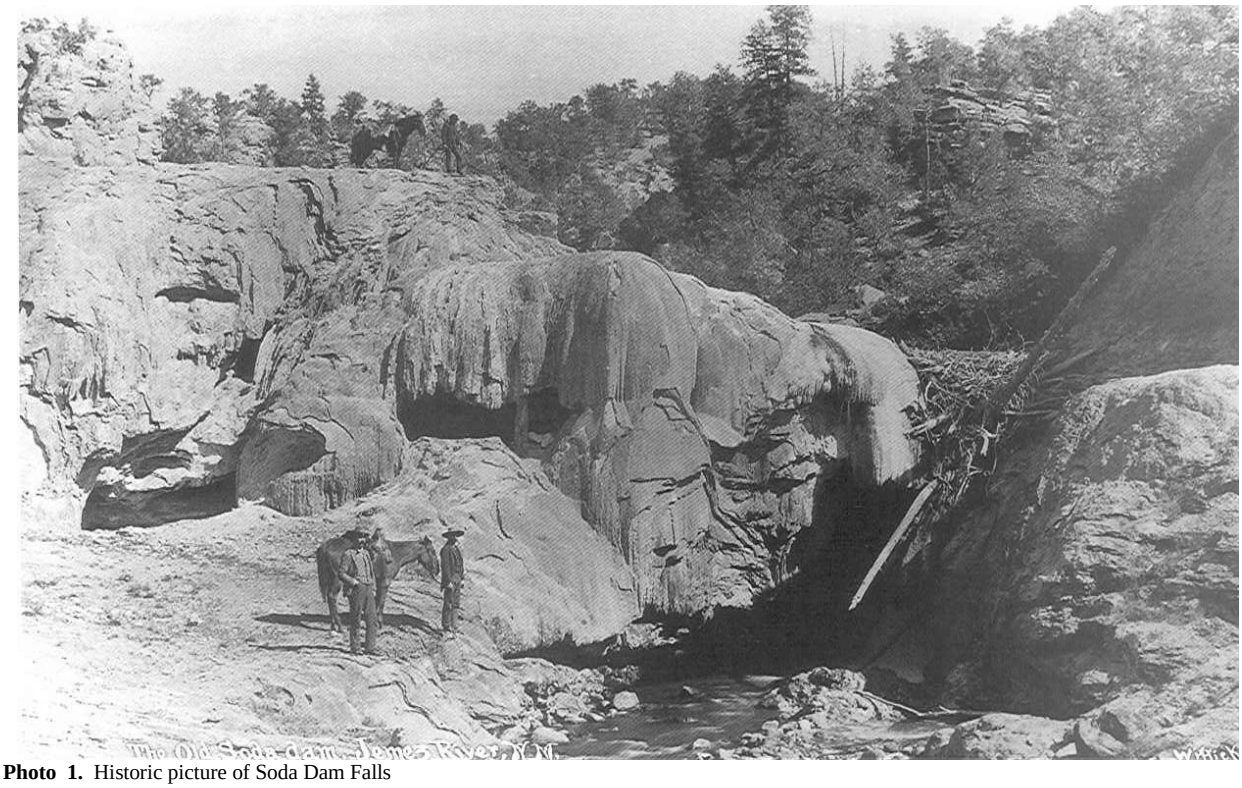


Photo 1. Historic picture of Soda Dam Falls

Cultural Resources

The cultural history of the Jemez Mountains appears to be long and fairly continuous. Though data are scarce for the early periods, there are clear indications of at least seasonal occupation of the Jemez Mountains through the early Basketmaker Period. More sedentary life-styles began appearing during the Coalition Period and continued until modern times. Population remained low during the Developmental Period of the Upper Rio Grande Classification (ca. AD 600-1150). Population and site frequency increased dramatically during the Coalition Period (ca. AD 1150-1350). The majority of known prehistoric sites on the Jemez District are considered to be ancestral Jemez Pueblo sites which date between 1350 and 1700 (Rio Grande Classic and Protohistoric). Numerous field houses (primarily seasonal dwellings), cavates, rock art and artifact scatters are often found associated with large, multi-storied pueblo ruins. Jemez State Monument, the remains of the pueblo village of Giusewa settled around 1500 A.D., also stands today marking one of the many ancestral dwellings of the native peoples of the area.

The word "Jemez" is a Spanish hybridization of the Towa word "Hemish," which means "people" in the Towa language, one of three branches of the Tanoan language which are still in use today. It is thought that the alteration of the Towa word came about as a result of the arrival of the Spanish in the region around 1540-1541 when Francisco Vasquez de Coronado entered the area.

In the years between 1598 and 1601 at the pueblo of Giusewa, the first church and convento was erected by Franciscan priest Father Alonso de Lugo. This was done under the charge of Don Juan de Oñate for the purpose of converting the natives to Catholicism. In 1621 the San Jose church and convento was constructed by Fray Geronimo de Zarate Slameron in the pueblo, a Franciscan priest familiar with European Baroque architecture as seen in the surviving structure. Numerous structures were also built and eventually subsumed the pueblo into what became the mission of San Jose de los Jemez.

Twelve years after the successful revolt of 1680 that drove the Spaniards from New Mexico and freed the pueblos from Spanish rule, the Spaniards were re-established under Governor Diego De Vargas. In 1696 the pueblos revolted once again and retreated to pueblo sites atop the nearby mesas. Between 1696 and 1706 most of the Jemez peoples abandoned the Jemez Mountains and joined other pueblos. The modern day Jemez Pueblo was established in 1706 and the Jemez pueblo returned to their native lands. As a result of European contact many of the Jemez peoples life-styles were permanently altered. Some of these are apparent in artifacts such as pottery and the introduction of Spanish metals.

Anglo-American occupation in the region began in the mid-1800s, continuing into the present. Historic sites in the Jemez are commonly associated with mining activities, stock grazing, and logging.

Photo 2. Guadalupe Mesa in the background

Geologic History

The Jemez Mountains were formed from a series of explosive volcanic episodes over the course of the last 10 to 15 million years. This volcanic field resulted because of two main "fractures" within the earth's crust, one called the Jemez Lineament (about 1.7 billion years old) and the other called the Rio Grande Rift (about 26 million years old) that intersect one another. This intersection caused an area of distinct crustal weakness that allowed near surface magmas to escape to the surface and eventually form the mountains.

The Jemez Mountains experienced their most dramatic explosions between 1.8 and 1.2 million years ago. The intensity of these eruptions released nearly 250 times the amount of volcanic material than the 1980 Mount St. Helens eruption did. The upper half of the exposed rock in the canyon walls consist of volcanic tuff that this eruptive period produced, the San Diego Canyon Tuff and the Bandelier Tuff. Eruptions have taken place since this time but on a much smaller scale, with the youngest, the Banco Bonito obsidian, being only 50,000 years old.

The Jemez Watershed has an upper and lower segment to it, with the upper segment confined by the Valles Caldera. Here the San Antonio Creek and East Fork of the Jemez River flow down towards the lower watershed, meeting at the confluence of Battleship Rock. The geology of this area is characterized by rock type's common of explosive volcanoes (e.i., pumice, rhyolites, andesites and tuffs). The general mineral composition of these rocks contain high amounts of aluminum oxides (nearly twice the average crustal abundance) and are thought to be the source of excessive dissolved aluminum in the lower watershed (NMED, 2002).

The lower watershed starts at Battleship Rock and continues south until the confluence of the Rio Guadalupe near Highway 485. In this section of the watershed the river is confined within the valley of San Diego Canyon with the geology very well exposed on the canyon walls. The upper canyon walls have the earlier mentioned tuffs that comprise roughly the upper half. Below the tuffs, a boundary of "missing time" in the geologic record occurs (called an unconformity) representing approximately 180 million years where the geology was not preserved. Finally, below this unconformity, spectacular red rocks are exposed that are between 300 and 200 million years old. These lower rocks contribute high amounts of silt and sand to the watershed in high precipitation events.

Several faults exist in the Jemez Mountains and in the Jemez watershed in particular. These faults act as conduits for deep hydrothermal mineral waters that form hot springs. Among the more well known examples of this are the Spence, McCauley, San Antonio and Soda Dam Falls areas. Soda Dam Falls is perhaps the most visually striking of these springs, as it has led to massive deposition of travertine in the river and on top of the ridge to the west of the falls. At present, the bulk of the spring flow has been diverted by a series of culverts to prevent deposition along Highway 4. Because of the diversion of the spring water, the travertine falls are thought to be eroding at present day, since little deposition can now occur on it.

Timber Harvest

No known timber harvests have occurred within the lower section of the Jemez Watershed. This is attributed to the confined and relatively narrow valley of this part of the watershed and the lack of large quantities of harvestable trees. Combined, these two factors make potential harvests less economically feasible relative to other potential harvest areas in the Jemez Mountains. In the upper watershed however, timber harvests have an active history, and will be included in here.

Forests in the East Fork Jemez River consist primarily of ponderosa pine (*Pinus ponderosa)*. However, higher elevations produce Douglas-fir (*Pseudotsuga menziesii*) and a mix of spruce and fir. There is no record of the first timber harvest in the East Fork Jemez River Watershed, but there is a noted history of private harvest on the 100,000 acre San Diego Land Grant that was turned over to the USDA Forest Service in 1965.

There have only been two major timber sales in the East Fork Jemez River Watershed within the last decade. The largest sale was Bonito Timber Sale and was completed in 1993. The sale units covered a total of 383 acres within the watershed and removed approximately 4.66 MMBF total. All sale units were up slope from the floodplain; none of which reached the stream.

The second timber sale was the Banco Timber Sale, located in the East Fork Jemez and San Antonio Creek Watersheds. This project was completed in 1991. The sale units covered a total of 193 acres within both watersheds. Approximately one third of the sale fell in the East Fork Jemez Watershed. The sale removed approximately 1.24 MMBF total.

Forested areas of the San Antonio Creek Watershed consist primarily of ponderosa pine (*Pinus ponderosa*). However, higher elevations produce white fir (*Abies concolor*) and a mix of spruce (*Picea spp.*), quaking aspen (*Populus* temuloides), and Douglas-fir (*Psuedotsuga menziesii*). Jemez District records date back to the late 1980s, but timber harvesting has occurred in the San Antonio Watershed since people have inhabited the area. Local history notes a timer sale in Mushroom Basin, which lies on Forest Service land, within the San Antonio Watershed. The notes of the Mushroom Basin timber sale leave no indication of the extent of the harvest.

Forest thinning of drainages in the vicinity of the western boundary of the Valles Caldera (on Forest Service land) occurred around 1977. The Barley sale in the San Antonio Creek Watershed occurred between 1993 and 1998 and most of the sale took place outside of the watershed. The area in the watershed was located between FR 144 and 376.

Recreation

Prior to the late 1980s most of Reach 1 experienced extremely heavy recreational use that was managed by the Forest Service in a very limited manner. Years of impact via numerous widely dispersed camping areas, off road recreation, and angling led to severe habitat degradation and were the impetus behind the LJCP (Lower Jemez Corridor Project). The LJCP's objective was to reduce recreational impact by the creation of designated and monitored access areas along the corridor based on a previous inventory of the first 5.1 miles above the confluence of the Rio Guadalupe and the Jemez River. In 1989 17 sites were proposed in this range, nine of which were implemented. Since this time, riparian and stream habitat has begun to re-establish itself.

Photo 3. V-shaped log structure at Las Casitas Campsite.

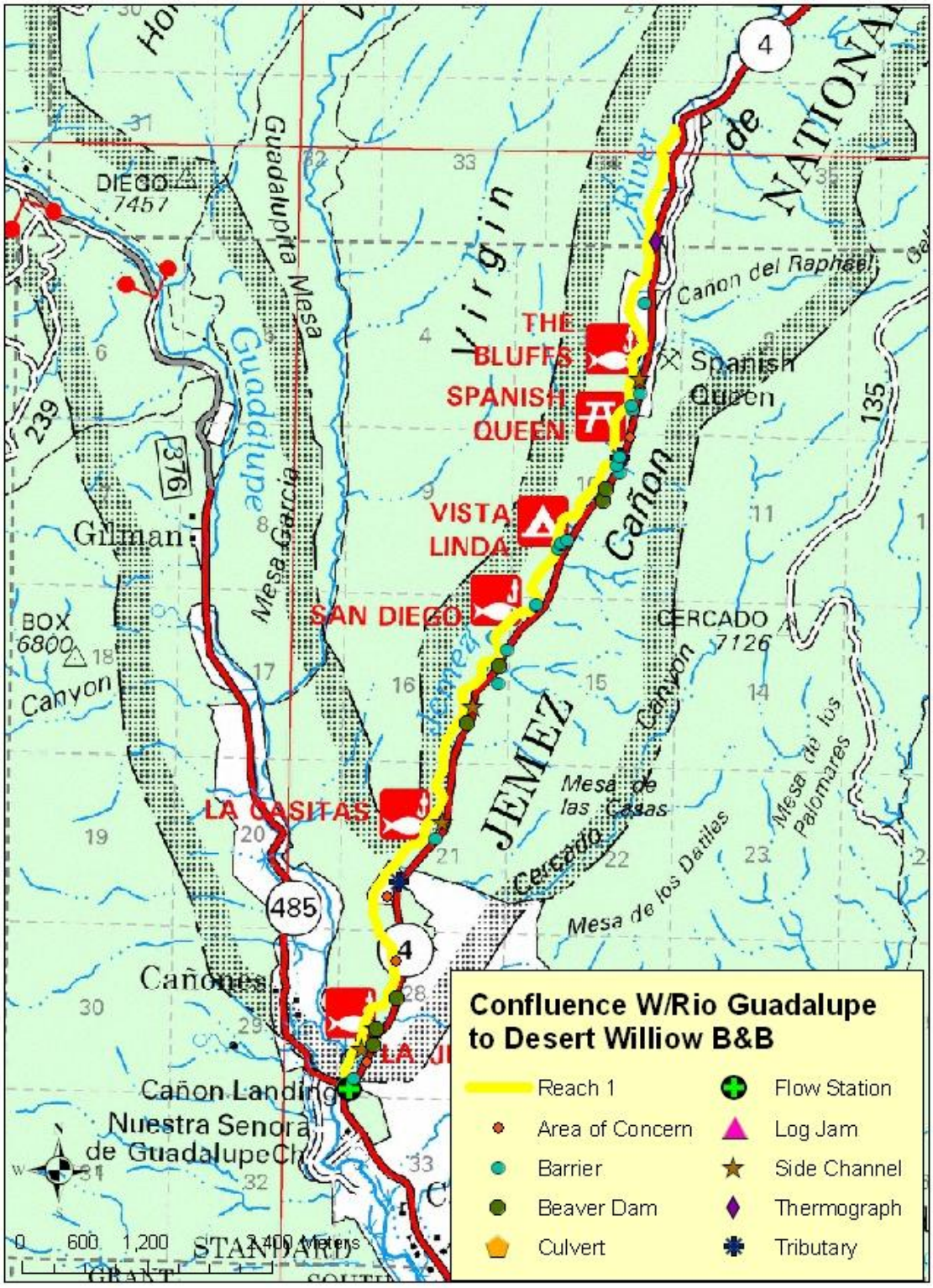
There are now 9 Forest Service managed recreational area accesses within the survey corridor. All but one is day use and all are directly accessible from State Highway 4. Seven of these nine lie within Reach 1, including five fishing accesses (La Junta Fishing Area, Las Casitas Fishing Area, San Diego Fishing Area, River's Bend Fishing Area and The Bluffs Fishing Area), one picnic area (Spanish Queen Picnic Area), and one overnight camping area (Las Casitas Camping Area), the only permitted overnight area within the survey. Soda Dam Falls Recreation Area lies at the end of Reach 3 and is

perhaps the most heavily visited recreation area within the survey boundaries next to Battleship Rock Picnic Area.

The recreation sites along the survey corridor are quite possibly the most heavily of those used in the Jemez Ranger District and impact seen from their usage is evident in a dramatic way. The most obvious impact from usage is in the form of abundant refuse found along the banks and in the stream itself. Items seen ranged from discarded clothing to diapers and watermelon rinds to beverage containers. Excessive lumber and tin/steel debris was found as well, though these items are likely not derived from recreation. Compaction from bank-side trails was abundant in each recreation area, and though no significant bank-side deterioration or alteration was observed in these areas, it is likely that sand and silt input in the stream is noticeably increased along these portions of the river.

Photo 4. Trash left behind by visitors to Soda Dam Falls Area.

Reach 1: Confluence with Rio Guadalupe to Desert Willow Bed and Breakfast in Jemez Springs



Reach 1: Confluence with Rio Guadalupe to Desert Willow Bed and Breakfast in Jemez Springs

Reach 1 of the Jemez River was surveyed between June 5 and June 27, 2006. Reach 1 begins at the confluence with Rio Guadalupe, just north of the State Highway 4 and 485 junction (T17N, R2E, Sec. 28, elev. 5660'). The reach ends 6.98 miles upstream from the confluence at a right bank arroyo that marks the southern private property boundary of Desert Willow Bed and Breakfast in Jemez Springs (T18N, R2E, Sec. 34, elev. 6030'). This low gradient section (1.0%) of the Jemez River has a meandering channel with point bars (sinuosity 1.07) and flows down San Diego Canyon in between mesas and a broad, well defined floodplain. Reach 1 can be classified as a Rosgen stream type C3 with a dominant substrate of cobble.

State Highway 4 (Jemez Mountain Trail National Scenic Byway) runs adjacent to the river's right bank throughout the reach, in some cases coming within roughly 20 feet. The proximity of the road is an area of concern with respect to non-point source pollutants entering the stream. The reach has 5 day use fishing access areas (The Bluffs, San Diego, Las Casitas, River's Bend, and La Junta), 1 day use picnic area (Spanish Queen) and 1 overnight campground area (Vista Linda). These areas experience heavy recreational use, most of which occurs on weekends and holidays within the summer season. Impact from recreational usage is not limited to recreation areas but is seen throughout the reach. The most abundant items seen were artificial damming structures, refuse, and private land usage structures. Damming structures mainly consisted of man-made cobble dams. Refuse consisting of old clothing to camping litter to lumber was abundant on the banks and in the stream bed.

Damming structures and refuse, while found throughout the reach, were more concentrated closer to recreation area grounds. Private land usage structures, such as channel spanning barbed wire fencing, an old channel spanning cable, and two large, submerged pumping hoses were among the documented items.

Reach 1 bank vegetation consists primarily of willow, grass, horsetail, and cottonwood, with sporadic occurrences of Russian olive and salt cedar, imported to the area for ornamentation and erosion control respectively. Concern over these two species stems from the accelerated soil moisture consumption rates relative to indigenous species, lowering the water table.

Reach 1 is predominately cobble substrate until approximately the last 2.5 miles of the reach, where the substrate progressively enlarges with cobble, boulder and bedrock. This was indicated by slightly increased gradient and greater entrenchment. Entrenchment in turn, leads to a decrease in willow and increase in piñon pine and juniper. The survey team elected not to divide this portion into a separate reach as it seemed to display more transitory morphological characteristics as opposed to the more definitive changes used to classify other reaches. In addition, more fish were observed in the last 2.5 miles of the reach. The largest numbers of fish seen were juvenile and were likely suckers, chubs, and daces. Some juveniles may have been German brown trout as they have been found to survive in this portion of the stream and having spawned last fall, would be juvenile sized at the time of the survey. Most of the fish that could be confidently identified were rainbow trout and of sub-adult to adult size. Crawfish were seen regularly throughout the entirety of Reach 1. In the afternoon, stream temperatures reached upwards of 81°F causing trout to exhibit lethargic and sluggish behavior.

Reach 1 had several dry tributaries, or arroyos, feeding into the main channel. No flow contribution or sediment input was observed in the dry tributaries except in heavy precipitation events. Reach 1 is comprised of nearly equal occurrences of riffles (59) and pools (53) and contained 4 side channels. The first two side channels were braided and the final two consisted of a single channel flow. Near the old Spanish Queen Mine location (T17N, R2E, Sec. 3), the reach encounters a water treatment facility just off the right bank. The left bank remains Forest Service land until the end of the reach. Most bank instability appeared to be natural except around developed areas. Very little bank undercutting was seen in this reach.

Abundant beaver activity was documented in Reach 1 with several areas of recent but incomplete damming and several recently completed willow dams. Two large cottonwoods with active beaver damage were seen along the banks with their lower trunks halfway chewed through. Most cottonwoods seen in the survey were wrapped in chicken wire at the base of their trunks to protect against beaver damage. No evidence of wire was found on the two trees that had been damaged.

Very few occurrences of LWD were observed throughout Reach 1 with 19 small pieces and 1 medium piece. Most of the LWD documented was from failed or partially functioning V-notches, used to create artificial pools for the fishing access areas. In total, 9 V-notch structures were documented in Reach 1. Source potential for more LWD contribution is assessed as minor as cottonwood is the only large tree species and is unreliable as a long term wood component. This is also in conjunction with the measures the Forest Service has taken to protect what cottonwood remains from beaver consumption.

Water temperatures were measured at random intervals during the survey using a handheld thermometer. Twenty-six temperature readings were taken throughout the Reach 1 survey. The highest recorded temperature was 81°F and the lowest was 62°F. The average stream temperature was 73.5°F. In addition to handheld measurements, two thermograph stations were installed Reach 1: upstream from the confluence and at the southern village boundary.

Habitat Characteristics

The 6.98 miles (36841 ft) of stream in Reach 1 were divided into 116 NSOs (see Table 1). The 59 riffle habitats make up the majority, 89.39% of the stream habitat. The 53 pool habitats only comprise 9.65% of the stream habitat and the 4 side channels form a scant 0.96% of stream habitat.

Table 10. Summary of Reach 1 habitat types.

Habitat Type	Number of Habitats	Total Stream Habitat (ft)	Stream Length[1] (%)	Stream Habitat[2] (%)	Properly Functioning Indicators
Pool	53	3556	9.75	9.65	≥30%
Riffle	59	32932	90.25	89.39	-
Culvert	0	0	0.0	0.0	-
Tributary	0	N/A	N/A	N/A	-
Falls	0	0	0.0	0.0	-
Side Channel	4	353	N/A	.96	-
Dry Channel	0	0	0.0	0.0	-
Total	116	36841	100.0	100.0	-

Red – Not Properly Functioning

.

When compared to the matrix of factors and indicators of stream health condition for historic and occupied Rio Grande cutthroat trout streams, riffle habitat in Reach 1 is **not properly functioning** due to the large amount of fine sediments (sand, silt, clay) outside of expected natural streambed conditions.

Table11. Summary of riffle habitat and substrate composition in Reach 1.

Riffle Habitat Summary (ft)						
Reach	# Riffles	Avg. Length	Avg. Width	Avg. Depth	Avg. Max Depth	
1	59	499.11	19.26	1.14	2.09	
Substrate Summary (%)						
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
1	33.62	18.45	35	11.90	1.03	100.00
Properly Functioning Indicators	<20.0	-	-	-	-	-

Red – Not Properly Functioning
Orange – Dominant Substrate

Pool habitat in Reach 1 is **properly functioning** according to the standard for average residual depth, but pool development is **not properly functioning**. Only 9.65% of the stream habitat consists of

pools, which is below the matrix standard (≥30%). The length of pool habitat relative to other types of habitat determines pool development by area of pools.

Table 12. Summary of pool habitat and substrate composition in Reach 1.

Pool Habitat Summary											
Reach	# Pool Habitats	Avg. Length (ft)	Avg. Width (ft)	Avg. Max Depth (ft)	Avg. PTC (ft)	Avg. Residual Depth (ft)	Pools per mile	# Pools w/ Residual Depth >1'	Pools w/ Residual Depth >1'/mi.	# Pools w/ Max Depth >3'	Pools w/ Max Depth >3'/mi.
1	53	67.09	16.98	2.79	0.78	2.01	7.67	49	7.02	17	2.43
Properly Functioning Indicators	-	-	-	-	-	≥1.0	-	-	-	-	-

Substrate Summary (%)						
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
1	43.48	15.87	29.57	9.35	1.73	100.00

Orange – Dominant Substrate

Large woody debris (LWD) was not analyzed for Reach 1 because of the low source potential. Cottonwood is the only large tree species and is unreliable as a long term wood component.

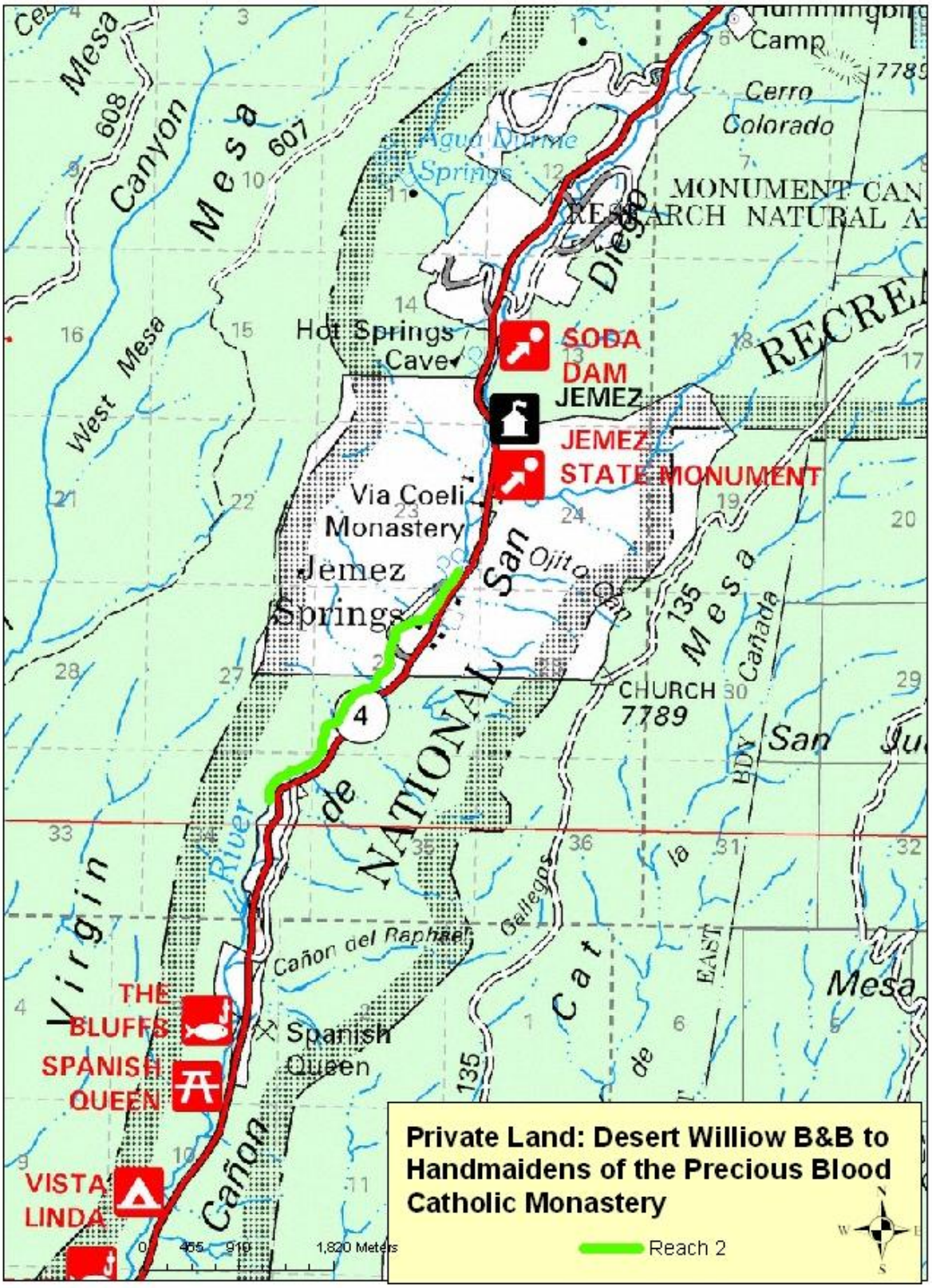
Table 13. Habitat characteristics for Reach 1.

Reach	Pool:Riffle Ratio	Avg. Bankfull Width:Depth	Pieces of LWD per mile	Total Unstable Banks (ft)	% Unstable Banks
1	1.1:1	22:1	2.9	4,754	12.9
Properly Functioning Indicators	-	X<Y	>30	-	<10

Red – Not Properly Functioning

According to standards set by the state of New Mexico, water quality is **non-supporting** if the water temperature measures at or above 73.4^{o} F at one time or above 68° F for four consecutive hours over 4 consecutive days. Reach 1 water quality is **not properly functioning** because the water temperature exceeded these standards. Temperature was measured 26 times during the survey of Reach 1. The highest temperature measured in Reach 1 was 81° F, with average water temperature of 73.5^{o} F.

Reach 2: Private Land



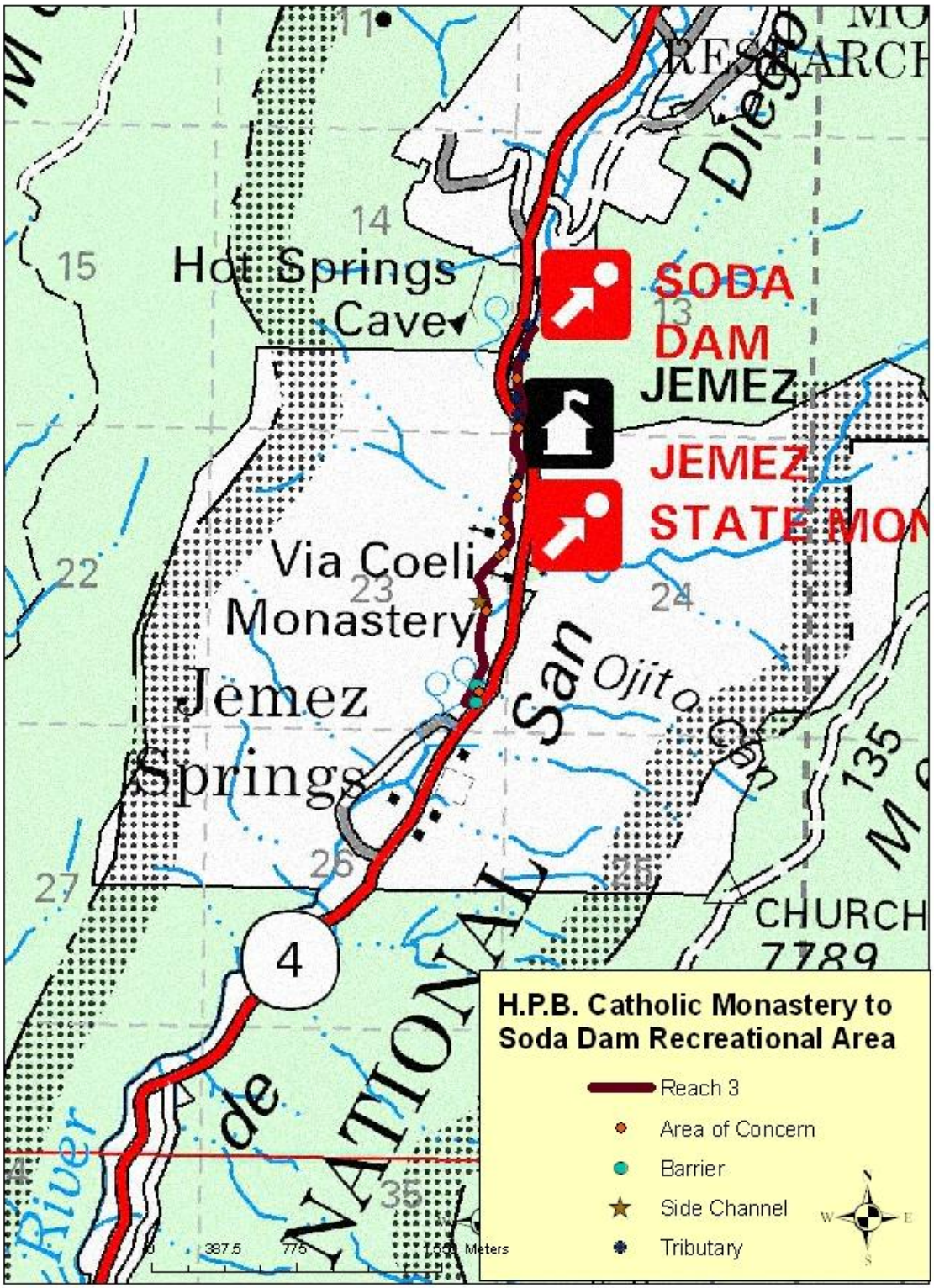
Reach 2: Private Land (Desert Willow Bed and Breakfast to Handmaidens of the Precious Blood Catholic Monastery)

Reach 2 of the Jemez River was not surveyed because the extent of the reach is private land owned by various individuals and organizations of the village of Jemez Springs. Reach 2 begins at the right bank arroyo at the southern boundary of the Desert Willow Bed and Breakfast (T18N, R2E, Sec. 34, elev. 6030') and continues 1.89 river miles upstream to the southern boundary of the property owned by the Handmaidens of the Precious Blood Catholic Monastery (T18N, R2E, Sec. 23, elev. 6200'). Channel gradient in this reach is 1.7% and sinuosity is 1.08. These numbers might be slightly different if channel length had been measured in the field instead of map derived. Reach 2 can be classified as a Rosgen stream type C, most likely with a substrate that is cobble dominated as the last 2.5 miles of Reach 1 was (based on bridge observations of the stream).

The extent of Reach 2 is primarily made up of the village of Jemez Springs. The village has a main plaza area where a small municipal park is located along with the Library and the Bathhouse among other attractions. Many shops, inns, and cafes are located in the village limits along this reach. It is

important to note that several hot springs and seeps occur along this reach, although the exact number could not be determined without surveying. Two known springs within the town are at The Bathhouse and the Bodhi Buddhist temple grounds. Two public road bridges on the Mooney Blvd. loop cross the Jemez River. These are the only areas in the village that permit any kind of close viewing of the stream through here. Substrate, bank conditions, and vegetation appear very similar to the last 2.5 miles of Reach 1 as viewed from the two bridges. No alteration or man-made modifications to the stream could be seen from the bridges. An unknown number of acequias irrigate from the Jemez River in the village. One known acequia is located west of the Library down Mooney Blvd. on the right hand side of the road.

Reach 3: Handmaidens of the Precious Blood Catholic Monastery to Soda Dam Recreational Area



Reach 3: Handmaidens of the Precious Blood Catholic Monastery in Jemez Springs to Soda Dam Recreational Area

Reach 3 of the Jemez River was surveyed from July 11 to July 13, 2006. Reach 3 begins at the southern property boundary of the Handmaidens of the Precious Blood Catholic Monastery in Jemez Springs (T18N, R2E, Sec. 23, elev. 6200'). The reach ends 1.45 miles upstream from the Monastery at the Soda Dam Falls Recreational Area (T18N, R2E, Sec. 13, elev. 6320'). This moderate to high gradient section (1.6%) of the Jemez River has a meandering channel (sinuosity1.15) with very little point bar deposition and a higher degree of entrenchment (observed) relative to Reach 1. Reach 3 can be classified as a Rosgen stream type C2 with a dominant substrate of boulder.

State Highway 4 continues to run adjacent to the river's right bank until crossing over a bridge next to the Jemez District Ranger Station, and then runs along the left bank to the end of Reach 3. The road's proximity encroaches to within 20 feet of the left bank in the final 1000' of Reach 3. The proximity of the road is an area of concern with respect to non-point source pollutants entering the stream as in the case of Reach 1. The first mile of Reach 3 is private land owned by entities of the Catholic Church and by private land owners on old Spanish land grants and private in-holdings. The remainder of the reach is Forest Service land. No recreational areas were encountered in Reach 3 with the exception of the Soda Dam Falls Recreational access that marked the end of the reach. Impact along the stream

was observed in the form of cobble dam modifications, barbed-wire fencing denoting land grant boundaries, construction debris, and litter. Litter was again seen as old clothing items, discarded beverage containers, and Styrofoam insulation and lumber debris. No active construction projects were seen during the survey time, so debris and litter could possibly have originated from construction projects and recreational areas upstream from Reach 3.

Reach 3 bank vegetation consists primarily of willow and cottonwood, with sporadic occurrences of Russian olive and salt cedar as seen in Reach 1. Wild Rose, Wild Grape Vine, Squawbush, Alder Tree, Chinese Elm/Siberian Elm, and Tree of Heaven were also abundant in Reach 3. Salt Cedar, Russian Olive, and Tree of Heaven are of concern as they have a dramatic impact in lowering the water table. Two aquatic species, water-cress and, were seen consistently throughout Reach 3 in the more sandy pockets of the stream substrate.

Reach 3 is predominately boulder substrate. The stream in Reach 3 was observed to have a slightly too moderately increased level of entrenchment relative to Reach 1. It should be noted that entrenchment calculations were not made in the entire survey, and references to entrenchment are based solely on observation. The number of fish observed was less than what was seen in Reach 1 and three dead fish were noted in Reach 3. The stream waters contained higher than normal turbidity levels due to recent monsoon precipitation, and this was considered a possible correlation between the lower numbers of fish observed and the number of dead fish encountered. Species that were most commonly seen were juvenile chubs and suckers. Two dead rainbow trout were seen in the reach and one dying German Brown trout was seen, thought to be choking on suspended sediment. In addition, significantly less crawfish were seen in Reach 3.

Reach 3 had one arroyo that was noted approximately 150 feet after the northern boundary of the northern Paraclete Church boundary on the left bank (T18N, R2E, Sec. 23). The arroyo was documented as an area of concern within Reach 3 because it was forming a depositional sediment fan of sand and gravel into the stream. Because of the recent drought of the last six years, no spring runoff has been available to wash out the fan and this in turn has allowed the fan to build up to the point that the stream is now forced to meander around it (personal communication). No other arroyos were seen in this reach. Reach 3 was comprised of nearly equal occurrences of pools (14) and riffles (12) and one Falls at Soda Dam Falls Reacreation Area. Several irrigation structures were seen in Reach 3. Three acequia returns and two acequia headgates were seen, and approximately 900 feet south of Soda Dam Falls an irrigation diversion structure channeling flow on both banks was documented. The amount of bank instability was roughly in line with that seen in Reach 1, and very little bank undercutting was seen in Reach as well.

No beaver activity was seen in this reach, with the exception three chewed cottonwoods. However, two muskrats were seen swimming within approximately 750 feet of Soda Dam Falls. Muskrat dwellings observed were bank-side burrows that had no cut vegetation comprising any part of the dwelling.

LWD in the stream consisted of only 5 pieces and were all part of two falls structures on the Handmaidens of the Precious Blood Monastery grounds. The second and largest of the structures was aggrading the stream bed with silt just above. Source potential for more LWD contribution is assessed as minor as Cottonwood and Chinese Elm/Siberian Elm are the only large tree species and are

unreliable as long term wood components. This is also in conjunction with the measures the Forest Service has taken to protect what cottonwood remains from beaver consumption.

Water temperatures were measured at random intervals during the survey using a handheld thermometer. Eleven temperature readings were taken throughout the Reach 3 survey. The highest recorded temperature was 79°F and the lowest was 64°F. The average stream temperature was 73.3°F. In addition to handheld measurements, one thermograph station was installed in Reach 3, just under the State Highway 4 bridge across from the Jemez District Ranger Station.

The Soda Dam Falls travertine deposit marks the end of the reach. Travertine is a finely crystalline calcium- and sodium-carbonate rich deposit that is precipitated out of the many hydrothermal spring waters that mark the area. Deep magma heated hydrothermal waters reach the surface through a fault zone that is roughly in line with the dam. In the 1950s Soda Dam was breached by a road cut for State Highway 4, redirecting the spring waters that once built the dam. Culverts have been established to redirect the travertine spring flows back to the river and all observed culverts with the exception of one were choked with travertine deposition.

Habitat Characteristics

The 1.45 miles (7655 ft) of stream in Reach 3 were divided into 28 NSOs (see Table 5). The 14 riffle habitats make up the majority, 87.83% of the stream habitat. The 13 pool habitats only comprise 12.11% of the stream habitat and the remaining fall habitat forms a scant 0.06% of stream habitat.

Table 14. Summary of Reach 3 habitat types.

Habitat Type	Number of Habitats	Total Stream Habitat (ft)	Stream Length[1] (%)	Stream Habitat[2] (%)	Properly Functioning Indicators
Pool	13	927	12.11	12.11	≥30%
Riffle	14	6723	87.83	87.83	-
Culvert	0	0	0	0	-
Tributary	0	N/A	N/A	N/A	-
Falls	1	5	0.06	0.06	-
Side Channel	0	0	N/A	0	-
Dry Channel	0	0	0	0	-
Total	28	7655	100.0	100.0	-

Red – Not Properly Functioning

Table 15. Summary of riffle habitat and substrate composition in Reach 3.

Riffle Habitat Summary (ft)						
Reach	# Riffles	Avg. Length	Avg. Width	Avg. Depth	Avg. Max Depth	
3	14	480.2	21.4	1.1	1.9	
Substrate Summary (%)						
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
3	17.86	13.57	27.14	32.14	9.29	100.00
Properly Functioning Indicators	<20.0	-	-	-	-	-

Orange – Dominant Substrate

According to standards set by the state of New Mexico, water quality is **non supporting** if the water temperature measures at or above 73.4 ^{o}F at one time or above 68 ^{o}F for four consecutive hours over 4 consecutive days. Reach 3 water quality is **not properly functioning** because the water temperature exceeded these standards. 11 temperature readings were taken during the survey of Reach 3. The highest temperature measured in Reach 3 was 79°F, with average water temperature of 73.27^{o}F.

Pool habitat in Reach 3 is **properly functioning** according to the standard for average residual depth, but pool development is **not properly functioning**. Only 12.11% of the stream habitat consists of pools, which is below the matrix standard (≥30%). The length of pool habitat relative to other types of habitat determines pool development by area of pools.

Table 16.. Summary of pool habitat and substrate composition in Reach 3.

Pool Habitat Summary											
Reach	# Pool Habitats	Avg. Length (ft)	Avg. Width (ft)	Avg. Max Depth (ft)	Avg. PTC (ft)	Avg. Residual Depth (ft)	Pools per mile	# Pools w/ Residual Depth >1'	Pools w/ Residual Depth >1'/mi.	# Pools w/ Max Depth >3'	Pools w/ Max Depth >3'/mi.
3	13	71.3	20.3	3.1	0.98	2.12	9	13	9	6	4
Properly Functioning Indicators	-	-	-	-	-	≥1.0	-	-	-	-	-

Substrate Summary (%)							
	Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
	3	43.08	10.77	19.23	23.84	3.08	100

Orange – Dominant Substrate

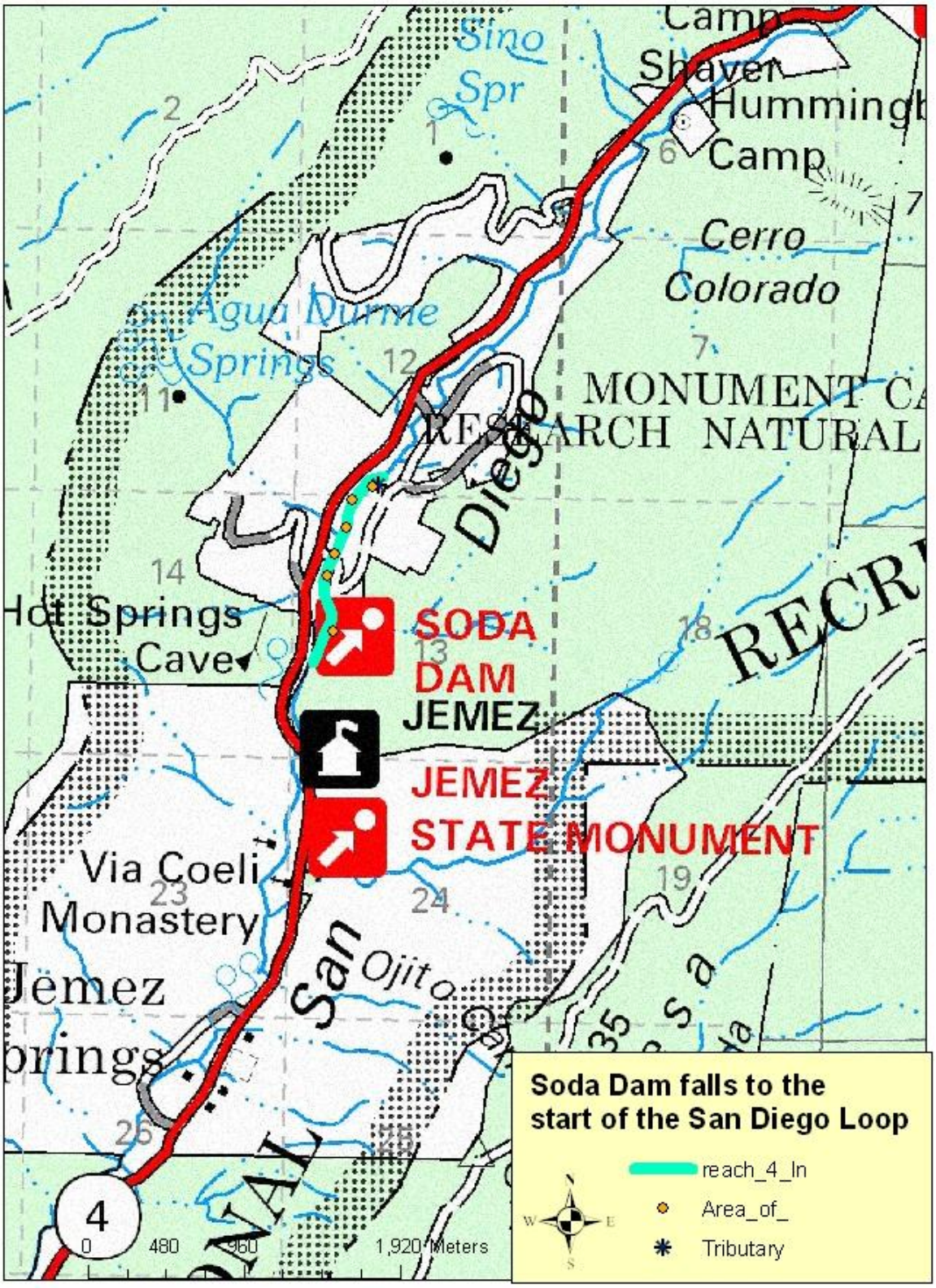
Large woody debris (LWD) was not analyzed in Reach 3 because of the low potential for source contribution.

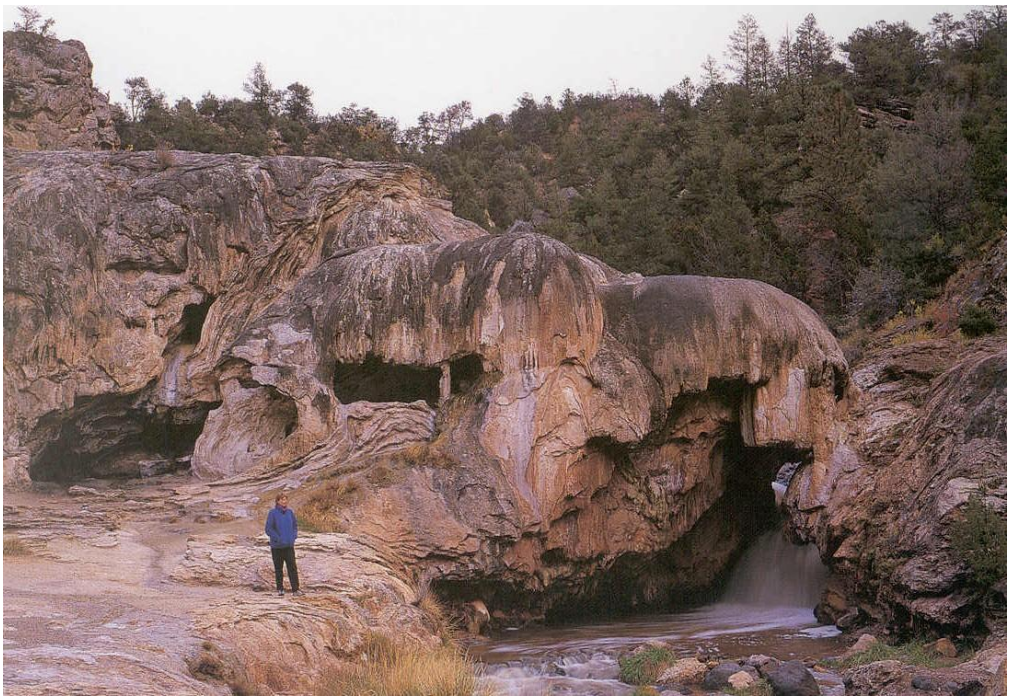
Table 17. Habitat characteristics for Reach 3.

Reach	Pool:Riffle Ratio	Avg. Bankfull Width:Depth	Pieces of LWD per mile	Total Unstable Banks (ft)	% Unstable Banks
3	1:1.1	25.5 : 1	3.45	855	5.58
Properly Functioning Indicators	-	-	>30	-	**<10**

Red – Not Properly Functioning

Reach 4: Soda Dam Falls Recreational Area to the Start of San Diego Loop





Reach 4: Soda Dam Falls Recreational Area to the Start of San Diego Loop

Reach 4 of the Jemez River was surveyed from July 19 to July 20, 2006. Reach 4 begins at the top of Soda Dam Falls Recreational Area (T18N, R2E, Sec. 13, elev. 6320') and ends 0.86 miles upstream near the southern end of San Diego Loop (T18N, R2E, Sec 12, elev. 6420'). Reach 4 is a high gradient section (2.2%) of the Jemez River and has a low sinuosity (1.12) meandering channel with significant point bar deposition for most of the reach and a similar degree of entrenchment relative to Reach 3. This reach was classified as a Rosgen stream type C2/3 with a dominant substrate of cobble and boulder.

State Highway 4 continues adjacent to the river's left bank for the length of Reach 4 but does not encroach as close to the stream as opposed to previous reaches. Reach 4 is private land that is primarily residential with the exception of the Servants of the Paraclete retreat grounds about midway through the reach. Individual homes were within 100 feet of both banks throughout Reach 4 and acequias were found on both banks. No recreational areas were encountered in Reach 4 with the exception of the Soda Dam Falls Recreational access that marked the start of the reach. Spring waters above the waterfall continue to precipitate calcium and sodium carbonate. An above bank-full width log and the left bank closest to the falls were both actively assimilating into the travertine structure of the dam. Impact along the stream was limited and observed in the form of cobble dam modifications that diverted water into the acequia head-gates. Very little refuse was seen in Reach 4 with the

exception of minor lumber and corrugated steel fragments (likely from old culverts) in the stream bed. Four submerged pumping hoses were seen in the reach.

Reach 4 bank vegetation consists primarily of willow and cottonwood, with sporadic occurrences of Russian olive and salt cedar as seen in the previous reaches. Salt cedar was most heavily concentrated just north of Soda Dam Falls on the right bank. Wild Rose, Wild Grape Vine, Squawbush, Saw grass, and Gamble Oak were also abundant in Reach 3. Aquatic species were not seen in Reach 4.

Reach 4 is predominately cobble (27.50%) and boulder (27.50%) substrate. The stream in Reach 4 was observed to have a slightly too moderately increased level of entrenchment similar to that seen in Reach 3. The number of fish observed was more than what was seen in Reach 3. Fry was mostly seen, with some chubs, and some sub-adult sized fish that could not be identified. The stream waters continued to contain higher than normal turbidity levels due to recent monsoon precipitation. No crawfish were seen in Reach 4.

Reach 4 had one arroyo that was noted approximately 50 feet upstream from Soda Dam Falls on the right bank. No flow contribution or sediment input was observed from the arroyos except in precipitation events. No other large arroyos were documented in Reach 4, though minor drainages were observed from the steeper banks. Reach 4 is comprised of equal amounts of pools (4) and riffles (4) with no side channels observed. Long riffles (from 1300’ to 2600’) with frequent pocket-water areas characterized the NSO breakdowns of Reach 4 and account for the majority of its length. One right bank irrigation structure was seen in Reach 4 and was diverted to Paraclete land by a man-made cobble dam that was being reclaimed by the river. This acequia had a high sediment accumulation, within-channel vegetation, and a broken head-gate mechanism that appeared to no longer be in use. The amount of bank instability was less than what was noted in previous reaches, but several banks were flanked by moderate to high standing erosional escarpments and abandoned river terraces. Very little bank undercutting was seen in Reach 4.

Considerable beaver activity was seen in Reach 4, with several small woody accumulations in the stream that appeared to be old damming structures in the process of being washed out. A few large cottonwoods had been toppled into the stream, and several smaller logs were in the stream as well. The beaver activity that was seen was old and no instances of recent beaver activity were identified.

LWD in the stream consisted of only 4 pieces and were all recruited from bank-side sources. None of the LWD documented was integrated into manmade structures as in previous reaches. Source potential for more LWD contribution continues to be assessed as minor with large tree species being unreliable as long term wood components. This is due mostly to the measures land owners have taken to protect the trees with chicken wire.

Water temperatures were measured at random intervals during the survey using a handheld thermometer. Four temperature readings were taken throughout Reach 4. The highest recorded temperature was 79°F and the lowest was 65°F. The average stream temperature was 72.4^{o}F.

Habitat Characteristics

The 0.86 miles (4525 ft) of stream in Reach 4 were divided into 8 NSOs (see Table 9). The 4 riffle habitats make up the majority, 95.87% of the stream habitat. The 4 pool habitats only comprise 4.13% of the stream habitat.

Table 18. Summary of Reach 4 habitat types.

Habitat Type	Number of Habitats	Total Stream Habitat (ft)	Stream Length[1] (%)	Stream Habitat[2] (%)	Properly Functioning Indicators
Pool	4	187	4.13	4.13	≥30%
Riffle	4	4338	95.87	95.87	-
Culvert	0	0	0	0	-
Tributary	0	N/A	N/A	N/A	-
Falls	0	0	0		-
Side Channel	0	0	N/A	0	-
Dry Channel	0	0	0	0	-
Total	8	4525	100.0	100.0	-

Red – Not Properly Functioning

Table 19. Summary of riffle habitat and substrate composition in Reach 4.

Riffle Habitat Summary (ft)						
Reach	# Riffles	Avg. Length	Avg. Width	Avg. Depth	Avg. Max Depth	
4	4	1084.5	20.573	1.1	2.0	
Substrate Summary (%)						
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
4	25	20	27.5	27.5	0	100.00
Properly Functioning Indicators	<20.0	-	-	-	-	-

Red – Not Properly Functioning
Orange – Dominant Substrate

According to standards set by the state of New Mexico, water quality is **non-supporting** if the water temperature measures at or above 73.4 ^{o}F at one time or above 68 ^{o}F for four consecutive hours over 4 consecutive days. Reach 4 water quality is **not properly functioning** because the water temperature exceeded these standards. 5 temperature readings were taken during the survey of Reach 4. The highest temperature measured in Reach 4 was 79°F, with average water temperature of 72.4^{o}F.

Pool habitat in Reach 4 is **properly functioning** according to the standard for average residual depth, but pool development is **not properly functioning**. Only 4.13% of the stream habitat consists of pools, which is below the matrix standard (≥30%). The length of pool habitat relative to other types of habitat determines pool development by area of pools. Bank instability was low (1.1%) with banks in good condition

Table 20. Summary of pool habitat and substrate composition in Reach 4.

Pool Habitat Summary											
Reach	# Pool Habitats	Avg. Length (ft)	Avg. Width (ft)	Avg. Max Depth (ft)	Avg. PTC (ft)	Avg. Residual Depth (ft)	Pools per mile	# Pools w/ Residual Depth >1'	Pools w/ Residual Depth >1'/mi.	# Pools w/ Max Depth >3'	Pools w/ Max Depth >3'/mi.
4	4	46.75	20.3	2.5	1.1	1.4	4.7	2	2.3	1	1.2
Properly Functioning Indicators	-	-	-	-	-	≥1.0	-	-	-	-	-

Substrate Summary (%)							
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total	
4	47.5	5.0	10.0	32.5	5.0	100	

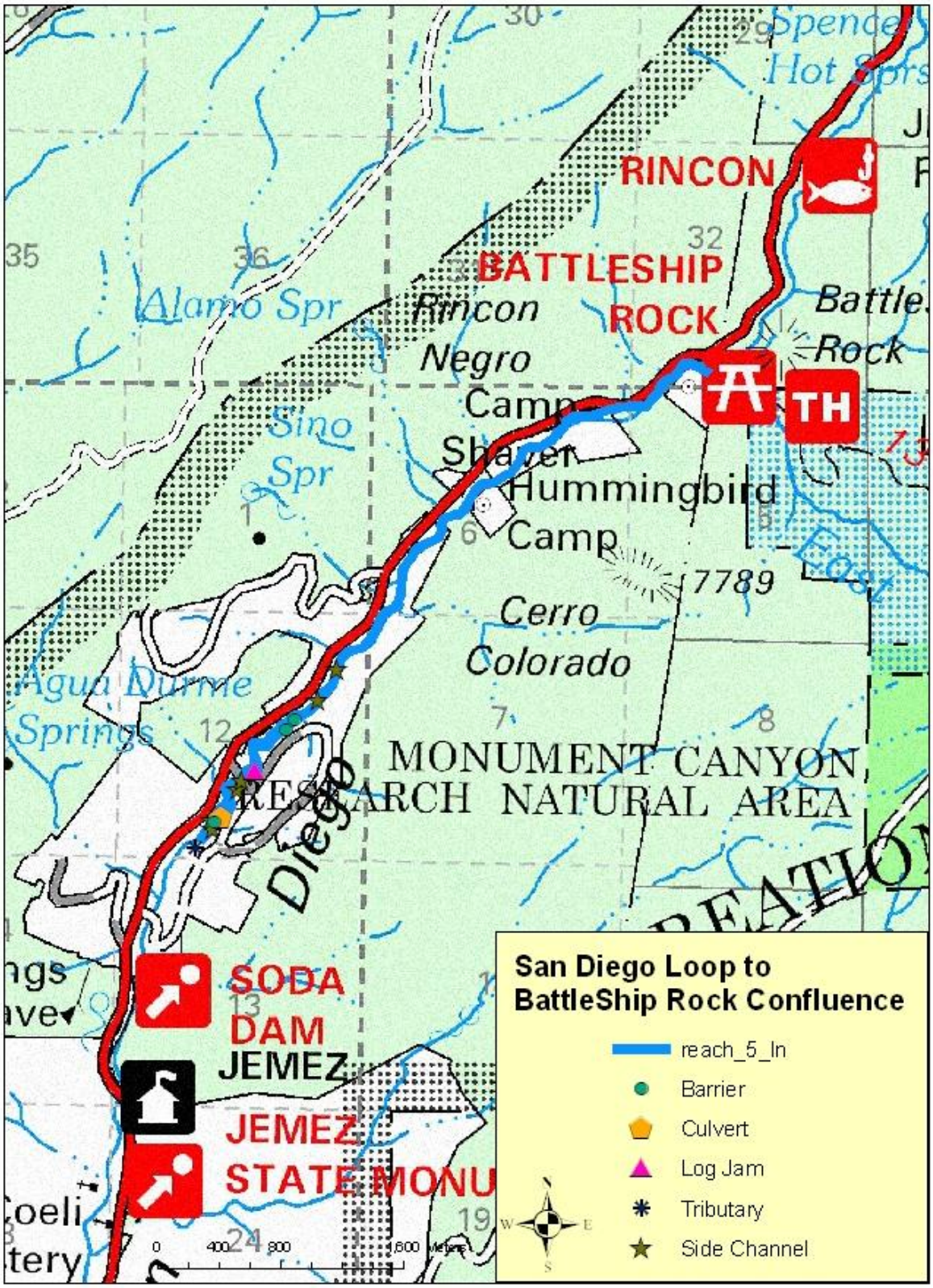
Yellow– at Risk
Orange – Dominant Substrate

Table 21. Habitat characteristics for Reach 4.

Reach	Pool:Riffle Ratio	Avg. Bankfull Width:Depth	Pieces of LWD per mile	Total Unstable Banks (ft)	% Unstable Banks
4	1:1	12:1	4	100	1.1
Properly Functioning Indicators	-	X<Y	>30	-	<10

Red – Not Properly Functioning

Reach 5: San Diego Loop to Battleship Rock



Reach 5: San Diego Loop to Battleship Rock

Reach 5 of the Jemez River was surveyed from July 19 to July31, 2006 by T. Lite and Emily Woolsely and completed by Sean Ferrell and Chuck Dentino from September 13 to September 18, 2006. Reach 5 begins at the start of the San Diego Loop (T18N, R2E, Sec 12, elev. 6420') and ends at the Battleship Rock confluence where the East Fork Jemez River and San Antonio River meet (T19N, R3E, Sec 32, elev. 6800').

Reach 5 is a high gradient section (2.1%) of the Upper Jemez River with a low sinuosity (1.09) meandering channel. Reach 5 can be classified as a Rosgen stream type C2 with a dominate substrate of cobble and boulder.

One home was seen that was under construction and had exposed insulation, and might have been the source for some of the construction debris noted in Reach 3. The last acequia on the left bank irrigated private residential land and ran along the edge of a 20' high erosion escarpment closer to the end of Reach 4. This acequia was in use and it was noted that there were several water runoffs from this irrigation channel that appeared to be leaks in the irrigation channel as opposed to designated returns. Inspection of the irrigation channel revealed that it was in a mild state of disrepair, and had occasional culverts to contain water flow in less stable areas of the acequia.

Very few LWD were observed in Reach 5 and only 5 pieces were recorded: two small, two medium, and one large. LWD in Reach 5 only had .08 pieces of LWD per mile and failed to meet the required >20peices per mile. LWD in this Reach was not properly functioning.

Habitat Characteristics

The 3.45 miles (18,238 ft) of stream in Reach 5 were divided into 88 NSOs (see Table 13). The 41 riffle habitats make up the majority, 81.7% of the stream habitat. The 29 pool habitats only comprise 9.15% of the stream habitat and the 15 side channels form a scant 9.15 % of stream habitat.

Table 22. Summary of Reach 5 habitat types.

Habitat Type	Number of Habitats	Total Stream Habitat (ft)	Stream Length[1] (%)	Stream Habitat[2] (%)	Properly Functioning Indicators
Pool	29	1,668	10.07	9.15	≥30%
Riffle	41	14,902	89.93	81.70	-
Culvert	1	0	0.0	0.0	-
Tributary	3	N/A	N/A	N/A	-
Falls	0	0	0.0	0.0	-
Side Channel	15	1,668	N/A	9.15	-
Dry Channel	0	0	0.0	0.0	-
Total	88	18,238	100.0	100.0	-

Red – Not Properly Functioning

Table 23. Summary of riffle habitat and substrate composition in Reach 5.

Riffle Habitat Summary (ft)						
Reach	# Riffles	Avg. Length	Avg. Width	Avg. Depth	Avg. Max Depth	
5	40	363.46	21.9	1.24	2.39	
Substrate Summary (%)						
Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
5	14.36	24.87	26.15	33.85	0.77	100.00
Properly Functioning Indicators	<20.0	-	-	-	-	-

Red – Not Properly Functioning
Orange – Dominant Substrate

According to standards set by the state of New Mexico, water quality is **non supporting** if the water temperature measures at or above 73.4 ^{o}F at one time or above 68 ^{o}F for four consecutive hours over 4 consecutive days. Reach 5 water quality is **at risk** because the water temperature exceeded these standards. 21 temperature readings were taken during the survey of Reach 5. The highest temperature measured in Reach 5 was 74°F, with average water temperature of 64.1^{o}F.

Pool habitat in Reach 5 is **properly functioning** according to the standard for average residual depth, but pool development is **not properly functioning**. Only 9.15% of the stream habitat consists of pools, which is below the matrix standard (≥30%). The length of pool habitat relative to other types of habitat determines pool development by area of pools.

Table 24. Summary of pool habitat and substrate composition in Reach 5.

Pool Habitat Summary											
Reach	# Pool Habitats	Avg. Length (ft)	Avg. Width (ft)	Avg. Max Depth (ft)	Avg. PTC (ft)	Avg. Residual Depth (ft)	Pools per mile	# Pools w/ Residual Depth >1'	Pools w/ Residual Depth >1'/mi.	# Pools w/ Max Depth >3'	Pools w/ Max Depth >3'/mi.
1	29	57.52	19.21	2.73	0.86	1.96	8.2	27	7.6	7	1.9
Properly Functioning Indicators	-	-	-	-	-	≥1.0	-	-	-	-	-

Substrate Summary (%)							
	Reach	Sand	Gravel	Cobble	Boulder	Bedrock	Total
	5	25.4	30	17.1	26.8	0.7	100.00

Yellow- At Risk
Orange – Dominant Substrate

Table 25. Habitat characteristics for Reach 5.

Reach	Pool:Riffle Ratio	Avg. Bankfull Width:Depth	Pieces of LWD per mile	Total Unstable Banks (ft)	% Unstable Banks
1	1:1.4	1:5.3	1.5	1407	7.7
Properly Functioning Indicators	-	X<Y	>30	-	<10

Red – Not Properly Functioning
Yellow – At Risk

References

USDA Forest Service. 2005. Stream Inventory Handbook: Level I and II. Version 3.1. U.S. Forest Service, Southwestern Region, Albuquerque, New Mexico.