

INTRODUCTION

According to Forest Service Manual (FSM) 2500, Chapter 2520 on Watershed Protection and Management, agency policy requires that the Forest Service “apply management practices that meet requirements for protecting, maintaining, restoring, or improving watershed conditions.” To comply with this policy, the Forest Service must assess watershed condition trends as they are influenced by land use practices by applying a scientific approach to evaluate, protect, and restore watershed conditions. The purpose of the watershed condition assessment is to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes and interactions within a watershed. Watershed analysis is essentially ecosystem analysis at the watershed scale.

This Watershed Assessment is intended to describe current conditions with a focus on the resources that would be used to characterize watershed condition, identify watersheds or subwatersheds in need of treatment, and recommend changes in the management of critical resources to protect or restore watersheds. The analysis follows the steps provided in Part 2 of *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis – Version 2.2* (USFS 1995) and consists of six steps:

1. Characterization of the watershed
2. Identification of issues and key questions
3. Description of current conditions
4. Description of reference conditions
5. Synthesis and interpretation of information
6. Recommendations

STEP 1: WATERSHED CHARACTERIZATION

The purpose of this section is to identify the dominant physical, biological and human processes or features of the watershed that affect ecosystem functions or conditions. This section provides the context for identifying elements that need to be addressed in the analysis, as well as the management decisions and regulatory constraints that influence resource management. The *Federal Guide for Watershed Analysis* (USFS 1995) lists seven core topics to be considered: Hydrology, Stream Channel, Erosion Processes, Water Quality, Vegetation, Species and Habitats, and Human Uses. The features of greatest importance in the Jicarilla Ranger District are described in more detail by watershed in later sections to establish current conditions and to provide a basis for development of recommendations for watershed improvements.

Location and Setting

The Jicarilla Ranger District (District) is located in the westernmost portion of the Carson National Forest in Rio Arriba County, New Mexico (**Map 1**). The District is located in the Colorado Plateau Semidesert Province (Bailey 1995) consisting of tablelands with moderate to considerable relief. Surface elevations range from approximately 6,200 feet to almost 7,700 feet.

Due to the region's generally high altitude, the climate on the District is characterized by cold winters with hot summer days and cool nights. Annual average temperatures are 40 to 55 degrees Fahrenheit, which decrease as the elevation increases. Average annual precipitation in the region ranges from less than 10 inches to 20 inches, with the District precipitation closer to the low end of the range. Summer rains are thunderstorms, with ordinary rains or snowfall in winter.

Hydrology

The five 5th-level hydrologic units or watersheds¹ that occur in the District are located within two subbasins (4th-level hydrologic units)—the Upper San Juan and the Blanco. All of these watersheds ultimately flow into the San Juan River. The watersheds in the District are shown on **Map 2** and summarized in **Table 1**.

Hydrologic units are identified by a Hydrologic Unit Code (HUC) and by a name. For the purposes of this analysis, the Compañero and Tapacito watersheds are combined. Only 1 percent of the Tapacito watershed falls within the District, too small to be analyzed independently. Both of these watersheds are within the same subbasin, Blanco, and flow to the same location on the San Juan River.

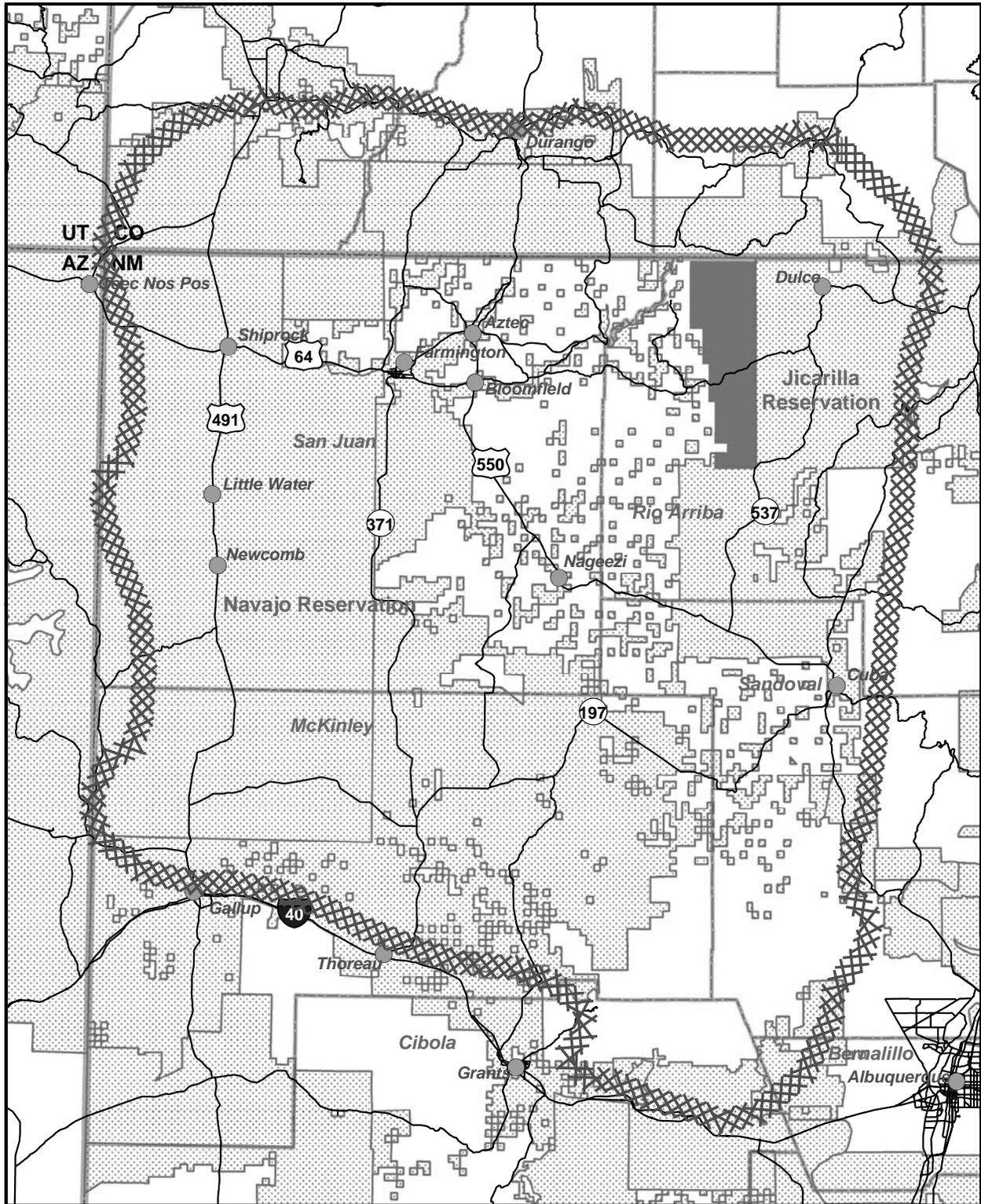
Table 1. Watersheds on the Jicarilla Ranger District

Watershed Name	HUC (5 th -Level)	Subbasin	Acreage of National Forest land	Total acreage	% in District
Bancos	14080101134	Upper San Juan	59,109	107,986	55%
Compañero	14080103050	Blanco	30,815	213,837	14%
Tapacito	14080103030	Blanco	2,022	240,525	1%
Carracas	14080101060	Upper San Juan	13,193	51,940	25%
La Jara	14080101136	Upper San Juan	52,389	185,112	28%

Source: NRCS 1999.

¹ Watersheds are hierarchical in nature and are defined as “any area of land that drains to a common point” (USFS 1995). Generally, for analysis purposes, the term watershed refers to all areas resulting from the first subdivision of a subbasin. For the District, these 5th-level watersheds were delineated by the USDA-Natural Resources Conservation Service (NRCS) and are based on subdivisions of the 4th-level hydrologic unit codes (HUC) delineated by the U.S. Geological Survey (USGS).

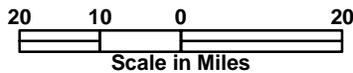
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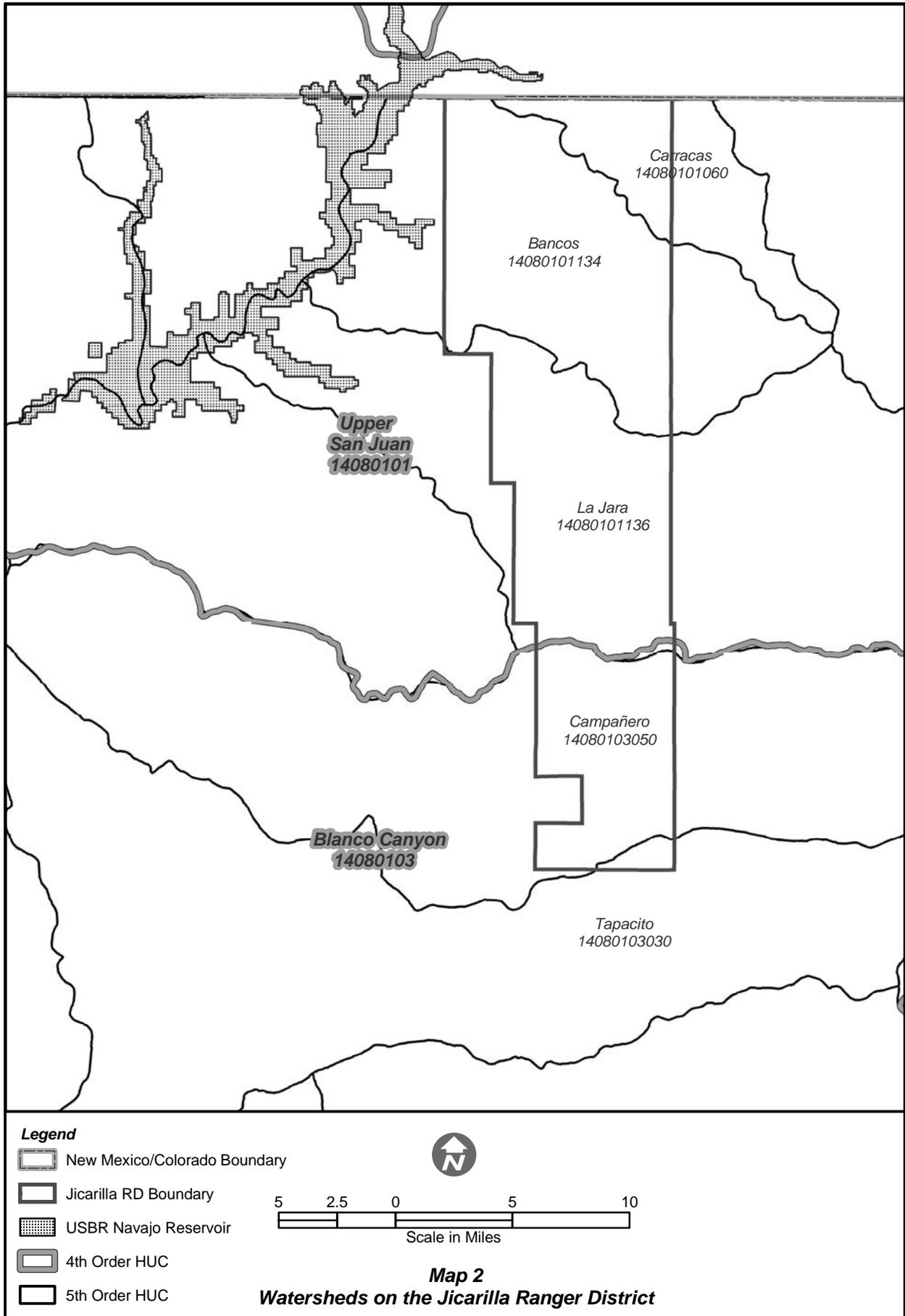
Legend

-  New Mexico/Colorado Boundary
-  County Boundary
-  Jicarilla Ranger District
-  Tribal Land
-  Highway
-  San Juan Basin

**Map 1. Location of
Jicarilla Ranger District
in the San Juan Basin**



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Bancos, Carracas, and La Jara watersheds are all part of the Upper San Juan 4th-level hydrologic unit (14080101) or subbasin. Bancos watershed, which drains into the San Juan River below Navajo Lake, is the only watershed with most of its area (55 percent) on National Forest land. The National Forest land is located in the middle to upper part of the watershed. Only 25 percent of the Carracas watershed, which outlets into Navajo Lake, is on National Forest land. The District land in the Carracas watershed is in the middle of the delineated area. The La Jara watershed outlets into the San Juan River downstream from the Bancos watershed. The District land in the La Jara watershed, 28 percent of the total area, is also located in the center of the area.

Compañero is a subwatershed of the Blanco basin (14080103) that flows into Blanco Canyon, through Largo Canyon, and ultimately into the San Juan River. Only 15 percent of the two watersheds are on National Forest land, which comprises a small area in the upper half of the basin.

In most cases, land management in these watersheds would have a relatively small impact on the quality of the receiving waters. However, restoration of degraded watersheds and protection of natural and cultural resources on National Forest land is necessary to comply with the Forest Plan goals and objectives.

A single stream gage on the San Juan River below Navajo Reservoir measures flow in the Bancos watershed near Archuleta, New Mexico on Bureau of Reclamation land. The other watersheds do not have gages, so flows must be estimated through hydrologic modeling. Annual peak flows typically occur with spring snowmelt, but may be surpassed by flows from monsoonal rains in the summer.

The canyons in the District, which are dry most of the time, can experience flash floods after precipitation events. Storms may create large flows, which are commonly of limited duration and extent. Peak flows and the time of concentration within each watershed are affected by the type, distribution, and condition of vegetation, soil characteristics, and slopes. Structures on the landscape also modify the flow of surface water runoff. Roads direct water to drainageways; roads and water bars redirect flows; areas such as well pads and roads are compacted or surfaced so that rainfall runs off where it originally infiltrated the soil; and stock tanks and wetlands represent artificial and natural water impoundments, respectively.

Stream Channels

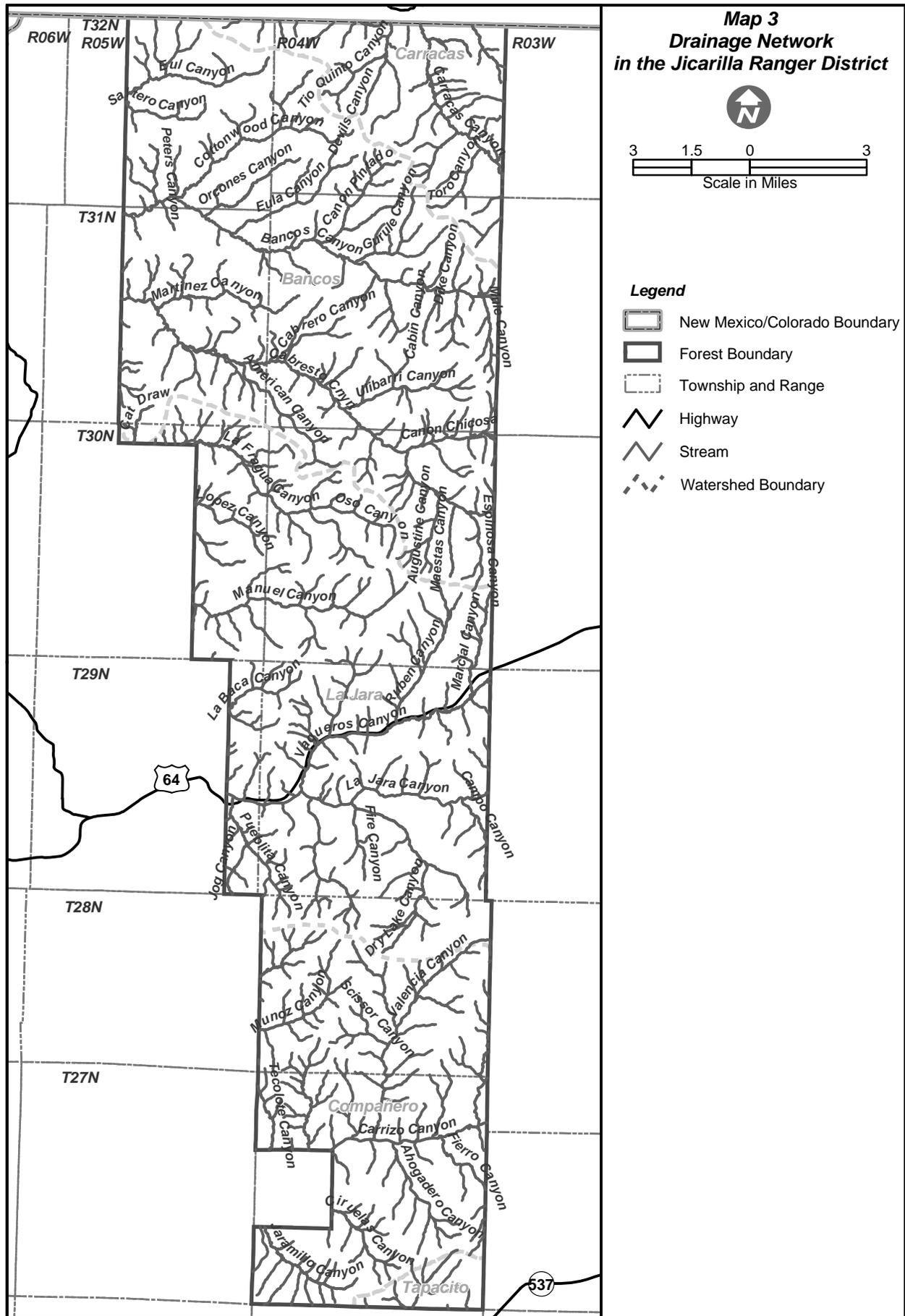
Although there are no perennial streams on District land, 565 miles of arroyos, washes, canyons, and intermittent streams exist as part of the drainage network, shown on **Map 3**. The San Juan River and other major streams of the basin are actively downcutting their channels (NMED 2002). The intermittently flowing arroyos, washes, canyons, and streams in the District often cut into soil and other unconsolidated materials, contributing sedimentation to the downstream river system. A typical arroyo has a flat bottom, commonly covered with gravel or sand and U-shaped or vertical sides (Stokes 1969). Bank erosion is often rapid in arroyos in the District. When water flows in the arroyos, it picks up mud and salts that are eventually deposited in the San Juan River, resulting in the impaired uses identified by the New Mexico Environment Department (NMED 2000).

Streambank erosion depends upon flood discharge, previous precipitation, the composition of bank material, and vegetation (EPA 2001). The sudden influx of water from storm events, especially thunderstorms, easily erodes soils that cover the area. The type and amount of vegetation in the watershed and along the arroyos affects the amount of surface water runoff. Healthy grass cover increases infiltration of surface water flows, filters out sediment before it reaches drainageways, reduces runoff, and lowers the peak flows in the surface water system.

Erosion Processes

The District is located on the northeastern-most part of the San Juan Basin, which is characterized by an asymmetrical layering of sedimentary rocks. Most soils in the District are deep and well drained, formed from alluvial or residual materials derived from sandstone, siltstone, and shale.

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The dominant types of erosion occurring in the District are wind erosion and sheet, rill, and gully water erosion. There is little evidence of mass wasting, except along a few steep canyon walls with intermittent surface water flows, especially at the outside of stream channel meanders, although streambank erosion is widespread because most of the waterways are actively downcutting.

The type and quality of vegetative cover have crucial impacts on erosion rates, soil productivity, and soil condition, all of which contribute to watershed health. Activities that damage vegetation and increase the amount of bare soil in a watershed such as road construction, well pad and pipeline construction, cross-country vehicular travel, and grazing accelerate natural soil erosion.

Water Quality

In the reach of the San Juan River between the mouth of Largo Canyon and Navajo Reservoir, the New Mexico Environment Department identified turbidity, sedimentation, and stream bottom deposits as the dominant water quality problems in the “303(d) List for Assessed Stream and River Reaches” (NMED 2000). The probable sources of pollutants identified in the list are rangeland, resource extraction, removal of riparian vegetation, and streambank modification/destabilization. The primary water quality concern in Navajo Reservoir is the chronic level of mercury, thought to be derived from atmospheric deposition. Aluminum and selenium are other metals that naturally occur in the sediments of the lake (NMED 2002).

Vegetation

Healthy vegetation is important to the stability of a watershed in many ways. Vegetative cover reduces the loosening of soil particles as rain hits the ground, making it less likely to be removed by sheet and rill erosion and more likely to infiltrate into the ground, recharging the groundwater system. Vegetation, especially grass roots, often holds soil in place and filters out sediment from overland surface water flows before the runoff reaches the stream system, minimizing sedimentation. A variety of types and structural stages of vegetation offer wildlife habitat diversity, as well as forage for livestock.

The vegetative communities in the District include grassland, mixed shrubland, mixed conifer woodlands, ponderosa pine forest, and riparian. The vegetation types are important as wildlife habitat, especially in the key areas of deer and elk winter range and the Wild Horse Territory.

Invasive plants are found in the District, especially on disturbed ground, primarily due to road construction and gas development. Control of invasive plants is important to maintain a healthy vegetative cover and wildlife habitat provided by native vegetation.

Species and Habitats

Altitudinal vegetation/habitat zones within the District include a foothills zone (generally below 7,000 feet) characterized by mixed grasses, shrublands, and piñon-juniper woodlands; and an open forest zone (above 7,000 feet), characterized by ponderosa pine and mixed ponderosa pine-Douglas fir forests. Riparian habitat, comprised mostly of willows, sedges and rushes, is limited due to a lack of perennial water. Habitat conditions are affected by a variety of management activities such as gas development, livestock grazing, fire suppression, wild horse management, and recreation.

Eleven Management Indicator Species (MIS) have the potential to occur in the District, including three federally listed and one formally federally listed species. MIS are considered to be representative of a variety of species with similar life requirements and were determined to reflect the habitat needs for the majority of the Forest's species. MIS were selected because population changes are believed to indicate the effects of management activities that occur in the Forest. Trends in the population of each MIS are monitored to evaluate the conditions of the Forest's ecosystems (USFS 1990). The Forest Plan provides direction on managing quality habitat for MIS by management area (MA). While the descriptions of the occurrence of sensitive species and MIS do not lend themselves to being grouped by watershed, consideration of the distribution of habitat by vegetation type in each watershed is useful for characterizing watershed condition.

Special status wildlife include species that are listed as threatened or endangered under the federal Endangered Species Act, Forest Service Region three sensitive species, or other species of special concern. Eight of the 26 species listed for Rio Arriba County are known to occur or may occur in the District.

Habitat loss, disturbance, and fragmentation by other uses in the District are of concern when considering the character and quality of wildlife habitat.

Human Uses

Minerals

The dominant human use in the District is gas extraction and development. There are over 800 well pads (active and plugged) that are serviced by roads and pipelines in the District, shown on **Map 4**. Many of the roads in the District are single-use roads, built specifically to serve well pads. Gas development activities are the primary cause of surface disturbance in the District affecting watershed vulnerability.

Livestock Grazing

Six grazing allotments are used by seven permittees and cover the entire District, shown on **Map 5**. Allotments are managed as units that do not correspond to watershed boundaries, but the management of the allotments affects vegetation health and watershed conditions.

Transportation

Most of the 464 miles of roads in the District are used by the gas industry to service its equipment and develop new wells. Most of the single-use roads, built specifically to serve well pads, are gated to limit traffic. The main collector roads are the open roads that provide access to the gas service roads and also provide access to the campgrounds and hunting areas.

Recreation

Recreation in the District is estimated in terms of Recreational Visitor Days (RVD). (An RVD represents one visitor for a 12-hour stay on the forest.) Hunting in the District, the primary recreational activity, is estimated to be almost 16,000 RVDs during September, October, November, and January, and includes some use of the campgrounds. General day use recreation, mostly during the summer months, accounts for approximately 900 RVDs.

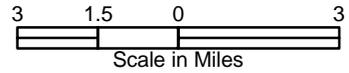
Cultural Resources

There are 862 recorded archaeological sites containing 949 cultural components within the District (USFS 2003a). The distribution of these sites is shown on **Map 6**. The majority of recorded sites contain early Pueblo and Navajo habitation sites, limited activity sites, and Navajo pueblitos.

Traditional cultural properties are most likely located on the district, but many of the locations and uses have not been documented by the Forest Service staff. Permits are issued by the Forest Service for some traditional uses of the land, including firewood cutting and the collection of oak leaves for ceremonial purposes. Agreements are in place with the Jicarilla Apache Tribe to the east to address the use and management of shared roads.

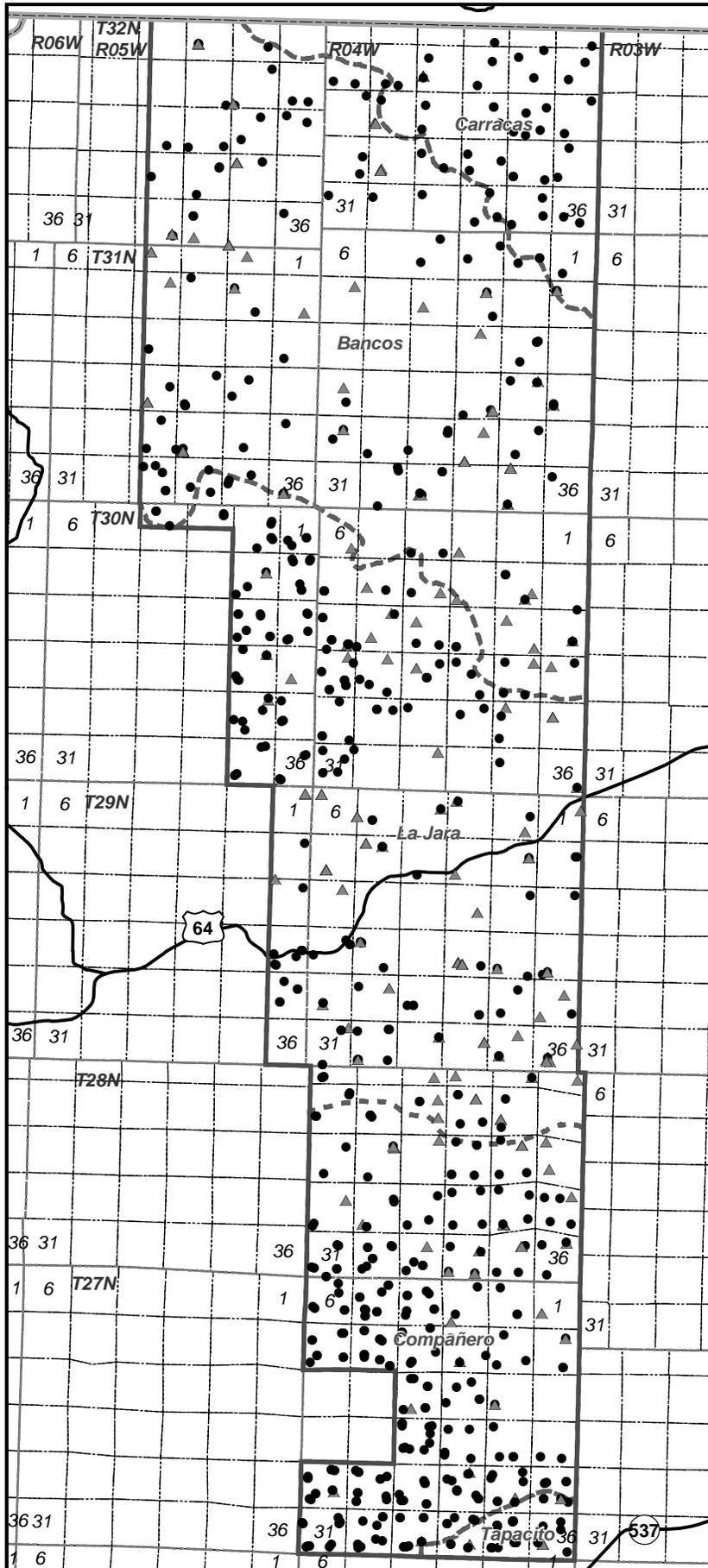
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Map 4
Wells in the Jicarilla
Ranger District



Legend

-  New Mexico/Colorado Boundary
-  Forest Boundary
-  Township and Range
-  Section Line
-  Highway
-  Watershed Boundary
- Well**
-  Existing
-  Plugged and/or Abandoned



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