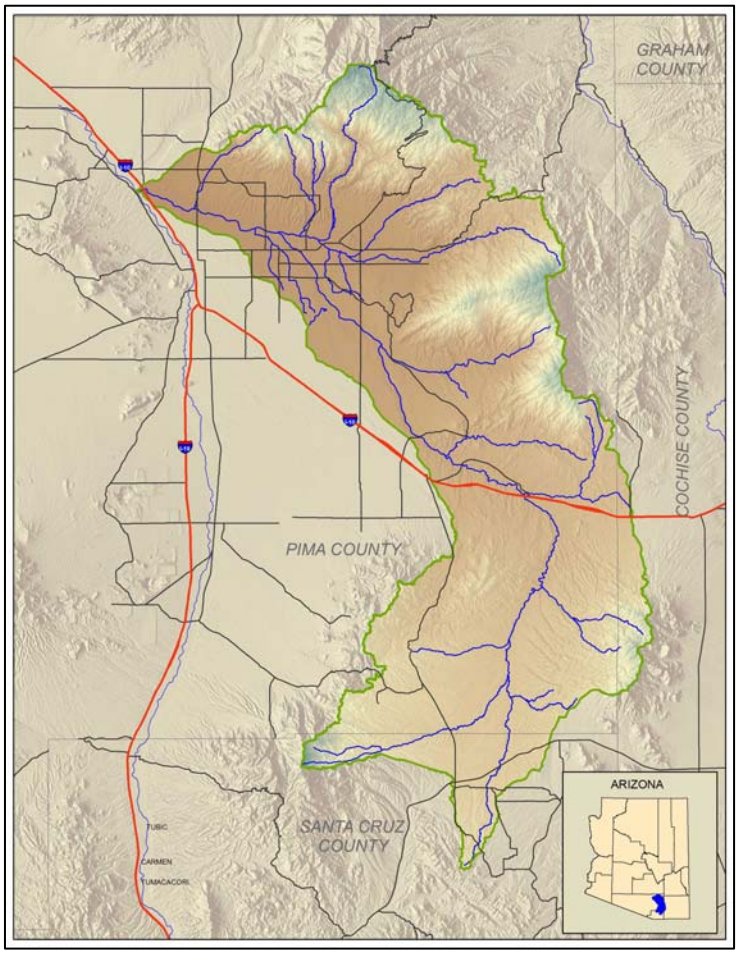
# Pantano Wash - Rillito River Watershed
# Arizona
## Rapid Watershed Assessment
**June 2007**

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**Pantano Wash - Rillito River**
**Watershed 15050302**
**8-Digit Hydrologic Unit**
**Rapid Watershed Assessment**

## Section 1: Introduction

### Overview of Rapid Watershed Assessments

A Rapid Watershed Assessment (RWA) is a concise report containing information on natural resource conditions and concerns within a designated watershed. The "rapid" part refers to a relatively short time period to develop the report as compared to a more comprehensive watershed planning effort. The “assessment” part refers to a report containing maps, tables and other information sufficient to give an overview of the watershed and for use as a building block for future planning. RWAs look at physical and socioeconomic characteristics and trends, as well as current and future conservation work.

The assessments involve the collection of readily available quantitative and qualitative information to develop a watershed profile, and sufficient analysis of that information to generate an appraisal of the conservation needs of the watershed. These assessments are conducted by conservation planners, using Geographic Information System (GIS) technology, assessing current levels of resource management, identifying priority resource concerns, and making estimates of future conservation work. Conservation Districts and other local leaders, along with public land management agencies, are involved in the assessment process.

An RWA can be used as a communication tool between the Natural Resources Conservation Service (NRCS) and partners for describing and prioritizing conservation work in selected watersheds. RWAs provide initial estimates of conservation investments needed to address the identified resource concerns in the watershed. RWAs serve as a platform for conservation program delivery, provide useful information for development of NRCS and Conservation District business plans, and lay a foundation for future cooperative watershed planning.

### General Description of the Pantano Wash – Rillito River Watershed

The Pantano Wash - Rillito River Watershed is located in the south-central portion of the state of Arizona, east of the city of Tucson. (Figure 1-1). The watershed can be defined as the area drained by the Pantano Wash to the confluence with the Santa Cruz River north of Tucson, near Oro Valley. The watershed comprises 588,800 acres (920 square miles), and is located approximately 90% in Pima County and about 10% in Santa Cruz County. Thirty two percent of the land is privately owned, 22% is State Land , 29% is managed by the Forest Service, 9% is managed by the National Parks 7% is managed by the BLM, and 1% by the military .

There are about 4,000 acres of irrigated cropland in the watershed. Important crops include alfalfa and cotton. The remaining area is primarily rangeland, with some forest land at the highest elevations. Livestock use is dominated by ephemeral steer operations at the

lower elevations, and cow calf operations at the higher elevations.

Major towns and cities include Oro Valley, Tanque Verde, Mountain View, and Sonoita. Conservation assistance is provided through five Natural Resource Conservation Districts: Hereford, Pima, Redington, Santa Cruz and San Pedro. There is one U.S. Department of Agriculture (USDA) Service Center in the area, located in Tucson.

Resource concerns in the watershed include soil erosion, rangeland site stability, rangeland hydrologic cycle, excessive runoff (causing flooding or ponding), aquifer overdraft, excessive suspended sediment and turbidity in surface water, effect of air quality on visibility and plant health, threatened or endangered plant and animal species, noxious and invasive plants, wildfire hazard, inadequate water for fish and wildlife, habitat fragmentation, and inadequate stock water for domestic animals (NRCS Factsheet)

## Section 2: Physical Description

Watershed Size

The Pantano Wash - Rillito River Watershed covers approximately 935 square miles (598,235 acres), representing about 1.0% of the state of Arizona. The watershed has a maximum width of about 25 miles east to west, and a maximum length of about 50 miles north to south.

The Pantano Wash - Rillito River Watershed was delineated by the U.S. Geological Survey and has been subdivided by the NRCS into smaller watersheds or drainage areas. Each drainage area has a unique hydrologic unit code number (HUC) and a name based on the primary surface water feature within the HUC. These drainage areas can be further subdivided into even smaller watersheds as needed. The Pantano Wash - Rillito River is an 8-digit HUC of 15070102 and contains the following 10-digit HUCs:

- 1505030201 (Cienega Creek)
- 1505030202 (Agua Verde-Pantano Wash)
- 1505030203 (Tanque Verde Creek -Rillito River) (Figure 1-2)

Geology

The Pantano Wash - Rillito River Watershed is located in Eastern Pima County within the Tucson Valley Basin. Elevations in this basin range from 3,720 feet in the southeast to 2,030 feet in the northwest within the river drainage, and approximately 9,440 feet at the watershed high-point near Summerhaven. The basin floor is generally level, and there are several primary and secondary drainage channels draining to the northwest. These channels convey surface runoff northward and westward through the basin. The Santa Catalina, Rincon, Tucson and Tortillita ranges abut the Pantano Wash area. The generally gentle slope of the basin floor tends to increase rapidly as it nears the various mountains ranges.

The mountains surrounding the Tucson Basin are composed of metamorphic, sedimentary, and intrusive igneous rock extending beneath the alluvial material filling the basin (Pima County, 2006). This impermeable material provides a physical boundary that forms the area's ground water basins. Over time, erosion or weathering of the mountainous areas has resulted in the deposition of alluvium up to 7,000 feet thick in areas south and southeast of Tucson. A stratigraphic section through the basin reveals, from the ground surface downward, superficial deposits (primarily stream channel and terrace deposits) of the Fort Lowell Formation, the Tinaja beds, and the Pantano Formation.

The Pantano Formation is composed primarily of Catalina granite and gneiss, ranging from loosely packed to weakly cemented into place. The Tinaja beds are a series of beds composed of Catalina gneiss changing to volcanics with increasing depth, ranging from sandy gravel along the basin's margins to gypsiferous clayey silt and mudstone in the center of the basin. The thickness of each unit varies throughout the basin, with the deeper beds generally thicker than those overlying them.

The basin is interwoven with deep geologic faults, which are considered to be inactive. Figure 2-1 shows the geology of the Pantano Wash – Rillito River Watershed.

Soils

Soils in the Pantano Wash - Rillito River Area are primarily the results of fluvial deposition of weathering products from the surrounding mountains. Soil particle sizes typically decrease as distance from the mountain fronts increases. Organic residue does not typically accumulate on and near the soil surface. Area soils have, at best, moderate infiltration rates. Infiltration rates tend to decrease near the mountains and are generally lower in the extreme southeastern and northeastern portions of the Pantano Wash - Rillito River. The effects of the soils' infiltration characteristics are low natural ground water recharge rates and relatively high volumes of surface runoff.

Detailed soils information for the watershed is available from the Natural Resources Conservation Service (NRCS) and the U.S. Forest Service (USFS). The USFS maintains Terrestrial Ecosystem Surveys on National Forest Lands within the watershed. Lands outside of National Forests are included within the following NRCS Soil Surveys: "Soil Survey of Pima County, AZ, Eastern Part"; and "Soil Survey of Santa Cruz and Part of Cochise and Pima Counties, AZ." Soils data and maps from these Soil Surveys can be accessed through the NRCS Web Soil Survey website: http://websoilsurvey.nrcs.usda.gov.

Common Resource Areas

The USDA, Natural Resources Conservation Service (NRCS) defines a Common Resource Area (CRA) as a geographical area where resource concerns, problems, or treatment needs are similar (NRCS 2006). It is considered a subdivision of an existing Major Land Resource Area (MLRA). Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area.

The Pantano Wash – Rillito River Watershed is comprised of three Common Resource Areas (Figure 2-2 and Table 2-1).

*Table 2-1: Pantano Wash - Rillito River Watershed - Common Resource Areas*

| Common Resource Area Type | Area (sq. mi.) | Percent of Watershed |
|---|---|---|
| 41.3 Chihuahuan Sonoran Semidesert Grasslands | 494 | 53.70% |
| 41.1 Mexican Oak-Pine Forest and Oak Savannah | 254 | 27.59% |
| 40.1 Upper Sonoran Desert | 172 | 18.71% |

Data Source: GIS data layer "cra", NRCS, and Arizona Land Resource Information System (ALRIS, 2004). Natural Resource Conservation Service (NRCS 2006)

At the lower end of the watershed, CRA 40.1 “Upper Sonoran Desert” occurs at elevations ranging from 2000 to 3200 feet with precipitation averaging 10 to 13 inches per year. Vegetation includes saguaro, palo verde, mesquite, creosotebush, triangle bursage, prickly pear, cholla, wolfberry, bush muhly, threeawns, ocotillo, and globe mallow. The soils in the area have a thermic soil temperature regime and a typic aridic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Deep, gravelly, limy, moderately coarse to moderately fine-textured soils occur on fan terraces. Deep and shallow to a hardpan, limy and gravelly, medium and moderately coarse textured soils occur on fan terraces. Deep, moderately coarse to moderately fine-textured soils occur on floodplains and alluvial fans.

Moving up the watershed, CRA 41.3 “Chihuahuan – Sonoran Semidesert Grasslands” occurs at elevations ranging from 3,200 to 5,000 feet with precipitation averaging 12 to 16 inches per year. Vegetation includes mesquite, catclaw acacia, palo verde, range ratany, fourwing saltbush, tarbush, littleleaf sumac, sideoats grama, black grama, plains lovegrass, cane beardgrass, tobosa, threeawns, Arizona cottontop and bush muhly. The soils in the area have a thermic temperature regime and an ustic aridic soil moisture regime. The dominant soil orders are Entisols, Aridisols, and Mollisols. Deep, gravelly, moderately coarse to moderately fine-textured soils occur on fan terraces. Shallow, cobbly and gravelly soils and rock outcrop occur on hills and mountains.

In the upper portions of the watershed occurs CRA 41.1 “Mexican Oak-Pine Forest and Oak Savannah” with elevations ranging from 4500 to 10,700 feet. Precipitation averages 16 to 30 inches. Vegetation includes Emory oak, Arizona white oak, one-seed juniper, alligator juniper, California bricklebush, skunkbush sumac, Arizona rosewood, wait-a-bit mimosa, sideoats grama, blue grama, wooly bunchgrass, plains lovegrass, squirreltail, and pinyon ricegrass. The soils in the area have a thermic to mesic temperature regime and an aridic ustic to typic ustic soil moisture regime. The dominant soil orders are Aridisols and Mollisols. Deep, fine-textured and gravelly, moderately coarse to moderately fine-textured soils occur on fan terraces. Shallow, gravelly and cobbly, moderately coarse to moderately fine-textured soils and rock outcrop occur on hills and mountains.

These three Common Resource Areas (CRA 40.1, CRA 41.3, CRA 41.1) occur within the Basin and Range Physiographic Province which is characterized by numerous mountain ranges rising abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

## Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. Approximately 44% of the Pantano Wash - Rillito River Watershed has a slope greater than 15%, while 32% of the watershed has a slope less than 5%. The Cienega Creek Watershed is relatively flat, with only

38% of its area over 15% slope, and 29% less than 5% slope. The Tanque Verde Creek-Rillito River and Aura Verde-Pantano Wash Watersheds are relatively steeper, with 53% and 41% of the area greater than 15% slope, respectively (Table 2-2 and Figure 2-3).

*Table 2-2: Pantano Wash - Rillito River Watershed Slope Classifications.*

| Watershed Name | Area (sq. mi.) | Percent Slope | | |
|---|---|---|---|---|
| | | 0-5% | 5-15% | >15% |
| Cienega Creek 1505030201 | 414 | 28.63% | 33.34% | 38.00% |
| Tanque Verde Creek – Rillito River 1505030203 | 318 | 32.62% | 14.71% | 52.70% |
| Agua Verde – Pantano Wash 1505030202 | 188 | 38.50% | 20.12% | 41.46% |
| Pantano Wash – Rillito River Watershed | 920 | 32.02% | 24.20% | 43.80% |

*Data Sources: USGS National Elevation Dataset, 2004. http://edc.usgs.gov/geodata/*

Streams, Lakes and Gaging Stations

The locations of active and inactive gaging stations, and their respective annual mean stream flow, are found in Table 2-3.1. Sabino Creek near Tucson has the largest active stream flow with 21.19 cfs. Cienega Creek near Sonoita has the lowest active stream flow with 1.55cfs. Table 2.3.2 lists major lakes and reservoirs in the Pantano Wash - Rillito River Watershed, as well as their watershed position, surface area, elevation and dam name. Kinnison Wash is the largest surface water in the watershed with an area of about 15 acres. Table 2-3.3 lists the major streams and their lengths. Stream lengths range from 45 miles for Cienega Creek to 12.0 miles for Rillito Creek (Figure 2-4).

*Table 2-3.1: Pantano Wash - Rillito River Watershed USGS Stream Gages and Annual Mean Stream Flow.*

| USGS Gage ID | Site Name | Begin Date | End Date | Annual Mean Stream Flow (cfs) |
|---|---|---|---|---|
| | Active Gages | | | |
| 09484550 | Cienega Creek near Sonoita, AZ | 10/1/2002 | 9/30/2006 | 1.55 |
| 09484600 | Pantano Wash near Vail, AZ | 10/1/1960 | 9/30/2006 | 6.13 |
| 09485000 | Rincon Creek near Tucson, AZ | 10/1/1953 | 9/30/2006 | 6.25 |
| 09485450 | Pantano Wash (at Broadway Blvd.) at Tucson | 10/1/1999 | 9/30/2006 | 4.04 |
| 09484500 | Tanque Verde Creek at Tucson, AZ | 10/1/1941 | 9/30/2006 | 25.47 |
| 09485700 | Rillito Creek at Dodge Blvd at Tucson, AZ | 10/1/1991 | 9/30/2006 | 29.32 |

| USGS Gage ID | Site Name | Begin Date | End Date | Annual Mean Stream Flow (cfs) |
|---|---|---|---|---|
| 09486055 | Rillito Creek at La Cholla Blvd near Tucson, AZ | 10/1/1996 | 9/30/2006 | 13.88 |
| 09484000 | Sabino Creek near Tucson, AZ | 10/1/1990 | 9/30/2006 | 21.19 |
| | | | | |
| | Inactive Gages | | | |
| 09484560 | Cienega Creek near Pantano, AZ | 10/1/1969 | 9/30/1975 | 2.35 |
| 09484590 | Davidson Canyon Wash near Vail, AZ | 10/1/1969 | 9/30/1975 | 0.70 |
| 09485390 | Atterbury Wash Tributary at Tucson, AZ | 10/1/1976 | 9/30/1983 | 0.23 |
| 09485550 | Arcadia Wash at Tucson, AZ | 10/1/1976 | 9/30/1983 | 0.36 |
| 09483100 | Tanque Verde Creek near Tucson, AZ | 10/1/1960 | 9/30/1974 | 8.90 |
| 09485500 | Pantano Wash near Tucson, AZ | 1976 | 1976 | 0.10 |
| 09485850 | Rillito Creek near Tucson, AZ | 10/1/1914 | 9/30/1975 | 13.74 |
| 09484200 | Bear Creek near Tucson, AZ | 10/1/1960 | 9/30/1974 | 4.69 |
| 09483300 | Sabino Creek near Mt Lemon, AZ | 10/1/1952 | 9/30/1958 | 1.63 |

*Data Sources: USGS website, National Water Information System http://waterdata.usgs.gov/nwis/*

*Table 2-3.2: Pantano Wash - Rillito River Watershed Major Lakes and Reservoirs.*

| Lake Name (if known) | Watershed | Surface Area (acre) | Elevation (feet above mean sea level) | Dam Name (if known) |
|---|---|---|---|---|
| Kinnison Wash | Agua Verde –Pantano Wash 1505030202 | 14.50 | 2697 | Lakeside Park Dam |
| Unknown | Agua Verde –Pantano Wash 1505030202 | 9.00 | 2979 | Unknown |
| Unknown | Cienega Creek 1505030201 | 3.00 | 4757 | Unknown |

*Data Sources: GIS data layer "Lakes", Arizona State Land Department, Arizona Land Resource Information System (ALRIS, 2004) http://www.land.state.az.us/alris/index.html*

*Table 2-3.3: Pantano Wash - Rillito River Watershed Major Streams and Lengths.*

| Stream Name | Watershed | Stream Length (miles) |
|---|---|---|
| Cienega Creek | Cienega Creek, Agua Verde | 45 |
| Tanque Verde Creek | Tanque Verde Creek | 26 |
| Pantano Wash | Agua Verde, Tanque Verde Creek | 23 |
| Gardner Canyon Stream | Cienega Creek | 20 |
| Sabino Creek | Tanque Verde Creek | 20 |
| Drainage Way | Agua Verde, Tanque Verde Creek | 16 |
| Rincon Creek | Agua Verde | 16 |
| Agua Caliente Wash | Tanque Verde Creek | 14 |
| Agua Verde Creek | Agua Verde | 13 |
| Rillito Creek | Tanque Verde Creek | 12 |

*Data Sources: GIS data layer "Streams", Arizona State Land Department, Arizona Land Resource Information System (ALRIS 2004). http://www.land.state.az.us/alris/index.html*

## Riparian Vegetation

The Arizona Game & Fish Department has identified and mapped riparian vegetation associated with perennial waters in response to the requirements of the state Riparian Protection Program (July 1994). This map was used to identify riparian areas in the Agua Fria Watershed (Figure 2-5).

Four of the ten types of riparian areas occur within the Pantano Wash - Rillito River Watershed. Riparian areas encompass approximately 2,181 acres (3.4 sq. mi.) or less than 0.1% of the entire watershed. Mesquite comprises about 1,029 acres, or 41% of the riparian areas. Cottonwood Willow and Strand each comprise less than 8% of the watershed (Table 2-4).

Cienega Creek Watershed has the greatest amount of riparian vegetation with about 1,453 acres (2.3 square miles). The Tanque Verde Creek/Rillito River Watershed has about 694 acres (1.1 sq. mi.) and the Agua Verde/Pantano Wash Watershed has only about 34 acres (less that 0.1 sq. mi.).

*Table 2-4: Pantano Wash - Rillito River Watershed Riparian Vegetation (acres) by 10-digit Watershed.*

| Riparian Vegetation Community | Tanque Verde Creek – Rillito River 1505030203 | Agua Verde – Pantano Wash 1505030202 | Cienega Creek 1505030201 | Pantano Wash - Rillito River Watershed TOTAL |
|---|---|---|---|---|
| Cottonwood Willow | 66.11 | - | 69.51 | 135.62 |
| Mesquite | 188.79 | 0.52 | 839.82 | 1029.13 |
| Mixed Broadleaf | 439.02 | 32.63 | 371.99 | 843.63 |
| Strand | - | 1.25 | 171.47 | 172.72 |
| Total Area (acres) | 693.92 | 34.40 | 1452.79 | 2181.11 |

*Data Sources: GIS data layer "pan_riparian_att", Arizona State Land Department, Arizona Land Resource Information System (ALRIS, 2004) http://www.land.state.az.us/alris/index.html*

## Land Cover

The Riparian Vegetation map (Figure 2-5) and Land Cover map (Figure 2-6) were created from the Southwest Regional Gap Analysis Project land cover map (Lowry et. al, 2005). Within the Pantano watershed, Table 2-5 identifies the Apacherian-Chihuahuan Grassland and Mesquite Scrub as the most common land cover type over the entire watershed, encompassing about 30% of the watershed. The next most common types are Chihuahuan Desert, Thorn, and Sand Flat Scrub (16%), Madrean Pine Oak Woodland (14%), and Developed Open Space-Low Intensity (11%).

Note: There are a total of 26 GAP vegetation categories present within the Pantano Wash-Rillito River Watershed boundary. Some of these categories occur only in small concentrations, and are not visible at the small scale in which the maps are displayed. Some of the vegetation categories were re-grouped in order to increase the legibility of the map. In collaboration with NRCS, staff were able to create a total of 14 grouped GAP vegetation categories, as shown on Table 2-5.

*Table 2-5: Pantano Wash - Rillito River Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed*

| Landcover | Tanque Verde Creek – Rillito River 1505030203 | Agua Verde – Pantano Wash 1505030202 | Cienega Creek 1505030201 | Percent of Total Pantano Watershed |
|---|---|---|---|---|
| Agriculture | - | - | - | - |
| Apacherian-Chihuahuan Grassland and Mesquite Scrub | 9.38% | 21.08% | 50.96% | 30.48% |
| Chihuahuan Desert, Thorn, and Sand Flat Scrub | 8.75% | 11.68% | 23.91% | 16.17% |
| Developed, Medium - High Intensity | 24.58% | 9.29% | 0.35% | 10.55% |
| Developed, Open Space - Low Intensity | 12.20% | 4.40% | 0.70% | 5.43% |
| Madrean Pine Oak Woodland | 19.29% | 7.34% | 13.45% | 14.22% |
| Madrean Pinyon-Juniper Woodland | 5.61% | 6.76% | 4.98% | 5.56% |
| Mogollon Chaparral | 2.66% | 3.13% | 2.69% | 2.77% |
| North American Warm Desert Barren Lands | 3.66% | 4.94% | 1.85% | 3.11% |
| North American Warm Desert Woody and Emergent Wetlands | 1.20% | 0.73% | 0.51% | 0.79% |
| Open Water | 0.01% | 0.01% | <0.01% | <0.01% |
| Rocky Mountain Aspen Forest and Woodland | 0.77% | 0.07% | 0.05% | 0.31% |
| Sonoran Desert Scrub | 11.40% | 25.28% | 0.36% | 9.27% |
| Sonoran-Mojave Desert Scrub | 0.38% | 5.28% | 0.17% | 1.28% |
| *Area (sq. mile)* | 318 | 188 | 414 | 920 |

*Data Sources: GIS data layer "Arizona Gap Analysis Project Vegetation Map", University of Arizona, Southern Arizona Data Services Program, 2004 http://sdrsnet.srnr.arizona.edu/index.php Originated by Arizona Game & Fish Department, Habitat Branch, 1993, this dataset was digitized from the August 1980 David E. Brown & Charles H. Lowe 1:1,000,000 scale, 'Biotic Communities of the Southwest'.*

## Meteorological Stations, Precipitation and Temperature

For the years 1961-1990, the average annual precipitation for the Pantano Wash - Rillito River Watershed was about 25 inches (Table 2-6). The Cienega Creek watershed received the most rainfall with about 24 inches of rain in an average year, while the Tanque Verde Creek/Rillito River and Agua Verde/Pantano Wash Watersheds typically received about 24 and 20 inches respectively. Average Temperature for the Tanque Verde Watershed/Rillito River Watershed ranged from 66.85 $^{o}$F to 68.80 $^{o}$F. Active meteorological stations in the watershed are located at the Tucson Magnetic Observatory, Tucson Camp Ave. Exp. FM, the N Lazy H Ranch and at Elgin 5 N (Figure 2-7).

*Table 2-6: Pantano Wash - Rillito River Watershed Meteorological Stations, Temperature ($^{o}$F) and Precipitation (in/yr) with Recent Long-term Records.*

| Watershed Name | Meteorological Stations | Average Temperature ($^{o}$F) | | | Precipitation (in/yr) | | |
|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Weighted Average | Min. | Max. | Weighted Average |
| Tanque Verde Creek – Rillito River 1505030203 | Saguaro National Monument* | - | - | - | | | |
| | Tucson Magnetic Observatory | 50.4 | 83.3 | 66.85 | | | |
| | Tucson Camp Ave Exp FM | 50.4 | 84.2 | 67.30 | | | |
| | Sabino Canyon | 53.0 | 84.6 | 68.80 | 11 | 35 | 23.78 |
| Agua Verde – Pantano Wash 1505030202 | N Lazy H Ranch | - | - | - | 13 | 27 | 20.33 |
| Cienega Creek 1505030201 | Elgin 5 N* | - | - | - | 15 | 39 | 24.43 |
| Pantano Wash - Rillito River Watershed | - | - | - | - | 11 | 39 | 24.89 |

Source: Temperature: Western Regional Climate Center (WRCC), Temperature data: July 15, 2004.
Precipitation: Arizona Land Information System (ALRIS 2004).
*Note: WRCC lists these stations as inactive, or insufficient data reported.

## Land Ownership/Management

There are 5 different land ownership/management entities in the Pantano Wash - Rillito River Watershed (Figure 2-8 and Table 2-7). Privately held land is the largest category, representing about 32% of the watershed, followed by the US Forest Service with about 29%, and State Trust with about 22%. The National Parks, the Bureau of Land Management, and the Military hold smaller amounts of land in the watershed.

*Table 2-7: Pantano Wash - Rillito River Watershed Land Ownership/Management (Percent of each 10-digit Watershed)*

| Land Owner | Cienega Creek 1505030201 | Tanque Verde Creek – Rillito River 1505030203 | Agua Verde – Pantano Wash 1505030202 | Pantano Wash - Rillito River Watershed |
|---|---|---|---|---|
| BLM | 16.06% | 0.02% | - | 7.24% |
| Military | - | 0.01% | 3.35% | 0.69% |
| National Parks | - | 10.19% | 25.88% | 8.81% |
| Private | 21.05% | 42.62% | 39.80% | 32.34% |
| State Trust | 39.15% | 0.02% | 19.79% | 21.67% |
| USFS | 23.71% | 47.17% | 11.26% | 29.27% |
| *Area (square miles)* | *414* | *318* | *188* | *920* |

*Data Sources: GIS data layer "ownership", Arizona State Land Department, Arizona Land Resource Information System (ALRIS, 2004) http://www.land.state.az.us/alris/index.html*

Land Use

The Land Use map was created from the Southwest Regional GAP Analysis Project land cover map (Lowry et. al, 2005).

The land cover condition during the early 1990's was determined using the National Land Cover Dataset (NLCD). The NLCD classification contains 21 different land cover categories (USGS, NLCD Land Cover Class Definitions); however, these categories have been consolidated into five land cover types (Figure 2-9 and Table 2-8). The five groupings for the land cover categories are:

- Crop, which includes confined feeding operations; cropland and pasture; orchards, groves, vineyards, nurseries and ornamental horticulture; other agricultural land.
- Forest, includes areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover
- Water, identifies all areas of surface water, generally with less than 25% cover of vegetation/land cover
- Range, which includes herbaceous rangeland; mixed range; shrub and brush rangeland.

- Urban, which includes residential areas; commercial and services; industrial and commercial complexes; mixed urban or built-up land; other urban or built-up land; strip mines quarries and gravel pits; transportation, communication and utilities.

The most common land cover type is Range which makes up about 81% of the watershed. Urban is the next most common type with about 16% of the total area.

*2-8: Pantano Wash - Rillito River Watershed Land Use, Percent of 10-digit Watershed*

| Land Cover/Location | Crop | Forest | Urban | Range | Water | Area (sq. mi.) |
|---|---|---|---|---|---|---|
| Tanque Verde Creek – Rillito River 1505030203 | - | 7.43% | 36.77% | 55.80% | 0.01% | 318 |
| Agua Verde – Pantano Wash 1505030202 | - | 1.69% | 13.68% | 84.61% | 0.01% | 188 |
| Cienega Creek 1505030201 | - | 0.84% | 1.04% | 98.11% | <0.01% | 414 |
| Total Pantano Wash - Rillito River Watershed | - | 3.29% | 15.98% | 80.74% | <0.01% | 920 |

*Data Sources: GIS data layer "pan -gapveg", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2002 http://www.land.state.az.us/alris/index.html*

Mines - Primary Ores

Table 2-9 and Figure 2-10 show the types of ores being mined in the Pantano Wash Watershed. There are 153 mines whose ore type is unknown (Ward, J.S. and Associates. 1973). The most common known ore types are copper, lead, silver, gold, sand and gravel, and gypsum.

*Table 2-9: Pantano Wash - Rillito River Watershed Mines – Primary Ores.*

| Ore Type | Total Number of Mines | Ore Type | Total Number of Mines |
|---|---|---|---|
| Copper | 37 | Geothermal | 4 |
| Lead | 33 | Uranium | 4 |
| Silver | 21 | Unknown | 4 |
| Gold | 20 | Tungsten | 2 |
| Sand and Gravel | 15 | Gemstone | 1 |
| Gypsum | 12 | Mica | 1 |
| Stone | 9 | Wollastonite | 1 |
| Clay | 7 | Zinc | 1 |

GIS data layer "mines", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2002 http://www.land.state.az.us/alris/index.html

## Section 3: Resource Concerns

Introduction

Conservation Districts and other local leaders, along with NRCS and other resource management agencies, have identified priority natural resource concerns for this watershed. These concerns can be grouped under the broad resource categories of Soil, Water, Air, Plants, or Animals (SWAPA). Refer to Table 3-1 for a listing of priority resource concerns by land use within the Pantano Wash – Rillito River Watershed.

Soil Erosion

Soil erosion is defined as the movement of soil from water (sheet and rill or gully) or wind forces requiring treatment when soil loss tolerance levels are exceeded. Sheet and rill erosion is a concern particularly on rangeland and forest land in areas of shallow soils and poor vegetative cover. Soil loss results in reduced water holding capacity and plant productivity. Gully erosion can be a significant problem in areas of steep slopes and deep soils. Loss of vegetative cover and down-cutting of streams contribute to gully formation. Wind erosion is locally significant where adequate vegetative cover is not maintained.

Conservation practices applied to address this resource concern are generally those that help improve vegetative cover, stabilize sites, and control water flows. Practices may include critical area planting, deferred grazing, grade stabilization structures, herbaceous wind barriers, prescribed grazing, range planting, stream channel stabilization, tree and shrub establishment, water and sediment control basins, water spreading, windbreak establishment, and wildlife upland habitat management.

Water Quality

The Arizona Department of Environmental Quality (ADEQ) assesses surface water quality to identify which surface waters are impaired or attaining designed uses and to prioritize future monitoring. Impaired waters, as defined by Section 303(d) of the federal Clean Water Act, are those waters that are not meeting the state's water quality standards for designated uses. Attaining waters meet state water quality standards for designated uses. Strategies are implemented on impaired waters to reduce pollutant loadings so that surface water quality standards will be met, unless impairment is *solely* due to natural conditions.

*Table 3-1: Pantano Wash – Rillito River Watershed Priority Resource Concerns by Land Use*

| Resource Category | Cropland Concerns | Rangeland Concerns | Forest Concerns | Urban Concerns |
|---|---|---|---|---|
| Soil Erosion | | Sheet & Rill Erosion | | Roads & Construction Sites |
| Water Quality | Aquifer Depletion | Excessive Suspended Sediment in Surface Water; Aquifer Depletion | Aquifer Depletion | Aquifer Depletion |
| Water Quantity | | | | |
| Air Quality | | | | Roads & Construction Sites |
| Plant Condition | | Plant Productivity, Health & Vigor | | |
| Noxious & Invasive Plants | | Noxious & Invasive Plants | Noxious & Invasive Plants | Noxious & Invasive Plants |
| Domestic Animals | | Inadequate Quantities & Quality of Feed & Forage & Water | | |
| Species of Concern | | T&E Species & Declining Species & Species of Concern | | |

*(NRCS, 2007)*

Once a surface water has been identified as impaired, activities in the watershed that might contribute further loadings of the pollutant are not allowed. Agencies and individuals planning future projects in the watershed must be sure that activities will not further degrade these impaired waters and are encouraged through grants to implement strategies to reduce loading. One of the first steps is the development of a Total Maximum Daily Load (TMDL) analysis to empirically determine the load reduction needed to meet standards.

The *Draft 2006 Status of Ambient Surface Water Quality in Arizona* (ADEQ 2007) indicates that generally surface water quality is excellent where monitored and assessed (Figure 3-1). However, the following surface waters in the Pantano Wash - Rillito River Watershed are impaired:

**Pantano Wash – Rillito River (15050302)**

- Lakeside Lake (A city park lake in Tucson also known as Lakeside Park Dam in Kinnison Wash). 15050302-0760. 15 acres. Impaired by ammonia, low dissolved oxygen, high pH. (EPA indicates it is also impaired due to chlorophyll, nitrogen, and

phosphorus.) (02 Agua Verde Creek – Pantano Wash Sub-Basin)

- Rose Canyon Lake. 15050302-1260. 7 acres. ADEQ assesses it as attaining some uses. Low pH in 2 of 3 sampling events. EPA listed it as impaired due to pH in 2004. (03 Tanque Verde–Rillito River Sub-Basin)

The draft ADEQ Assessment indicates that the remaining lakes and streams within the Pantano Wash – Rillito River Watershed were either attaining all or some of their designated uses (other designated uses were assessed as "inconclusive.")

Water Quantity

According to the Arizona Department of Water Resources, water levels have declined substantially in the Tucson AMA (Active Management Area) since around 1940 (ADWR Third Management Plan, 1999). The City of Tucson's Central Wellfield has experienced substantial decline. Net natural recharge of 60,800 acre-feet replenishes the AMA's aquifers, but overdraft continues due to growing water demand.

Ground water in storage has decreased by an estimated 6 to 8 million acre-feet since around 1940. This decline has resulted in depletion of the upper layer of the aquifer and some land surface subsidence. The potential for additional subsidence exists as long as ground water levels continue to decline. The renewable supplies available for use in the Tucson AMA are effluent and CAP water. Use of both supplies will be necessary to offset ground water pumping.

Air Quality

The EPA defines particulate matter as the term for solid or liquid particles found in the air. Some particles are large enough to be seen as soot or smoke. Other particles are so small they can only be detected with an electron microscope. PM-10 particles are very small and can have adverse health effects because of their ability to reach the lower regions of the respiratory tract. Exposure to PM-10 can result in: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. Children, older people, and people with chronic lung disease, are particularly sensitive to particulate matter (EPA website). In the Pantano Wash - Rillito River Watershed area, Tucson and Rillito are both listed on the ADEQ Air Quality website.

The Rillito Area is classified as a PM10 Nonattainment Area (Figure 3-2). Emission Sources include: the Arizona Portland Cement Company, construction, unstabilized river banks, agriculture, unpaved roads and unstabilized road shoulders. The Rillito PM10 State Implementation Plan was submitted to EPA on April 22, 1994.

Air quality is a resource concern whenever human activities contribute significantly to airborne sediment and smoke, resulting in property damage and health problems. Conservation practices applied to address this resource concern are generally those that reduce wind erosion and smoke. Practices may include atmospheric

resource quality management, critical area planting, heavy use area protection, and windbreak or shelterbelt establishment.

Plant Condition

Plant condition is a resource concern whenever plants do not manufacture sufficient food to continue the growth cycle or to reproduce. Plant condition is frequently a concern where proper grazing management is not being applied.

Conservation practices applied to address this resource concern are generally those that maintain or improve the health, photosynthetic capability, rooting and reproductive capability of vegetation. Practices may include brush management, critical area planting, deferred grazing, fencing, forest stand improvement, herbaceous wind barriers, nutrient management, pest management, prescribed grazing, prescribed burning, range planting, recreation area improvement, riparian forest buffers, tree and shrub establishment, wetland development or restoration, wildlife upland habitat management, wildlife watering facility, wildlife wetland habitat management, and windbreak establishment.

Noxious and Invasive Plants

Noxious and invasive plants are a resource concern whenever these species cause unsuitable grazing conditions for livestock or wildlife and due to their potential to out-compete native species which are generally preferred for wildlife habitat value. Increases in noxious and invasive plants can result from poor grazing management, drought, control of wildfires in the higher elevations, and other causes.

Conservation practices applied to address this resource concern are generally those that control the establishment or reduce the population of noxious and invasive plant species. Practices may include brush management, deferred grazing, fencing, forest stand improvement, pest management, prescribed burning, prescribed grazing, and wildlife upland habitat management.

Bark Beetle, Drought and Wildfire

Over the past several years, Arizona has experienced increased piñon and ponderosa pine mortality due to outbreaks of several species of bark beetles. The Ips beetle and western pine beetle are the two most common groups of bark beetles responsible for the outbreaks in Arizona (USFS, 2004 USFS, 2007). Low tree vigor caused by several years of drought and excessively dense stands of trees have combined to allow beetle populations to reach outbreak levels. These insects are native to ponderosa pine forests and piñon-juniper woodlands of the Southwest, and normally only attack a small number of diseased or weakened trees. Healthy trees are usually not susceptible to these beetles.

The dominant vegetation communities in the Pantano Wash - Rillito River Watershed are Apacherian-Chihuahuan Mesquite Upland Scrub, Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe, Madrean Encinal and Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub. Based

on an analysis of the Forest Service GIS data for bark beetle occurrence, approximately 95 acres of lands in this watershed have been affected by bark beetles, or only about 0.05 percent of the total watershed area.

The land cover types where bark beetles occur in the Pantano Wash - Rillito River Watershed are Madrean Pine-Oak Forest and Woodland, Southern Rocky Mountain Pinyon-Juniper Woodland, Mogollon Chaparral, Madrean Pinyon-Juniper Woodland, and Developed Medium-High Intensity.

Arizona has been in an extended drought since 1996. Most areas of the state continue to experience record low winter precipitation and snowpack, above-average temperatures, and low soil moisture. These conditions have led to high vegetation stress, high fire potential, below-normal streamflow, decreasing water supplies and deteriorating range and pasture conditions. (adapted from Arizona Drought Preparedness Annual Report, 2006)

The Climate Assessment for the Southwest (CLIMAS) website www.ispe.arizona.edu/climas) provides information on Arizona's drought status. The area of Arizona that encompasses the Pantano Watershed has received less than 50% of average annual precipitation, placing it in moderate drought status. The long-term drought status is severe.

The Southwest Coordination Center (gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm) places the Pantano Wash – Rillito River Watershed in the Above Normal category for significant wildland fire activity potential due to persistent drought conditions.

Domestic Animal Concerns

Domestic animal concerns occur whenever the quantity and quality of food are not adequate to meet the nutritional requirements of animals, or adequate quantity and quality of water is not provided. This is frequently a concern on rangeland when changes in species composition resulting from poor grazing management and drought can reduce the availability of suitable forage.

Conservation practices applied to address this resource concern are generally those that maintain or improve the quantity, quality, and diversity of forage available for animals, reduce the concentration of animals at existing water sources, and insure adequate quantity and reliability of water for the management of domestic animals. Practices may include brush management, deferred grazing, fencing, pest management, prescribed burning, prescribed grazing, pipelines, ponds, range planting, water spreading, wells, spring development, watering facility, and wildlife upland habitat management.

Species of Concern

There are 55 threatened and endangered species listed for Arizona (U. S. Fish and Wildlife Service website). In 1990 Arizona voters created the Heritage Fund, designating up to $10 million per year from lottery ticket sales for the conservation and protection of the state's wildlife and natural areas. The Heritage Fund allowed for the creation of the Heritage Data Management System (HDMS)

which identifies elements of concern in Arizona and consolidates information about their status and distribution throughout the state. (Arizona Game & Fish website, 2006)

The Pantano Wash - Rillito River Watershed contains 43 species that are either listed, species of concern, or candidate species, under the U.S. The fact that there is wide diversity of land types and ownerships contributes to the large number of species in the watershed. Endangered Species Act (Table 3-2). The watershed is also designated Critical Habitat (CH) for Gila chub (Gila intermedia) and the Mexican spotted owl (Strix occidentalis lucida).

*Table 3-2: Pantano Wash - Rillito River Watershed Species of Concern and Endangered Species Classifications and Observations(1)*

| Common Name | Species Name | USESA (2) | USFS (3) | BLM (4) | STATE (5) | Last Recorded Observation |
|---|---|---|---|---|---|---|
| Pima Indian Mallow | Abutilon parishii | SC | S | S | SR | 1992 |
| Northern Goshawk | Accipiter gentilis | SC | S | | WSC | 1999 |
| Arizona Giant Skipper | Agathymus aryxna | | S | | | 1988 |
| Poling's Giant Skipper | Agathymus polingi | | S | | | 1967 |
| Trelease Agave | Agave schottii var. treleasei | SC | S | | HS | 1988 |
| Gila Longfin Dace | Agosia chrysogaster chrysogaster | SC | | S | | 2004 |
| Baird's Sparrow | Ammodramus bairdii | SC | | | WSC | 2003 |
| Saiya | Amoreuxia gonzalezii | SC | S | | HS | 1976 |
| Felder's Orange Tip | Anthocharis cethura | | S | | | 1992 |
| Sabino Canyon Damselfly | Argia sabino | SC | S | | | 1988 |
| Greene Milkweed | Asclepias uncialis | SC | S | | | 1990 |
| Giant Spotted Whiptail | Aspidoscelis burti stictogrammus | SC | S | S | | 2005 |
| Western Burrowing Owl | Athene cunicularia hypugaea | SC | | S | | 2004 |
| | Bat Colony | | | | | 2005 |
| Northern Gray Hawk | Buteo nitidus maxima | SC | S | | WSC | 1994 |
| Common Black-Hawk | Buteogallus anthracinus | | S | | WSC | 1977 |
| Arizona Metalmark | Calephelis rawsoni arizonensis | | S | | | 1993 |
| A Sedge | Carex chihuahuensis | | S | | | 1994 |
| Arizona Giant Sedge | Carex ultra | | S | S | | 2003 |
| Mexican Long-tongued Bat | Choeronycteris mexicana | SC | | | WSC | 2005 |
| Western Yellow-billed Cuckoo | Coccyzus americanus occidentalis | C | S | | WSC | 2002 |
| Pale Townsend's Big- | Corynorhinus townsendii | SC | | | | 1986 |

| Common Name | Species Name | USESA (2) | USFS (3) | BLM (4) | STATE (5) | Last Recorded Observation |
|---|---|---|---|---|---|---|
| eared Bat | pallescens | | | | | |
| Pima Pineapple Cactus | Coryphantha scheeri var. robustispina | LE | | | HS | 2000 |
| Arizona Ridge-nosed Rattlesnake | Crotalus willardi willardi | | S | | WSC | 1999 |
| Magenta-flower Hedgehog-cactus | Echinocereus fasciculatus | | | | SR | 1993 |
| Acuna Cactus | Echinomastus erectocentrus var. acunensis | C | | | HS | 2002 |
| Needle-spined Pineapple Cactus | Echinomastus erectocentrus var. erectocentrus | SC | S | | SR | 2006 |
| Northern Buff-breasted Flycatcher | Empidonax fulvifrons pygmaeus | SC | | | WSC | 2000 |
| Southwestern Willow Flycatcher | Empidonax traillii extimus | LE | S | | WSC | 2001 |
| | Erigeron arisolius | | S | | | 1999 |
| San Carlos Wild-buckwheat | Eriogonum capillare | SC | | | SR | 1993 |
| Heathleaf Wild-buckwheat | Eriogonum ericifolium var. ericifolium | | S | | | 2002 |
| San Pedro River Wild Buckwheat | Eriogonum terrenatum | | | S | | 2003 |
| Greater Western Bonneted Bat | Eumops perotis californicus | SC | | | | 2005 |
| American Peregrine Falcon | Falco peregrinus anatum | SC | S | | WSC | 2005 |
| Gila Chub | Gila intermedia | LE | S | | WSC | 2004 |
| Cactus Ferruginous Pygmy-owl | Glaucidium brasilianum cactorum | SC | | | WSC | 1999 |
| Sonoran Desert Tortoise | Gopherus agassizii (Sonoran Population) | SC | | | WSC | 2004 |
| Bartram Stonecrop | Graptopetalum bartramii | SC | S | S | SR | 2004 |
| Chihuahuan Stickseed | Hackelia ursina | | S | | | 1976 |
| Mock-pennyroyal | Hedeoma dentatum | | S | | | 1999-PRE |
| Sparseleaf Hermannia | Hermannia pauciflora | | S | | | 1984 |
| Huachuca Golden Aster | Heterotheca rutteri | SC | S | S | | 35733 |
| Chisos Coral-root | Hexalectris revoluta | | S | S | SR | 2003 |
| Crested Coral Root | Hexalectris spicata | | | | SR | 2000 |
| Huachuca Morning Glory | Ipomoea plummerae var. cuneifolia | | S | | | 1978 |
| Western Black Kingsnake | Lampropeltis getula nigrita | | S | | | 2002 |

| Common Name | Species Name | USESA (2) | USFS (3) | BLM (4) | STATE (5) | Last Recorded Observation |
|---|---|---|---|---|---|---|
| Western Red Bat | Lasiurus blossevillii | | | | WSC | 2005 |
| Lesser Long-nosed Bat | Leptonycteris curasoae yerbabuenae | LE | S | | WSC | 2004 |
| Huachuca Water Umbel | Lilaeopsis schaffneriana var. recurva | LE | | | HS | 2006 |
| Obsolete Viceroy Butterfly | Limenitis archippus obsoleta | | S | | | 1966 |
| Broadleaf Twayblade | Listera convallarioides | | | | SR | 1997 |
| Littleleaf False Tamarind | Lysiloma watsonii | | | | SR | 1979 |
| California Leaf-nosed Bat | Macrotus californicus | SC | | | WSC | 1986-PRE |
| Madrean Adders Mouth | Malaxis corymbosa | | | | SR | 1996 |
| Purple Adder's Mouth | Malaxis porphyrea | | | | SR | 1987 |
| Slender Adders Mouth | Malaxis tenuis | | | | SR | 1997 |
| Counter Clockwise Fishhook Cactus | Mammillaria mainiae | | S | | SR | 1968 |
| Thornber Fishhook Cactus | Mammillaria thornberi | | | | SR | 2002 |
| Varied Fishhook Cactus | Mammillaria viridiflora | | | | SR | 1969 |
| Wilcox Fishhook Cactus | Mammillaria wrightii var. wilcoxii | | | | SR | 1981 |
| Arizona Manihot | Manihot davisiae | | S | | | 1976 |
| Box Canyon Muhly | Muhlenbergia dubioides | | S | | | 1986 |
| Weeping Muhly | Muhlenbergia xerophila | | S | | | 1999 |
| Arizona Myotis | Myotis occultus | SC | | S | | 1992 |
| Cave Myotis | Myotis velifer | SC | | S | | 2001 |
| Chiricahua Pine White | Neophasia terlooii | | S | | | 1978 |
| Lemmon Cloak Fern | Notholaena lemmonii | SC | | | | 1981 |
| Pocketed Free-tailed Bat | Nyctinomops femorosaccus | | | S | | 2005 |
| Big Free-tailed Bat | Nyctinomops macrotis | SC | | S | | 2003 |
| | Opuntia engelmannii var. flavispina | | | | SR | 1991 |
| Stag-horn Cholla | Opuntia versicolor | | | | SR | 2003 |
| Catalina Beardtongue | Penstemon discolor | | S | | HS | 2001 |
| Texas Horned Lizard | Phrynosoma cornutum | SC | | S | | 1995 |
| Broad-leaf Ground-cherry | Physalis latiphysa | | S | | | 2001 |
| Thurber's Bog Orchid | Platanthera limosa | | | | SR | 1976 |
| Gila Topminnow | Poeciliopsis occidentalis | LE | | | WSC | 2004 |

| Common Name | Species Name | USESA (2) | USFS (3) | BLM (4) | STATE (5) | Last Recorded Observation |
|---|---|---|---|---|---|---|
| | occidentalis | | | | | |
| Whisk Fern | Psilotum nudum | | | | HS | 2003 |
| Chiricahua Leopard Frog | Rana chiricahuensis | LT | S | | WSC | 2005 |
| Lowland Leopard Frog | Rana yavapaiensis | SC | S | | WSC | 2005 |
| Huachuca Groundsel | Senecio multidentatus var. huachucanus | | S | | HS | 1990 |
| Toumey Groundsel | Senecio neomexicanus var. toumeyi | | S | | | 1994 |
| Yellow-nosed Cotton Rat | Sigmodon ochrognathus | SC | | | | 2003 |
| Nodding Blue-eyed Grass | Sisyrinchium cernuum | | S | | | 2001 |
| Lemmon's Stevia | Stevia lemmonii | | S | | | 1984 |
| Mexican Spotted Owl | Strix occidentalis lucida | LT | S | | WSC | 2004 |
| Pinos Altos Flame Flower | Talinum humile | SC | S | | SR | 1987 |
| Tepic Flame Flower | Talinum marginatum | SC | S | | SR | 1986 |
| Northern Mexican Gartersnake | Thamnophis eques megalops | SC | S | | WSC | 2003 |
| Sonoran Noseburn | Tragia laciniata | | S | | | 1986 |
| Elegant Trogon | Trogon elegans | | | | WSC | 2004 |
| Tumamoc Globeberry | Tumamoca macdougalii | | S | S | SR | 1988 |
| Shade Violet | Viola umbraticola | | S | | | 2001 |

*Data Sources: Arizona Land Information System (ALRIS), Natural Resource Conservation Service (NRCS).*

**(1)** Status Definitions as Listed by Arizona Game and Fish Department, November 26, 2006
http://www.gf.state.az.us/w_c/edits/hdms_status_definitions.shtml

**(2) (USEA) Federal U.S. Status**
ESA Endangered Species Act (1973 as amended)
US Department of Interior, Fish and Wildlife Service:
LE Listed Endangered: imminent jeopardy of extinction.
LT Listed Threatened: imminent jeopardy of becoming Endangered.
XN Experimental Nonessential population.

PE Proposed Endangered
PT Proposed Threatened
PDL Proposed for Delisting

Candidate (Notice of Review: 1999):
C Candidate. Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.

SC Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife Service, but neither term has official status (currently all former C2 species).

Critical Habitat (check with state or regional USFWS office for location details)
Y Yes: Critical Habitat has been designated.

P Proposed: Critical Habitat has been proposed.

N No Status: Certain populations of this taxon do not have designated status (check with state or regional USFWS office for details about which populations have designated status)].

**(3) USFS US Forest Service** (1999 Animals, 1999 Plants)
US Department of Agriculture, Forest Service, Region 3
S Sensitive: those taxa occurring on National Forests in Arizona which are considered sensitive by the Regional Forester.

**(4) BLM US Bureau of Land Management** (2000 Animals, 2000 Plants)
US Department of Interior, BLM, Arizona State Office
S Sensitive: those taxa occurring on BLM Field Office Lands in Arizona which are considered sensitive by the Arizona State Office.
P Population: only those populations of Banded Gila monster (Heloderma suspectum cinctum) that occur north and west of the Colorado River, are considered sensitive by the Arizona State Office.

**(5) State Status**
NPL Arizona Native Plant Law (1993)
Arizona Department of Agriculture

HS Highly Safeguarded: no collection allowed.

SR Salvage Restricted: collection only with permit.

ER Export Restricted: transport out of State prohibited.

SA Salvage Assessed: permits required to remove live trees.

HR Harvest Restricted: permits required to remove plant by-products.

WSCA Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and Fish Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep).

WC Species indicated on printouts as WC are currently the same as those in Threatened Native Wildlife in Arizona (1988).

## Resource Concern Summary

Local leaders have identified watershed health as a priority concern for the Pantano Wash - Rillito River Watershed (Pima County, 2000). This includes both the upland areas of the watershed and the riparian or stream course areas. The condition of the upland areas is integral to hydrologic function, such that when precipitation falls on the land its disposition is affected by the soil and

vegetation, which in turn are affected by land uses, both historical and current. The amount of the precipitation which immediately runs off the land surface, and that which infiltrates into the soil to either be used for plant growth or to recharge ground water, is dependent on this critical interface.

The main concern in the Watershed is rapidly expanding urbanization and accelerated recreational use of public lands resulting in impacts to vegetation and soil surfaces which may affect hydrologic function. The desert and semi-desert ecosystems have developed in a climatic regime of wide fluctuations of precipitation, ranging from drought to flood. Human uses superimposed on that climatic regime can tend to exacerbate or ameliorate their effects on soils, vegetation and wildlife.

Another serious concern is current and future mining, which can result in permanent alterations to the land including removal of vegetation and wildlife habitat, disruption of normal hydrologic flow paths, and potential for water quality degradation (ground water and downstream) (Pima County, 2000). Sand and gravel mining in Pantano Wash - Rillito River can destabilize the channels, remove riparian habitat and alter hydrologic patterns.

The Pantano Wash - Rillito River Watershed includes the Pima County Cienega Creek Natural Preserve, designated to protect the rare perennial riparian ecosystem of Cienega Creek and its tributaries. Ground water pumping has lowered the ground water table, thereby reducing or eliminating springs and perennial surface waters flows and impacting the associated wetland and riparian vegetation communities and wildlife species. Riparian areas are highly important to both humans and wildlife. Maintenance of base flow of stream segments and springs is necessary for the health of these critical areas.

Conservation Progress/Status

Conservation progress for the previous five years in the Pantano Wash – Rillito River Watershed has focused on addressing the following primary resource concerns:

- Soil Erosion – Sheet and Rill Erosion.
- Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water.
- Plant Condition – Productivity, Health and Vigor.
- Domestic Animals – Inadequate Quantities and Quality of Feed and Forage.

The following table presents conservation accomplishments in this watershed during fiscal years (FY) 2002 through 2006, according to the NRCS Progress Reporting System (Table 3-3).

Table 3-3: Pantano Wash - Rillito River Watershed Conservation Treatment Applied

| Pantano Wash - Rillito River Watershed (15050302) Conservation Treatment Applied | FY02-06 TOTAL |
|---|---|
| Fence (feet) | 2,658 |
| Prescribed Grazing (acres) | 74,841 |
| Upland Wildlife Habitat Management (acres) | 645 |

(NRCS, 2007)

## Section 4: Census, Social and Agricultural Data

This section discusses the human component of the watershed and the pressure on natural resources caused by humans and by population change.

Population Density, 1990

Census block statistics for 1990 were compiled from information prepared by Geo-Lytics (Geo-Lytics, 1998). These data were linked with census block data and used to create a density map (Figure 4-1) through a normalization process using a grid of 7 km squares. This process involves calculating density per census block and intersecting it with the grid, which is then used to calculate the number of people and thus density per grid square.

Table 4-1 shows the tabulated minimum, maximum and mean number of people per square mile in 1990 for each watershed. In 1990, the mean population density for the entire watershed was about 444 people per square mile. Tanque Verde Creek/Rillito River had the highest population mean with about 1,126 people per square mile, and a maximum of 33,974 people per square mile. Cienega Creek Watershed had the lowest density with a mean of only about 25 people per square mile.

Population Density, 2000

The Census Block 2000 statistics data were downloaded from the Environmental Systems Research Institute (ESRI) website (ESRI Data Products, 2003) and are shown in Table 4-2.

A population density map (Figure 4-2) was created from these data. The mean population density in 2000 was about 561 people per square mile. Tanque Verde Creek/Rillito River and Agua Verde/Pantano Wash had the highest mean population density with 1,374 and 505 people per square mile, respectively. Tanque Verde Creek/Rillito River had the highest maximum density of 81,049 people per square mile.

Population Density Change, 1990-2000

The 1990 and 2000 population density maps were used to create a population density change map. The resulting map and table (Figure 4-3 and Table 4-3) show population increase or decrease over the ten year time frame. Overall, mean population density increased by about 117 people per square mile during this ten-year time period. Tanque Verde Creek/Rillito River and Agua Verde/Pantano Wash had the largest increases in mean population at about 248 and 113, respectively.

Housing Density, 2000 and 2030

The Watershed Housing Density Map for the years 2000 and 2030 were created with data developed by David M. Theobald (Theobald, 2005). Theobald developed a nationwide housing density model that incorporates a thorough way to account for land-use change beyond the “urban fringe.”

Exurban regions are the “urban fringe”, or areas outside suburban areas, having population densities greater than 0.68 –

16.18 ha (1.68 – 40 acres) per unit. Theobald stresses that exurban areas are increasing at a much faster rate than urban sprawl, are consuming much more land, and are having a greater impact on ecological health, habitat fragmentation and other resource concerns.

Theobald estimates that the exurban density class has increased at a much faster rate than the urban/suburban density classes. Theobald's model forecasts that this trend will continue and may even accelerate by 2030. This indicates that development patterns are shifting more towards exurban, lower density, housing units, and are thereby consuming more land. He suggests that exurban development has more overall effect on natural resources because of the larger footprint and disturbance zone, a higher percent of impervious surfaces, and higher pollution because of more vehicle miles traveled to work and shopping.

Figure 4-4 and Table 4-4, Pantano Wash - Rillito River Watershed Housing Density for 2000, identifies that about 24% of housing is located in "undeveloped private" areas, while about 59% is located in "rural" areas. Figure 4-5 and Table 4-5, Pantano Wash - Rillito River Watershed Housing Density for 2030, projects "undeveloped private" areas being reduced to about 3% and "rural" decreasing to 8%.

*Table 4-1: Pantano Wash - Rillito River Watershed 1990 Population Density (people/square mile).*

| Watershed Name | Area (sq. mi.) | Population Density (people/sq.mi.) | | |
|---|---|---|---|---|
| | | Min | Max | Mean |
| Tanque Verde Creek – Rillito River 1505030203 | 318 | 0 | 33974* | 1126 |
| Agua Verde – Pantano Wash 1505030202 | 188 | 0 | 5683 | 391 |
| Cienega Creek 1505030201 | 414 | 0 | 3359 | 25 |
| Total Pantano Wash - Rillito River Watershed | 920 | 0 | 33974* | 444 |

**Note: Density is shown as calculated as if the area sampled were a square mile. Note: Adjacent watersheds may share a grid square.*
*Data Sources: ESRI Data Products, Census 2000, October 17, 2003. http://www.esri.com/data/*

*Table 4-2: Pantano Wash - Rillito River Watershed 2000 Population Density (people/square mile).*

| Watershed Name | Area (sq. mi.) | Population Density (people/sq.mi.) | | |
|---|---|---|---|---|
| | | Min | Max | Mean |
| Tanque Verde Creek – Rillito River 1505030203 | 318 | 0 | 81049 | 1374 |
| Agua Verde – Pantano Wash 1505030202 | 188 | 0 | 12873 | 505 |
| Cienega Creek 1505030201 | 414 | 0 | 5800 | 30 |
| Total Pantano Wash - Rillito River Watershed | 920 | 0 | 81049 | 561 |

**Note: Density is shown as calculated as if the area sampled were a square mile. Note: Adjacent watersheds may share a grid square.*
*Data Sources: ESRI Data Products, Census 2000, October 17, 2003. http://www.esri.com/data/*

*Table 4-3: Pantano Wash - Rillito River Watershed Population Density Change 1990-2000 (people/square mile).*

| Watershed Name | Area (sq. mi.) | Population Density (people/sq.mi.) | | |
|---|---|---|---|---|
| | | Min | Max | Mean |
| Tanque Verde Creek – Rillito River 1505030203 | 318 | 0 | 51349 | 248 |
| Agua Verde – Pantano Wash 1505030202 | 188 | 0 | 12420 | 113 |
| Cienega Creek 1505030201 | 414 | 0 | 4786 | 5 |
| Total Pantano Wash - Rillito River Watershed | 920 | 0 | 51349 | 117 |

**Note: Density is shown as calculated as if the area sampled were a square mile. Note: Adjacent watersheds may share a grid square.*
*Data Sources: ESRI Data Products, Census 2000, October 17, 2003. http://www.esri.com/data/*

*Table 4-4: Pantano Wash - Rillito River Watershed Housing Density 2000 (Percent of Watershed)**

| Housing Density | Agua Verde Creek 1505030201 | Cienega Creek 155030201 | Tanque Verde Creek 1505030203 | Pantano Watershed Percent of Total |
|---|---|---|---|---|
| Undeveloped Private | 1.54% | 23.74% | 27.83% | 24.40% |
| Rural | 72.53% | 57.52% | - | 58.72% |
| Exurban | 25.29% | 18.62% | 20.00% | 19.33% |
| Suburban | 0.05% | 0.06% | 31.30% | 0.26% |
| Urban | 0.58% | 0.06 | 20.87% | 0.25% |
| Area (sq. mile) | 188 | 414 | 318 | 920 |

Source: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006) and Theobald (2005). This data, as tabulated by the AZ Fish and Game, is specific to the Rillito River area within the Pantano Wash - Rillito River Watershed. *All calculations are based on GIS data layer "housing density (Theobald, 2005)." The data layer does not include information for the Tucson urban area (see map).

*Table 4-5: Pantano Wash - Rillito River Watershed Housing Density 2030 (Percent of Watershed)**

| Housing Density | Agua Verde Creek 1505030201 | Cienega Creek 155030201 | Tanque Verde Creek 1505030203 | Pantano Watershed Percent of Total |
|---|---|---|---|---|
| Undeveloped Private | 0.53% | 3.56% | 11.30% | 3.29% |
| Rural | 11.42% | 7.84% | - | 8.17% |
| Exurban | 77.15% | 81.27% | 23.48% | 80.46% |
| Suburban | 0.53% | 5.81% | 7.83% | 5.26% |
| Urban | 10.36% | 1.52% | 57.39% | 2.82% |
| Area (sq. mile) | 188 | 414 | 318 | 920 |

Source: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006) and Theobald (2005). This data, as tabulated by the AZ Fish and Game, is specific to the Rillito River area within the Pantano Wash - Rillito River Watershed.
*All calculations are based on GIS data layer "housing density (Theobald, 2005)." The data layer does not include information for the Tucson urban area (see map).

Pantano Wash - Rillito River Watershed Agricultural Statistics

Arizona is known as one of the most productive and efficient agricultural regions in the world, with beauty that also provides the food and fiber to sustain life in the desert. Arizona is also one of the most diverse agricultural producing states in the nation, producing more than 160 varieties of vegetables, livestock, field crops and nursery stock. The climate, natural resources, agribusiness infrastructure and farm heritage help make agriculture a $9.2 billion dollar industry employing more than 72,000 individuals.

According to the United States Department of Agriculture's, 2002 Census, there are more than 7,000 farms and ranches, seventy-eight percent of which are owned by individuals or families. The total farmland in Arizona is comprised of more than 26,000,000 acres with irrigated crops on 1,280,000 acres and pasture for animals on 23,680,000.

Agriculture in general on the Pantano Wash - Rillito River Watershed is comprised of:

- Considerable grazing land for several livestock operations
- Multiple recreational equestrian facilities
- Farming operations
- A few Vineyards
- A number of apiary (honey bee) operations

Most farms in the Pantano Wash - Rillito River Watershed are fairly small. Eighty-six percent of all farms in the watershed are less than 1,000 acres in size, and 55% are less than 50 acres. Of the 203 farms that have pasture and rangeland, 41% have 100 or more acres. Of the 413 farms that harvest crops, 83% are 49 acres or less in size.

The NASS (National Agricultural Statistics Service, United States Department of Agriculture) has farm data by zip code. We used the U.S. Census Bureau ZIP Census Tabulation Areas (ZCTA) to generate maps. A typical 5-digit ZCTA (there are 3-digit ZCTAs as well) is typically nearly identical to a 5-digit U.S. Postal Service ZIP code, but there are some distinctions. Unlike ZIP codes, ZCTA areas are spatially complete and they are easier to map. The Bureau created special `XX ZCTAs (ZCTAs with a valid 3-digit ZIP but with "XX" as last two characters of the code) which represent large unpopulated areas where it made no sense to assign a census block to an actual ZIP code. Similarly, HH ZCTAs represent large bodies of water within a 3-digit zip area. There is typically no population in either an XX or HH ZCTA.

Data is withheld by NASS for categories with one to four farms. This is to protect the identity of individual farmers. Farm counts for these zip codes are included in the "State Total" category. Some categories only contained stars instead of numbers. Each star was counted as one farm. But because each star could represent as many as 4 farms, each number on the tables are actually greater than or equal to the number listed. In some cases this results in percentages that add up to more or less that 100 percent.

Tables Include data from zip codes both contained within the watershed and zip

codes crossing watershed boundaries. It is important to note that the figures in the tables include significant agricultural areas adjacent to but outside of the watershed area along the Santa Cruz and the San Pedro Rivers and other nearby drainages.

Only one zip code area contained no NASS data about agricultural practices. NASS assumes that no information for those areas means that there was no agricultural activity takes place within that zip code area.

*Figure 4-6: Pantano Wash - Rillito River Watershed Farms by Size (2002)*

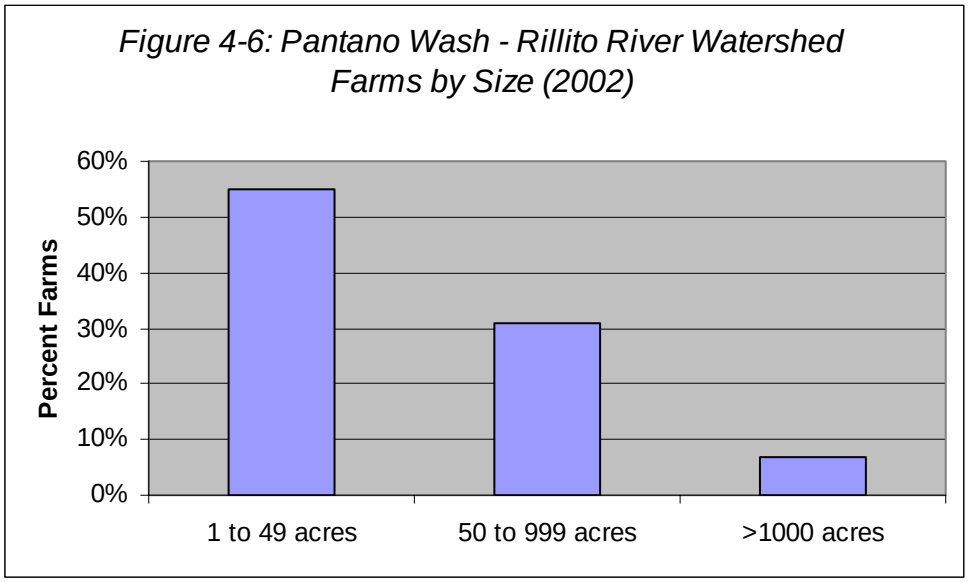



*Table 4-6: Pantano Wash - Rillito River Watershed Farms by Size*

| All farms | 1 to 49 acres | 50 to 999 acres | >1000 acres |
|---|---|---|---|
| 523 | 55% | 31% | 7% |

*NASS defines* A *"farm" as an operation with at least $1000 in agricultural sales from agriculture. Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*

*Figure 4-7: Pantano Wash - Rillito River Watershed Pasture and Rangeland (2002)*

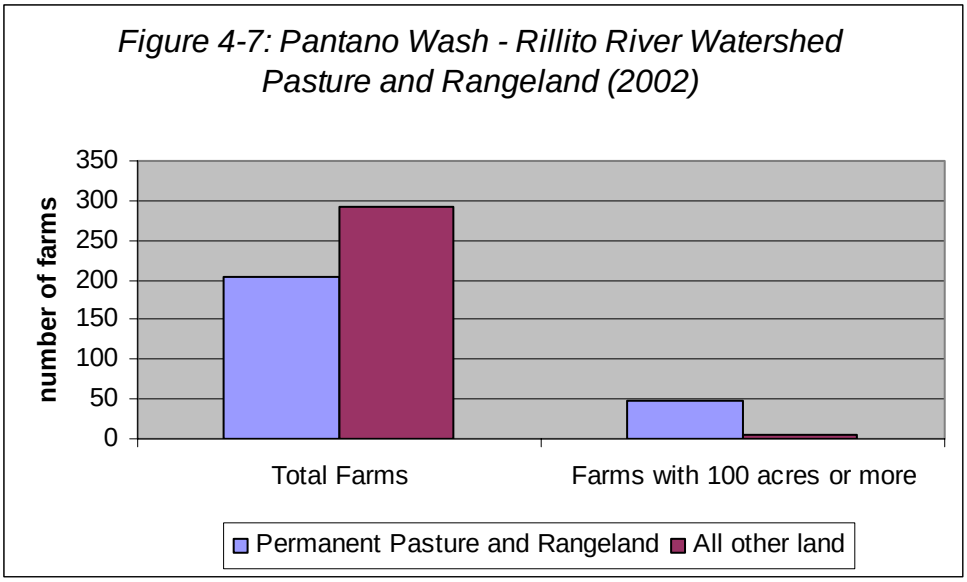



*Table 4-7: Pantano Wash - Rillito River Watershed Pasture and Rangeland (2002)*

| Category | Total farms | Farms 100 acres or more |
|---|---|---|
| Permanent pasture and rangeland | 203 | 41% |
| All other land | 293 | 5% |

*Grazing lands are the USDA Pastureland, as defined by NASS, includes cropland used only for pasture or grazing, woodland pastured, and other pastureland and rangeland.*
*Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*

*Figure 4-8: Pantano Wash - Rillito River Watershed Cropland Harvested (2002)*

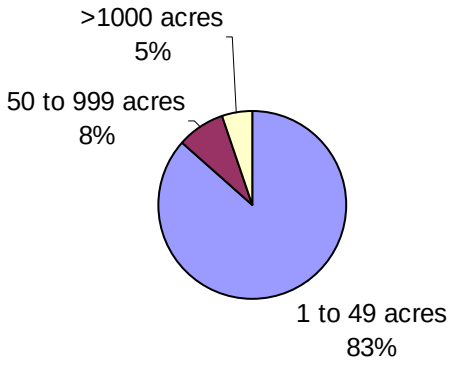


*Table 4-8: Pantano Wash - Rillito River Watershed Cropland Harvested*

| Total farms | 1 to 49 acres | 50 to 999 acres | >1000 acres |
|---|---|---|---|
| 413 | 83% | 8% | 5% |

*According to the NASS, "harvested cropland" Includes all land from which crops were harvested, including hay cut all land in orchards, citrus groves, and nursery and greenhouse crops. Land from which two or more crops were harvested was counted only once even though there was more than one use of that land.*

*Percents rounded. Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*

## Section 5: Resource Assessment Tables

The following Resource Assessment Tables summarize current and desired future natural resource conditions for the Pantano Wash – Rillito River Watershed. The tables present information on benchmark and future conservation systems and practices, qualitative effects on primary resource concerns, and estimated costs for conservation implementation. Conservation District board members, NRCS conservationists, and other people familiar with conservation work in the watershed were consulted for estimating current and future natural resource conditions.

The tables show three levels of conservation treatment (Baseline, Progressive, Resource Management System) for each of the major land uses (range and urban) within the watershed. **Baseline** is defined as a low level of conservation adoption with landowners who are typically not participating in conservation programs. There are, however, a few practices that have been commonly adopted by all landowners in this watershed. **Progressive** is defined as an intermediate level of conservation adoption with landowners who are actively participating in conservation programs and have adopted several practices but not satisfied all of the Quality Criteria in the NRCS Field Office Technical Guide. **Resource Management System** (RMS) is defined as a complete system of conservation practices that addresses all of the Soil, Water, Air, Plant, and Animal (SWAPA) resource concerns typically seen for this land use in this watershed.

For each land use, the results of the assessment are presented in two parts. Part 1 (Assessment Information) summarizes the conservation practices at each treatment level and the quantities of practices for current benchmark conditions and projected future conditions. Part 1 also displays the four primary resource concerns, along with individual practice effects and an overall Systems Rating (ranging from a low of 1 to a high of 5) indicating the effectiveness of the conservation system used at each treatment level. Part 2 (Conservation Cost Table) summarizes the installation, management, and related costs by conservation practice and treatment level for the projected future conditions by federal and private share of the costs. Part 2 also displays the benchmark and future conservation conditions status bars.

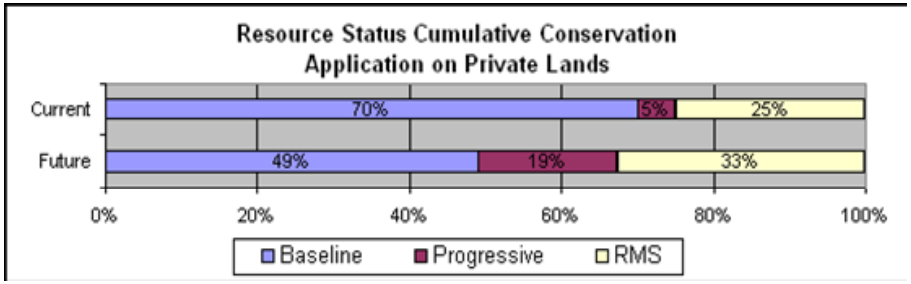
Credit goes to NRCS in Oregon for development of the template for these Resource Assessment Tables.

NOTE: the numbers in the first column of each table represent NRCS conservation practice codes.

| WATERSHED NAME & CODE | PANTANO WASH - RILLITO RIVER - 15050302 | | | | LANDUSE ACRES | | 493,008 | |
|---|---|---|---|---|---|---|---|---|
| LANDUSE TYPE | RANGE | | | | TYPICAL UNIT SIZE ACRES | | 50,000 | |
| ASSESSMENT INFORMATION | | | | | CALCULATED PARTICIPATION | | 29% | |
| | Benchmark Conditions | Future Conditions | | | RESOURCE CONCERNS | | | |
| Conservation Systems by Treatment Level | Total Units | Existing Unchanged Units | New Treatment Units | Total Units | Soil Erosion – Sheet and Rill | Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water | Plant Condition – Productivity, Health and Vigor | Domestic Animals – Inadequate Quantities and Quality of Feed and Forage |
| **Baseline** | | | | **System Rating ->** | **1** | **3** | **0** | **0** |
| Fence (ft.) 382 | 34,511 | 24,157 | 0 | 24,157 | 0 | 1 | 1 | 1 |
| Pipeline (ft.) 516 | 34,511 | 24,157 | 0 | 24,157 | 3 | 3 | 0 | 0 |
| Watering Facility (no.) 614 | 69 | 48 | 0 | 48 | 0 | 4 | 1 | 0 |
| **Total Acreage at Baseline** | **345,106** | **241,574** | **0** | **241,574** | | | | |
| **Progressive** | | | | **System Rating ->** | **4** | **3** | **4** | **4** |
| Fence (ft.) 382 | 12,325 | 17,995 | 27,608 | 45,603 | 0 | 1 | 1 | 1 |
| Pipeline (ft.) 516 | 12,325 | 17,995 | 27,608 | 45,603 | 3 | 3 | 0 | 0 |
| Prescribed Burning (ac.) 338 | 2,465 | 2,219 | 6,902 | 9,121 | 1 | 1 | 4 | 4 |
| Prescribed Grazing (ac.) 528 | 24,650 | 22,185 | 69,021 | 91,206 | 5 | 3 | 5 | 5 |
| Watering Facility (no.) 614 | 10 | 23 | 14 | 36 | 0 | 4 | 1 | 0 |
| **Total Acreage at Progressive Level** | **24,650** | **22,185** | **69,021** | **91,206** | | | | |
| **RMS** | | | | **System Rating ->** | **4** | **4** | **5** | **5** |
| Brush Management (ac.) 314 | 12,325 | 12,325 | 3,698 | 16,023 | 4 | 4 | 5 | 3 |
| Fence (ft.) 382 | 123,252 | 127,936 | 32,292 | 160,228 | 0 | 1 | 1 | 1 |
| Pipeline (ft.) 516 | 123,252 | 127,936 | 32,292 | 160,228 | 3 | 3 | 0 | 0 |
| Prescribed Burning (ac.) 338 | 12,325 | 12,572 | 3,451 | 16,023 | 1 | 1 | 4 | 4 |
| Prescribed Grazing (ac.) 528 | 123,252 | 125,717 | 34,511 | 160,228 | 5 | 3 | 5 | 5 |
| Range Planting (ac.) 550 | 12,325 | 12,325 | 3,698 | 16,023 | 4 | 2 | 5 | 5 |
| Upland Wildlife Habitat Management (ac.) 645 | 123,252 | 123,252 | 36,976 | 160,228 | 0 | 0 | 4 | 1 |
| Watering Facility (no.) 614 | 123 | 131 | 29 | 160 | 0 | 4 | 1 | 0 |
| Wildlife Watering Facility (no.) 648 | 25 | 25 | 7 | 32 | 0 | 4 | 1 | 0 |
| **Total Acreage at RMS Level** | **123,252** | **123,252** | **36,976** | **160,228** | **NOTE: Effectiveness ranges from 1 (low) to 5 (high)** | | | |

| WATERSHED NAME & CODE | PANTANO WASH - RILLITO RIVER - 15050302 | LANDUSE ACRES | 493,008 |
|---|---|---|---|
| LANDUSE TYPE | RANGE | TYPICAL UNIT SIZE ACRES | 50,000 |
| CONSERVATION COST TABLE | | CALCULATED PARTICIPATION | 29% |

| | FUTURE | FEDERAL | | | | PRIVATE | | |
|---|---|---|---|---|---|---|---|---|
| Conservation Systems by Treatment Level | New Treatment Units | Installation Cost 50% | Management Cost - 3 yrs 100% | Technical Assistance 20% | Total Present Value Cost | Installation Cost 50% | Annual O & M + Mgt Costs 100% | Total Present Value Cost |
| **Progressive** | | | | | | | | |
| Fence (ft.) 382 | 27,608 | $41,413 | $0 | $8,283 | $49,695 | $41,413 | $1,657 | $48,390 |
| Pipeline (ft.) 516 | 27,608 | $110,434 | $0 | $22,087 | $132,521 | $110,434 | $4,417 | $129,041 |
| Prescribed Burning (ac.) 338 | 6,902 | $172,553 | $0 | $34,511 | $207,063 | $172,553 | $3,451 | $187,090 |
| Prescribed Grazing (ac.) 528 | 69,021 | $51,766 | $0 | $10,353 | $62,119 | $51,766 | $0 | $51,766 |
| Watering Facility (no.) 614 | 14 | $6,902 | $0 | $1,380 | $8,283 | $6,902 | $414 | $8,647 |
| **Subtotal** | **69,021** | **$383,067** | **$0** | **$76,613** | **$459,681** | **$383,067** | **$9,939** | **$424,934** |
| **RMS** | | | | | | | | |
| Brush Management (ac.) 314 | 3,698 | $221,854 | $0 | $44,371 | $266,224 | $221,854 | $4,437 | $240,544 |
| Fence (ft.) 382 | 32,292 | $48,438 | $0 | $9,688 | $58,126 | $48,438 | $1,938 | $56,600 |
| Pipeline (ft.) 516 | 32,292 | $129,168 | $0 | $25,834 | $155,002 | $129,168 | $5,167 | $150,932 |
| Prescribed Burning (ac.) 338 | 3,451 | $86,276 | $0 | $17,255 | $103,532 | $86,276 | $1,726 | $93,545 |
| Prescribed Grazing (ac.) 528 | 34,511 | $25,883 | $0 | $5,177 | $31,060 | $25,883 | $0 | $25,883 |
| Range Planting (ac.) 550 | 3,698 | $110,927 | $0 | $22,185 | $133,112 | $110,927 | $2,219 | $120,272 |
| Upland Wildlife Habitat Management (ac.) 645 | 36,976 | $0 | $144,205 | $28,841 | $157,328 | $0 | $48,068 | $73,994 |
| Watering Facility (no.) 614 | 29 | $14,544 | $0 | $2,909 | $17,452 | $14,544 | $873 | $18,220 |
| Wildlife Watering Facility (no.) 648 | 7 | $3,698 | $0 | $740 | $4,437 | $3,698 | $74 | $4,009 |
| **Subtotal** | **36,976** | **$640,787** | **$144,205** | **$156,998** | **$926,273** | **$640,787** | **$64,500** | **$783,999** |
| **Grand Total** | **105,997** | **$1,023,854** | **$144,205** | **$233,612** | **$1,385,953** | **$1,023,854** | **$74,439** | **$1,208,933** |

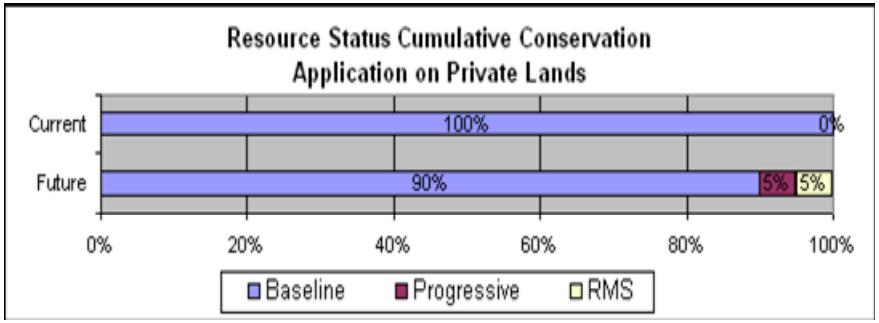



| Chart Refers To | |
|---|---|
| Landuse Type | RANGE |
| Calculated Participation Rate | 29% |

| Average PV Costs per Ac | | |
|---|---|---|
| System | Federal | Private |
| Prog | $6.66 | $6.16 |
| RMS | $25.05 | $21.20 |

| WATERSHED NAME & CODE | PANTANO WASH - RILLITO RIVER - 15050302 | | | | LANDUSE ACRES | 94,046 | | |
|---|---|---|---|---|---|---|---|---|
| LANDUSE TYPE | URBAN | | | | TYPICAL UNIT SIZE ACRES | 10 | | |
| ASSESSMENT INFORMATION | | | | | CALCULATED PARTICIPATION | 10% | | |
| | Benchmark Conditions | Future Conditions | | | RESOURCE CONCERNS | | | |
| Conservation Systems by Treatment Level | Total Units | Existing Unchanged Units | New Treatment Units | Total Units | Soil Condition – Organic Matter Depletion | Water Quantity – Inefficient Water Use on Irrigated Land | Water Quality – Excessive Nutrients and Organics in Groundwater | Air Quality – Particulate matter less than 10 micrometers in diameter (PM 10) |
| Baseline | | | | System Rating -> | 0 | 0 | 0 | 0 |
| No Conservation Practices being applied at this level | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Acreage at Baseline | 94,046 | 84,641 | 0 | 84,641 | | | | |
| Progressive | | | | System Rating -> | 2 | 3 | 3 | 1 |
| Irrigation System, Surface and Subsurface (ac.) 443 | 0 | 0 | 2,351 | 2,351 | 0 | 0 | 0 | 0 |
| Irrigation Water Management (ac.) 449 | 0 | 0 | 4,702 | 4,702 | 4 | 5 | 5 | 3 |
| Total Acreage at Progressive Level | 0 | 0 | 4,702 | 4,702 | | | | |
| RMS | | | | System Rating -> | 3 | 4 | 4 | 2 |
| Atmospheric Resource Quality Management (ac.) 370 | 0 | 0 | 4,702 | 4,702 | 2 | 0 | 0 | 3 |
| Irrigation System, Microirrigation (ac.) 441 | 0 | 0 | 470 | 470 | 0 | 4 | 0 | 0 |
| Irrigation System, Sprinkler (ac.) 442 | 0 | 0 | 470 | 470 | 0 | 4 | 0 | 0 |
| Irrigation System, Surface and Subsurface (ac.) 443 | 0 | 0 | 4,702 | 4,702 | 0 | 0 | 0 | 0 |
| Irrigation Water Management (ac.) 449 | 0 | 0 | 4,702 | 4,702 | 4 | 5 | 5 | 3 |
| Nutrient Management (ac.) 590 | 0 | 0 | 4,702 | 4,702 | 3 | 1 | 5 | 1 |
| Pest Management (ac.) 595 | 0 | 0 | 4,702 | 4,702 | 0 | 1 | 0 | 0 |
| Total Acreage at RMS Level | 0 | 0 | 4,702 | 4,702 | | | | |

| WATERSHED NAME & CODE | PANTANO WASH - RILLITO RIVER - 15050302 | | | | LANDUSE ACRES | 94,046 | |
|---|---|---|---|---|---|---|---|
| LANDUSE TYPE | URBAN | | | | TYPICAL UNIT SIZE ACRES | 10 | |
| CONSERVATION COST TABLE | | | | | CALCULATED PARTICIPATION | 10% | |
| | FUTURE | FEDERAL | | | | PRIVATE | | |
| Conservation Systems by Treatment Level | New Treatment Units | Installation Cost 50% | Management Cost - 3 yrs 100% | Technical Assistance 20% | Total Present Value Cost | Installation Cost 50% | Annual O & M + Mgt Costs 100% | Total Present Value Cost |
| **Progressive** | | | | | | | | |
| Irrigation System, Surface and Subsurface (ac.) 443 | 2,351 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Irrigation Water Management (ac.) 449 | 4,702 | $0 | $141,069 | $28,214 | $153,907 | $0 | $47,023 | $72,385 |
| **Subtotal** | **4,702** | **$0** | **$141,069** | **$28,214** | **$153,907** | **$0** | **$47,023** | **$72,385** |
| **RMS** | | | | | | | | |
| Atmospheric Resource Quality Management (ac.) 370 | 4,702 | $0 | $84,641 | $16,928 | $92,344 | $0 | $28,214 | $43,431 |
| Irrigation System, Microirrigation (ac.) 441 | 470 | $352,673 | $0 | $70,535 | $423,207 | $352,673 | $35,267 | $501,231 |
| Irrigation System, Sprinkler (ac.) 442 | 470 | $399,696 | $0 | $79,939 | $479,635 | $399,696 | $15,988 | $467,042 |
| Irrigation System, Surface and Subsurface (ac.) 443 | 4,702 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Irrigation Water Management (ac.) 449 | 4,702 | $0 | $141,069 | $28,214 | $153,907 | $0 | $47,023 | $72,385 |
| Nutrient Management (ac.) 590 | 4,702 | $0 | $141,069 | $28,214 | $153,907 | $0 | $47,023 | $72,385 |
| Pest Management (ac.) 595 | 4,702 | $0 | $141,069 | $28,214 | $153,907 | $0 | $47,023 | $72,385 |
| **Subtotal** | **4,702** | **$752,368** | **$507,848** | **$252,043** | **$1,456,906** | **$752,368** | **$220,538** | **$1,228,859** |
| **Grand Total** | **9,405** | **$752,368** | **$648,917** | **$280,257** | **$1,610,813** | **$752,368** | **$267,561** | **$1,301,244** |




| Chart Refers To | |
|---|---|
| Landuse Type | URBAN |
| Calculated Participation Rate | 10% |

| Average PV Costs per Ac | | |
|---|---|---|
| System | Federal | Private |
| Prog | $32.73 | $15.39 |
| RMS | $309.83 | $261.33 |

## Section 6: References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# GLOSSARY

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| **Drainage Basin** | A region or area bounded by a topographic divide and occupied by a drainage system, also known as a watershed. |
| **Drought** | There is no universally accepted quantitative definition of drought. Generally, the term is applied to periods of less than average precipitation over a certain period of time; nature's failure to fulfill the water wants and needs of man. |
| **Flood** | A flood is an overflow or inundation that comes from a river or other body of water and causes or threatens damage. It can be any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. It is also a relatively high flow as measured by either gage height or discharge quantity. |
| **Ground Water** | The supply of fresh and saline water found beneath the Earth's surface which is often used for supplying wells and springs. Because ground water is a major source of drinking water, there is a growing concern over areas where leaching agricultural or industrial pollutants are contaminating ground water. |
| **Soil Moisture Regimes** | **Aridic** is a soil moisture regime that has no water available for plants for more than half the cumulative time that the soil temperature at 50 cm (20 in.) below the surface is >5°C (41° F.), and has no period as long as 90 consecutive days when there is water for plants while the soil temperature at 50 cm (20 in.) is continuously >8°C (46°F.).<br>**Udic** is a soil moisture regime that is neither dry for as long as 90 cumulative days nor for as long as 60 consecutive days in the 90 days following the summer solstice at periods when the soil temperature at 50 cm (20 in.) below the surface is above 5°C (41° F.).<br>**Ustic** is a soil moisture regime that is intermediate between the aridic and udic regimes and common in temperate subhumid or semiarid regions, or in tropical and subtropical regions with a monsoon climate. A limited amount of water is available for plants but occurs at times when the soil temperature is optimum for plant growth. |
| **Soil Orders** | A soil order is a group of soils in the broadest category. In the current USDA classification scheme there are 12 orders, differentiated by the presence or absence of diagnostic horizons. |
| **Soil Temperature Regimes** | **Hyperthermic** is a soil temperature regime that has mean annual soil temperatures of 22°C (72°F.) or more and >5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.<br>**Thermic** is a soil temperature regime that has mean annual soil temperatures of 15°C (59°F.) or more but <22°C (72°F.), and >5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface. |

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| | **Mesic** A soil temperature regime that has mean annual soil temperatures of 8°C (46°F.) or more but <15°C (59°F.), and >5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface. |
| **Surface Water** | Water on the earth's surface. Lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or non-navigable, and including the beds and banks of all watercourses and bodies of surface water, that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that waters in treatment systems which are authorized by state or federal law, regulation, or permit, and which are created for the purpose of waste treatment. |
| **Watershed** | The area of land that contributes surface run-off to a given point in a drainage system and delineated by topographic divides. |

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