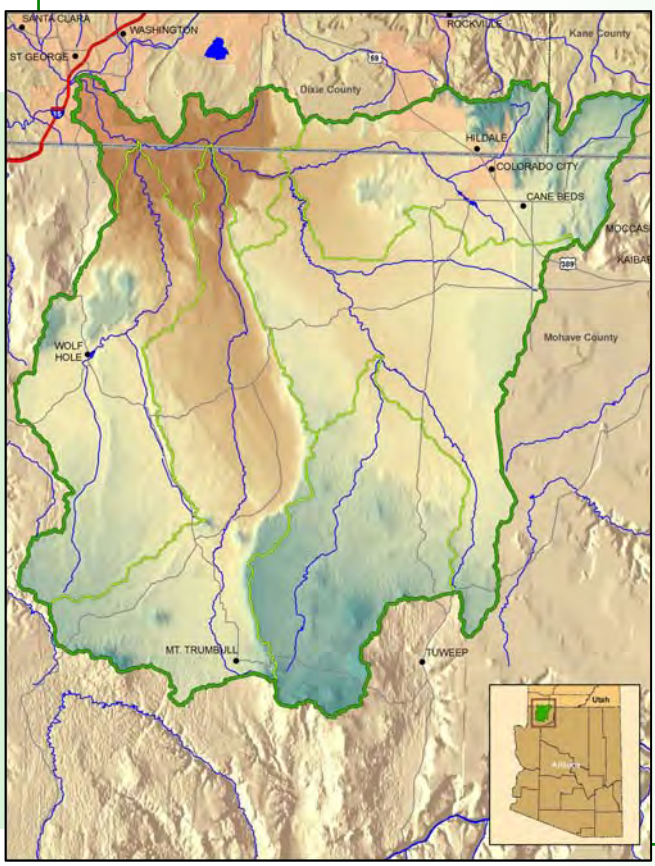
Fort Pearce Wash Watershed

Rapid Watershed Assessment Report June, 2009



Prepared by:

USDA Natural Resources Conservation Service

University of Arizona, Water Resources Research Center

In cooperation with:

Arizona & Utah Association of Conservation Districts
Arizona Department of Agriculture
Utah Department of Agriculture and Food
Arizona & Utah Department of Environmental Quality
Arizona Department of Water Resources
Utah Division of Water Resources
Arizona Game & Fish Department
Utah Division of Wildlife Resources
Arizona State Land Department
USDA Forest Service
USDI Bureau of Land Management

NRCS Natural Resources Conservation Service

Water Resources Research Center
The University of Arizona

Released by:

Sharon Megdal
Director
University of Arizona
Water Resources Research Center

David L. McKay - AZ
Sylvia Gillen - UT
State Conservationists
United States Department of Agriculture
Natural Resources Conservation Service

Principle Investigators:
Dino DeSimone – NRCS-AZ
Norm Evenstad – NRCS-UT
Kristine Uhlman – Water Resources Research Center
Terry Sprouse – Water Resources Research Center
Phil Guertin – School of Natural Resources
Erin Westfall – Water Resources Research Center

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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, including physical characteristics and socioeconomic trends.

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. Conservation Districts and other local leaders, along with public land management agencies, are involved in the assessment process.

A RWA serves as a communication tool between the Natural Resources Conservation Service (NRCS) and partners for prioritizing conservation work in selected watersheds. 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 Fort Pearce Wash Watershed

The Fort Pearce Wash Watershed is located in the north-western corner of Arizona, and in the southwestern corner of Utah (Figure 1-1). Fort Pearce Wash drains about 1,670 square miles (1.1 million acres) of southern Utah and northern Arizona. It is one of the major tributaries of the Virgin River, which it joins at the City of St. George.

The watershed is located in Mohave County, Arizona and in Washington and Cane Counties, Utah. Approximately 10% of the watershed lies in Utah and 90% lies in Arizona.

The majority of the watershed area is Federal land administered by the U.S. Bureau of Land Management (BLM). Most of the remainder of the land in the watershed is privately owned or managed by the Arizona State Land Department or the Utah Trust Lands Administration. A small portion of the Kaibab Indian Reservation is located within the watershed.

Major land uses in the watershed include rangeland and cropland. Important crops include alfalfa, corn, and small grains.

Major towns and cities in Arizona include Colorado City and Cane Beds. Conservation assistance is provided through the Littlefield-Hurricane Valley

and Fredonia Natural Resource Conservation Districts in Arizona and the Dixie and Kane Conservation Districts in Utah. The U.S. Department of Agriculture (USDA) Service Centers that serve the area are located in Fredonia, Arizona and Cedar City, Utah.

Resource concerns in the watershed include soil erosion (wind and streambank), water quantity (aquifer depletion), noxious and invasive plants, and threatened or endangered plant and animal species (NRCS Factsheet).

Section 2: Physical Description

Watershed Size

The Fort Pearce Wash Watershed covers approximately 1,068,800 acres (1670 square miles) in both Arizona and Utah. The 964,000 acres (1,507 square miles) in Arizona represents about 1.3% of the state. The watershed has a width of about 40 miles east to west, and a length of about 47 miles north to south.

The Fort Pearce Wash 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 Fort Pearce Wash Watershed has an 8-digit HUC of 15010009, and it contains the following 10-digit HUCs:

- 1501000901 Langs Run (AZ)
- 1501000902 Clayhole Wash (AZ)
- 1501000903 Short Creek (AZ & UT)
- 1501000904 Hurricane Wash (AZ)
- 1501000905 Dutchman Wash (AZ & UT)
- 1501000906 Fort Pearce Wash Local Drainage (AZ & UT) (Figure 2-1)

Geology

Highly fractured Permian age (245-290 million years before present) sedimentary rock overlaying 2,500 million year-old metamorphic schist and gneiss basement rock forms the geology of the Virgin River watershed. Bedrock is vertically displaced by high-angle faulting coincident to the development of the Basin and Range topography of the region. The Basin and Range extends east from central California to the Colorado Plateau, and extends south in Baja California. The landscape is characterized by a series of tilted fault blocks forming longitudinal ridges or mountains, and broad, intervening basins. Virtually all of Nevada, Utah, and parts of Arizona consist of these nearly parallel arid valleys. Deep geothermal systems associated with the tectonic crustal extension have introduced elevated concentrations of trace elements into the soils and water of this region, with fluorine, boron, and arsenic exceeding MCLs in some ground water (Zehner, et al, 2006).

The following four geologic units are generally found within the modern geologic floodplain along Fort Pearce Wash. Alluvial stream deposits from the Quaternary Period, with moderately to well-sorted clay to gravel deposits in and adjacent to active drainages. Stream-terrace deposits from the Quaternary Period, characterized by riverine alluvium of increasing age, elevation and carbonate accumulation. Older alluvial deposits from the Quaternary Period comprised of remnants of older alluvial deposits. Eolian sand and alluvium from the Quaternary Period, composed of well to very well sorted fine sand (Fuller, 2007).

Soils

Soils within the Fort Pearce Wash Watershed are diverse and formed as the result of differences in climate, vegetation, geology, and physiography. Detailed soils information for the watershed is available from the Natural Resources Conservation Service (NRCS) within the following Soil Surveys: “Soil Survey of the Shivwits Area, Part of Mohave County, AZ” and “Soil Survey of Mohave County Area, AZ, Northeastern Part.” 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 Fort Pearce Watershed is comprised of five Common Resource Areas (Figure 2-3 and Table 2-1).

The uppermost reaches of the watershed are comprised of CRA 35.6 "Colorado Plateau Pinyon-Juniper-Sagebrush" with elevations ranging from 5,500 to 7,000 feet and precipitation averaging 13 to 17 inches per year. This CRA occurs on high elevation plateaus and mountains. Vegetation includes pinyon, juniper, big sagebrush, cliffrose, Mormon tea, muttongrass, prairie junegrass, squirreltail, western wheatgrass, and blue grama. The soils in the area have a mesic soil temperature regime and an aridic ustic soil moisture regime. The dominant soil orders are Mollisols and Vertisols. Shallow, gravelly, cobbly and stony, medium and fine-textured soils occur on plains and mesa tops and cindery soils occur on volcanic cinder cones. Shallow to deep, gravelly, cobbly and stony, fine-textured soils occur on basaltic plains, mesas and hills.

Most of the upper watershed is comprised of CRA 35.3 "Colorado Plateau Sagebrush – Grasslands" with elevations ranging from 4,500 to 6,000 feet and precipitation averaging 10 to 14 inches per year. This CRA occurs on broad plateaus. Vegetation includes big sagebrush, juniper, pinyon, cliffrose, Mormon tea, fourwing saltbush, Indian ricegrass, needle and thread, western wheatgrass, galleta, and grama species. The soils in the area have a mesic soil temperature regime and an aridic ustic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Shallow, medium and fine-textured soils and rock outcrop occur on plateaus and plains. Shallow, gravelly and cobbly, moderately coarse to fine-textured soils and rock outcrop occur on hills and mountains.

The middle portion of the watershed is comprised of CRA 35.4 "Colorado Plateau Cold Sagebrush – Grasslands" with elevations ranging from 4,200 to 5,100 feet and precipitation averaging 7 to 11 inches per year. This CRA occurs on semiarid frigid high elevation plateaus and mountains. Vegetation includes fourwing saltbush, winterfat, buckwheat species, needlegrass, bottlebrush squirreltail, Indian ricegrass, grama species, and galleta. The soils in the area have a mesic soil temperature regime and a typic aridic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Deep, coarse to moderately fine-textured soils occur on plains. Shallow and deep, moderately coarse to moderately fine-textured soils occur on sandstone and shale plateaus.

The lower portion of the watershed is comprised of CRA 30.23 "Middle Mohave Desert" with elevations ranging from 1,200 to 3,200 feet and precipitation averaging 6 to 9 inches per

year. This CRA is dominated by basins, alluvial fans and low uplands. Vegetation includes creosotebush, white bursage, yucca, prickly pear and cholla species, Mormon tea, ratany, winterfat, bush muhly, threeawns, and big galleta. 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. Shallow and deep, gravelly, medium to coarse-textured, limy soils occur on valley slopes and hills. Deep, medium to coarse-textured soils occur on floodplains and low alluvial fans.

A small area of the watershed along the Virgin River is comprised of CRA 30.20 "Mojave Desert Basin and Range – Irrigated cropland" with elevations below 3,100 feet and precipitation averaging less than 9 inches per year. This CRA occurs in small irrigated areas in narrow valleys and hills. Soils are mostly aridic with thermic temperatures and have some elevated salt concentrations that limit use.

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Table 2-1: Fort Pearce Wash Watershed – Common Resource Areas

Common Resource Area Type	Area (sq. mi.)	Percent of Watershed
30.23 Middle Mohave Desert	80	4.8%
35.3 Colorado Plateau Sagebrush – Grasslands	754	45.6%
35.4 Colorado Plateau Cold Sagebrush – Grasslands	744	45.1%
35.6 Colorado Plateau Pinyon-Juniper-Sagebrush	74	4.5%

Data Sources: GIS map layer "cra_a_az". Arizona Land Information System (ALRIS 2004). Natural Resource Conservation Service (NRCS 2006).

Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. About 8.5% of the Fort Pearce Wash Watershed has a slope greater than 15%, while about 73% of the watershed has a slope less than 5%.

The Fort Pearce Wash Watershed has the least amount of slope, with 0.7% of its area over 15% slope, and 92% less than 5% slope. The Short Creek Watershed has the greatest amount of slope, with about 22% of the area greater than 15% slope (Table 2-2 and Figure 2-4).

Table 2-2: Fort Pearce Wash Watershed Slope Classifications.

10-digit Watershed Name	Area (sq. mi.)	Percent Slope		
		< 5%	5-15%	>15%
Langs Run (AZ) – 1501000901	266	62.1%	33.6%	4.3%
Hurricane Wash (AZ) – 1501000904	359	59.9%	29.6%	10.5%
Clayhole Wash (AZ) – 1501000902	352	91.8%	7.5%	0.7%
Dutchman Draw (AZ & UT) – 1501000905	302	66.1%	25.0%	8.9%
Short Creek (AZ & UT) –1501000903	275	58.3%	20.0%	21.7%
Fort Pearce Wash (AZ & UT) – 1501000906	116	50.4%	32.3%	17.3%
Fort Pearce Wash Watershed	1670	72.9%	18.6%	8.5%

Data Sources: Derived from DEM, obtained from U.S. Geological Survey, October, 2008
http://seamless.usgs.gov/

Streams, Lakes and Gaging Stations

There one inactive gaging station in the Fort Pearce Wash Watershed (Table 2-3.1). The station at Fort Pearce Wash near St. George, Utah recorded an annual mean stream flow of 1.86 cfs between the years 2002 and 2007. Table 2.3.2 and Figure 2-5 identify major lakes and reservoirs in the Watershed, as well as their watershed location, surface area, elevation and dam name (if applicable). Lakes of Short Creek is the largest surface water body in the watershed with an area of about 136 acres. Table 2-3.3 lists the major streams and their lengths. Stream lengths range from 54 miles for Hurricane Wash to 3 miles for Birch Creek.

Outstanding Arizona Waters

The Arizona Department of Environmental Quality (ADEQ) recognizes state resource waters of unique value as Outstanding Arizona Waters (OAW), a designation which affords such waters a Tier 3 level of antidegradation protection, meaning no degradation of current water quality can be tolerated. As stated in Antidegredation Implementation Procedures (ADEQ 2007), a body of water is eligible to be considered for OAW classification if the following criteria are met:

- The surface water is a perennial water and is in a free-flowing condition;
- The surface water has good water quality. For the purpose of this regulation, “good water quality” means that the surface water has water quality that meets or is better than applicable water quality standards; and
- The surface water meets one or both of the following conditions: (a) is of exceptional recreational or ecological significance because of its unique attributes; (b) threatened or endangered species are known to be associated with the surface water

and maintenance of existing water quality is essential to maintenance or propagation of said species or the surface water provides critical habitat for a threatened or endangered species.

ADEQ currently recognizes 20 reaches of various water bodies throughout the state as Outstanding Arizona Waters, and is reviewing two additional streams for possible OAW classification. Within the Fort Pearce Wash Watershed, there are currently no protected Outstanding Arizona Waters.

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Table 2-3.1: Fort Pearce Wash Watershed USGS Stream Gages and Annual Mean Stream Flow

USGS Gage ID	Site Name	Begin Date	End Date	Annual Mean Stream Flow (cfs)
09408195	Fort Pearce Wash Near St. George, UT	1985 2002	1989 2007	1.86

** Annual statistics for this gage are not available for all years, however the annual mean stream flow recorded here is the average of all recorded years.*
Data Sources: USGS website, National Water Information System
http://waterdata.usgs.gov/nwis/

Table 2-3.2: Fort Pearce Wash Watershed Major Lakes and Reservoirs

Lake Name (if known)	Watershed	Surface Area (acres)	Elevation (feet above mean sea level)	Dam Name (if known)
Lakes of Short Creek	Short Creek (AZ)	136	1,481	none
Wolf Hole Lake	Dutchman Draw (AZ)	58	1,523	none
Langs Run Reservoir	Langs Run (AZ)	13	1,851	Crosby Detention Dam

Data Sources: GIS data layer "Lakes", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2003 http://www.land.state.az.us/alris/index.html

Table 2-3.3: Fort Pearce Wash Watershed Major Streams and Lengths.

Stream Name	10-digit Watershed Name	Stream Length (miles)
Birch Creek	Short Creek Wash (AZ & UT)	3
Clayhole Wash	Clayhole Wash (AZ)	50
Dutchman Draw	Fort Pearce Wash (AZ & UT), Dutchman Wash (AZ & UT)	40
Fort Pearce Wash	Fort Pearce Wash (AZ & UT)	24
Hurricane Wash	Fort Pearce Wash Local Drainage (AZ & UT), Hurricane Wash (AZ)	54
Langs Run	Langs Run (AZ)	32
Sandridge Wash	Clayhole Wash (AZ)	18
Short Creek	Short Creek Wash (AZ & UT)	39
Sullivan Draw	Dutchman Wash (AZ & UT)	27

Data Sources: GIS data layer "Streams", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), October, 10, 2002, ESRI data layer "dtl_streams", 2007
http://www.land.state.az.us/alris/index.html

Riparian Vegetation

Five types of riparian vegetation communities occur within the Fort Pearce Wash Watershed (Figure 2-6). Riparian areas encompass approximately 2,772 acres (4.3 sq. mi.) or less than 1.0% of the entire watershed. The majority of the riparian vegetation is made up of two riparian vegetation communities. Invasive Southwest Riparian Woodland and Shrubland comprises about 1,481 acres, or 53% of the riparian areas. Rocky Mountain Lower Montane Riparian Woodland and Shrubland comprise 1,159 acres, or 42% of the riparian area (Table 2-4).

Short Creek Watershed has the greatest amount of riparian vegetation with about 1,256 acres (45% of the riparian area). Hurricane Wash Watershed accounts for 1,123 acres (41% of the riparian area); Clayhose Wash Watershed 137 acres (5%); Dutchman Draw Watershed 95 acres (3%), Ft. Pearce Wash Watershed; 87acres (3%); and, Langs Run Watershed 74 acres (3%).

Table 2-4: Fort Pearce Wash Watershed Riparian Vegetation (acres) by 10 Digit Watershed.

Riparian Vegetation Community	Langs Run (AZ) – 1501000901	Hurricane Wash (AZ) – 1501000904	Clayhole Wash (AZ)– 1501000902	Dutchman Draw (AZ & UT) – 1501000905	Short Creek (AZ & UT) – 1501000903
Invasive Southwest Riparian Woodland and Shrubland	-	830	92	39	508
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	-	-	-	55	-
North American Warm Desert Riparian Mesquite Bosque	-	-	-	-	-
North American Warm Desert Riparian Woodland and Shrubland	-	2	-	-	-
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	74	291	45	1	748
Total Riparian Area (acres)	74	1,123	137	95	1,256

Data Sources: GIS data layer "newgapveg", Southwest Regional GAP Vegetation (SWGAP), 2005 http://earth.gis.usu.edu/swgap/

Table 2-4: Fort Pearce Wash Watershed Riparian Vegetation (acres) by 10 Digit Watershed.

Riparian Vegetation Community	Fort Pearce Wash (AZ & UT)– 1501000906	Total Fort Pearce Watershed (AZ & UT)
Invasive Southwest Riparian Woodland and Shrubland	12	1481
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	10	65
North American Warm Desert Riparian Mesquite Bosque	65	65
North American Warm Desert Riparian Woodland and Shrubland	-	2
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	-	1159
Total Riparian Area (acres)	87	2,772

Data Sources: GIS data layer "newgapveg", Southwest Regional GAP Vegetation (SWGAP), 2005 http://earth.gis.usu.edu/swgap/

Land Cover

The Riparian Vegetation map (Figure 2-6) and Land Cover map (Figure 2-7) were created from the Southwest Regional Gap Analysis Project land cover map (Lowry et. al, 2005). Within the Fort Pearce Wash Watershed, Table 2-5 identifies the Scrub/Shrub as the most common land cover type over the entire watershed, encompassing about 53% of the watershed. The next most common type is the Evergreen Forest, comprising 19% of the watershed.

Note: There are a total of 10 GAP vegetation categories present within the Fort Pearce Wash 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 10 grouped GAP vegetation categories, as shown on Table 2-5.

Table 2-5: Fort Pearce Wash Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed. (Part 1 of 2)

Land Cover	10-digit Watershed Name				
	Langs Run (AZ) 1501000901	Hurricane Wash (AZ) 1501000904	Clayhole Wash (AZ) 1501000902	Dutchman Draw (AZ & UT) 1501000905	Short Creek (AZ & UT) 1501000903
Agriculture*	-	-	-	-	1.5%
Altered or Disturbed	0.1%	0.9%	1.6%	0.1%	3.2%
Developed – High Intensity	-	-	-	-	0.8%
Developed – Low Intensity	-	-	<0.1%	-	0.8%
Evergreen Forest	35.2%	14.5%	3.0%	31.0%	21.5%
Grassland / Herbaceous Cover	12.3%	15.1%	17.5%	8.3%	6.5%
Mixed Forest	0.3%	-	-	-	<0.1%
Scrub / Shrub	46.3%	51.5%	73.5%	55.3%	53.2%
Sparsely Vegetated / Barren	5.4%	15.1%	4.0%	5.2%	11.3%
Woody Wetlands	0.4%	2.9%	0.4%	0.1%	1.3%
Area (Sq.mi.)	266	359	352	302	275

***Not necessarily irrigated land.*
Data Sources: GIS data layer "Southwest Regional GAP Program", originated by Southwest Regional GAP program, 2005. http://ftp.nr.usu.edu/swgap/

Table 2-5: Fort Pearce Wash Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed. (Part 2 of 2)

Land Cover	10-digit Watershed Name	
	Fort Pearce Wash (AZ & UT) 1501000906	Percent of Total (AZ & UT)
Agriculture*	0.4%	0.3%
Altered or Disturbed	1.3%	1.2%
Developed – High Intensity	<0.1%	0.1%
Developed – Low Intensity	1.4%	0.2%
Evergreen Forest	<0.1%	19%
Grassland / Herbaceous Cover	4.2%	12%
Mixed Forest	-	0.05%
Scrub / Shrub	77.5%	58%
Sparsely Vegetated / Barren	13.8%	9%
Woody Wetlands	1.4%	1%
Area (Sq.mi.)	116	1,670

***Not necessarily irrigated land.*
Data Sources: GIS data layer "Southwest Regional GAP Program", originated by Southwest Regional GAP program, 2005. http://ftp.nr.usu.edu/swgap/

Meteorological Stations, Precipitation and Temperature

For the years 1961-1990, the average annual precipitation for the Fort Pearce Wash Watershed was 13 inches (Table 2-6). Langs Run Watershed received the most rainfall with 15 inches of rain in an average year, while Hurricane Wash, Clayhole Wash, Short Creek, Dutchman Draw, and Fort Pearce Wash Watersheds typically received 13, 13, 13, 11, and 11 inches per year, respectively. Average temperature for the Fort Pearce Wash Watershed ranged from 54.2^{o} F in the Short Creek Watershed to 63^{o} F in the Fort Pearce Wash Watershed. Active meteorological stations are located in Hurricane Wash, Short Creek and Fort Pearce Wash Watersheds (Figure 2-8).

The Western Regional Climate Center calculates the average minimum and maximum temperatures for each month for the period of record and then takes an annual average.

Table 2-6: Fort Pearce Wash Watershed Meteorological Stations, Temperature and Precipitation.

10-digit Watershed Name	Meteorological Stations and Map ID	Temperature (^{o}F)			Precipitation (in/yr)		
		Avg. Ann. Min.	Avg. Ann. Max.	Avg	Avg. Min.	Avg.Max.	Weighted Average
Langs Run (AZ) – 1501000901	None	-	-	-	11	19	15
Hurricane Wash (AZ) – 1501000904	"Mount Trumbull"*[a]	-	-	-	11	15	13
Clayhole Wash (AZ) – 1501000902	None	-	-	-	11	15	13
Dutchman Draw (AZ & UT) – 1501000905	None	-	-	-	7	15	11
Short Creek (AZ & UT) –1501000903	"Colorado City" "Short Creek" "Cannan" "CW2921 Hidale"	41.1 39.3 - -	69.6 69.1 - -	55.4 54.2 - -	11	15	13
Fort Pearce Wash (AZ & UT) – 1501000906	"Fort Pearce/ST George" "ST George FD" "Virgin River/ST George 10SW"	48..2 *[b]	78..5	63.3	7	15	11
Total Fort Pearce Watershed (AZ & UT)	-	-	-	-	7	19	13

Data Sources: GIS data layer "precip_a_az" Water and Climate Center of the NRCS (1998); GIS data layer "NWS_Stations" Western Regional Climate Center (WRCC), Temperature data. July 15, 2004; http://www.wrcc.dri.edu/summary/climsmaz.htm

*[a] Insufficient Data

*[b] Temperature data is based on the ST George station

Land Ownership/Management

There are four different land ownership/management entities in the Fort Pearce Wash Watershed (Figure 2-9 and Table 2-7). The Bureau of Land Management (BLM) holds the most land, representing 82% of the watershed, followed by Private Land with 9%, State Trust Land with 8%, and Kaibab Indian Reservation with 0.4% of the land in the watershed.

Table 2-7: Fort Pearce Wash Watershed Land Ownership/Management (Percent of each 10-digit Watershed).

10-digit Watershed Name	Land Ownership				Area (sq.mi)
	BLM	Kaibab Indian Reservation	Private Land	State Trust Land	
Langs Run (AZ) – 1501000901	89.5%	-	3.5%	7.0%	266
Hurricane Wash (AZ) – 1501000904	78.5%	-	11.0%	10.5%	359
Clayhole Wash (AZ)– 1501000902	83.6%	-	7.4%	9.0%	352
Dutchman Draw (AZ & UT)– 1501000905	94.0%	-	1.1%	4.9%	302
Short Creek (AZ & UT) – 1501000903	67.4%	2.3%	24.0%	6.3%	275
Fort Pearce Wash (AZ & UT) – 1501000906	73.7%	-	13.2%	13.1%	116
Fort Pearce Watershed (AZ & UT)	82%	0.4%	9%	8%	1,670

Data Sources: GIS data layer "ownership", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), October 27, 2007 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) (Figure 2-10 and Table 2-8). The five groupings for the land use categories are:

- Agriculture (Crop), which includes: confined feeding operations; cropland and pasture; orchards, groves, vineyards, nurseries and ornamental horticulture; and 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 (high density and low density), 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 corridors, communication facilities and utilities.

The most common land use type is Range which makes up about 98% of the watershed. Forest is the next most common type which comprises about 1% of the total area watershed.

Table 2-8: Fort Pearce Wash Watershed Land Use, Percent of 10-digit Watershed

10-digit Watershed Name	Land Use					Area (sq.mi.)
	Crop	Forest	Urban High Intensity	Urban Low Intensity	Range	
Langs Run (AZ) – 1501000901	-	4.8%	-	-	95.2%	266
Hurricane Wash (AZ) – 1501000904	-	< 0.1%	-	-	99.9%	360
Clayhole Wash (AZ) – 1501000902	-	-	-	< 0.1%	99.9%	352
Dutchman Draw (AZ & UT) – 1501000905	-	< 0.1%	-	-	99.9%	304
Short Creek (AZ & UT) –1501000903	1.7%	< 0.1%	1.2%	0.9%	96.1%	340
Fort Pearce Wash (AZ & UT) - 1501000906	0.3%	-	< 0.1%	1.0%	98.6%	150
Fort Pearce Watershed (AZ & UT)	0.4%	1%	0.2%	0.3%	98%	1,670

Data Sources: GIS data layer "Southwest Regional GAP Program", originated by Southwest Regional GAP program, 2005. http://ftp.nr.usu.edu/swgap/

Mines - Primary Ores

Table 2-9 and Figure 2-11 show the types of ores being mined in the Fort Pearce Wash Watershed. The most common type of ore type is Sand and Gravel with 5 mines. Other ore types in the area include gypsum, beryllium, copper, gold, iron, and uranium.

Table 2-9: Fort Pearce Wash Watershed Mines – Primary Ores

Ore Type	Total Number of Mines
Beryllium	1
Copper	1
Gold	1
Gypsum	3
Iron	1
Sand and Gravel	5
Uranium	1

Note: If a mine contains more than one ore, only the major ore is noted. Data Source: "mines" Arizona Land Information Service, 2006. "SGID_U100_Mineral" Utah GIS Portal, 2008.

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 Fort Pearce Wash Watershed.

Table 3-1: Fort Pearce Wash Watershed Priority Resource Concerns by Land Use

Resource Category	Cropland Concerns	Rangeland Concerns	Forest Concerns	Urban Concerns
Soil Erosion		✓ Wind Erosion		
Water Quality				
Water Quantity	✓ Inefficient Water Use on Irrigated Land	✓ Rangeland Hydrologic Cycle		
Air Quality				
Plant Condition		✓ Plant Productivity, Health & Vigor ✓ Noxious & Invasive Plants		✓ Noxious & Invasive Plants
Fish & Wildlife		✓ Inadequate Water		
Domestic Animals		✓ Inadequate Quantities & Quality of Feed & Forage ✓ Inadequate Stock Water		

(NRCS, 2009)

Soil Erosion

Wind erosion on rangeland is a major concern within the watershed. The sandy soils of this watershed are highly susceptible to erosive wind forces. This condition is exacerbated in areas where vegetative cover has been reduced due to prolonged drought and improper grazing practices.

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 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 designated uses and to prioritize future monitoring. Strategies must be 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.

Once a surface water body 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 ADEQ 2006/*2008 Status of Ambient Surface Water Quality in Arizona* indicates that there are no "impaired" or "not attaining" surface waters in the Fort Pearce Wash Watershed (ADEQ, 2008) (see Figure 3-1).

Water pollution from suspended sediment and turbidity is a resource concern whenever accelerated soil erosion contributes excessive sediment to perennial waters that support aquatic fauna. Conservation practices used to address this resource concern are generally those that improve vegetative cover and reduce upland and stream bank erosion. Practices may include critical area planting, filter strips, heavy use area protection, prescribed grazing, range planting, sediment basins, stream bank protection, upland wildlife habitat management, and windbreak establishment.

Water Quantity

Surface water is an important supply in some areas, but is geographically limited. The Hurricane Wash, the main drainage in the area, flows intermittently 54 miles from its headwaters to its confluence with Fort Pearce Wash, 15 miles west of Colorado City. A 50-mile reach of the Clayhole Wash is also intermittent. Most of the watershed is utilized for range with some farming around Colorado City.

Although the watershed is sparsely populated, local communities are expected to grow in the future. Irrigation, for both surface water and ground water, is the biggest source of water demand (U.S. Army Corps of Engineers, 2008).

Water quantity is a resource concern whenever water supplies are inadequate to meet the needs for agricultural or domestic uses. Conservation practices applied to address this resource concern on irrigated cropland are generally those that improve the quantity and efficient distribution of water. Practices may include irrigation land leveling, irrigation system, irrigation water conveyance (ditch or pipeline), irrigation water management, and structure for water control.

Air Quality

There are no known air quality concerns in the watershed (Figure 3-2).

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 establishment.

Environmental Sites

There are no environmental Superfund or WQARF sites located in the Fort Pearce Wash Watershed (Figure 3-3).

Plant Condition

Most of the land within the Fort Pearce Wash Watershed (approximately 80%) is managed by the U.S. Bureau of Land Management (BLM). The grazing impact is very low due to the presence of very few animals on the BLM allotments. Invasive plants and trespass overgrazing are resource concerns.

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, herbaceous wind barriers, nutrient management, pest management, prescribed grazing, prescribed burning, range planting,

recreation area improvement, wildlife upland habitat management, and windbreak establishment.

Noxious and Invasive Plants

Invasive species of major concern in the Fort Pearce Wash Watershed include tamarisk (*tamarix spp.*) and cheatgrass (*bromus tectorum*). Tamarisk is a concern where dense stands have become established in stream courses, crowding out native species, and constricting the flow in the channels. This condition exacerbates flooding and erosion damages during flow events. Cheatgrass is a concern where this annual grass has spread over vast areas of rangeland, building up a high fuel load. This condition results in damaging wildfires, causing increased runoff and erosion on the uplands.

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, 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.

Drought and Wildfire

The Desert Southwest has been in an extended drought since 1996. The Fort Pearce Wash Watershed area, however, has experienced only slightly below normal precipitation over the past decade, at about 83% of average annual precipitation. In some areas of the watershed, however, drought conditions persist, leading to high vegetation stress, high fire potential, below-normal streamflow, decreasing water supplies and deteriorating range and pasture conditions. The Climate Assessment for the Southwest (CLIMAS) website (www.ispe.arizona.edu/climas) and the Arizona Department of Water Resources website (www.azwater.gov/dwr/drought) provide information on drought status in the Fort Pearce Wash Watershed area.

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 ensure 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 Fort Pearce Wash Watershed contains 50 species that are either listed, species of concern, or candidate species, under the U.S. Endangered Species Act (Table 3-2). Among other listed species, the watershed provides habitat for the Southwestern Willow Flycatcher (Empidonax traillii extimus) (Arizona), which is classified as being in imminent jeopardy of extinction, and for Spotted Bat (Utah) and the Fringed Myotis (Utah), both wildlife species of concern.

Table 3-2: Fort Pearce Wash Watershed Species of Concern Classifications

Species Name	Common Name	USESA (1)	USFS (2)	BLM (3)	STATE AZ (4)	STATE UT (5)
Accipiter gentilis	Northern Goshawk	SC	S		WSC	
Arctomecon humilis	Dwarf Bearclaw-poppy	LE				
Astragalus holmgreniorum	Paradox Milkvetch	LE				
Astragalus toanus var. scidulus	Diamond Butte Milkvetch			S		
Athene cunicularia	Burrowing Owl				SPC	
Athene cunicularia hypugaea	Western Burrowing Owl	SC		S		
Bufo microscaphus	Arizona Toad	SC	S			
Callisaurus draconoides	Zebra-tailed Lizard				SPC	
Canis lupus	Gray Wolf	LE			S-ESA	
Catostomus clarkia	Desert Sucker				SPC	
Catostomus discobolus	Bluehead Sucker				CS	
Catostomus latipinnis	Flannelmouth Sucker				CS	
Charadrius montanus	Mountain Plover				SPC	
Coccyzus americanus	Yellow-billed Cuckoo	C			S-ESA	
Coleonyx variegates	Western Banded Gecko				SPC	
Corynorhinus townsendii	Townsend's Big-eared Bat				SPC	
Corynorhinus townsendii pallescens	Pale Townsend's Big-eared Bat	SC				
Crotalus cerastes	Sidewinder				SPC	
Dolichonyx oryzivorus	Bobolink				SPC	
Empinonax traillii extimus	Southwestern Willow Flycatcher	LE			S-ESA	
Enceliopis argophylla	Silverleaf Sunray			S		
Eriogonum thompsoniae var atwoodii	Atwood Wild-buckwehat	SC	S		SR	
Euderma maculatum	Spotted Bat	SC			WSC	SPC
Gila robusta	Roundtail Chub				CS	
Gila seminude	Virgin Chub	LE			S-ESA	
Gopherus agassizii	Desert Tortoise	LT			S-ESA	
Heloderma suspectum	Gila Monster				SPC	
Idionycteris phyllotis	Allen's Big-eared Bat				SPC	
Lepidomeda mollispinis	Virgin Spinedace				CS	
Leptotyphlups humilis	Western Threadsnake				SPC	
Melanerpes lewis	Lewis's Woodpecker				SPC	
Mentzelia memorabalis	September 11 Stickleaf			S		
Myotis ciliolabrum	Western Small-footed Myotis	SC		S		

Species Name	Common Name	USESA (1)	USFS (2)	BLM (3)	STATE AZ (4)	STATE UT (5)
Myotis thysandodes	Fringed Myotis	SC		S		SPC
Myotis volans	Long-legged Myotis	SC		S		
Nyctinomops macrotis	Big Free-tailed Bat	SC		S		
Opuntia basilaris var aurea	Yellow Beavertail				SR	
Opuntia whipplei var. multigeniculata	Blue Diamond Cholla	SC			SR	
Opuntia whipplei var. shipplei	Whipple Cholla				SR	
Pediocactus peeblesianus var. fickeis	Fickeisen Plains Cactus	C	S		HS	
Pediocactus sileri	Siler Pincusion Cactus	LT		S	HS	
Pelecanus erythrorhynchos	American White Pelican				SPC	
Plagopterus argentissimus	Woundfin	LE			S-ESA	
Pyrgulopsis deserta	Desert Springsnail				SPC	
Rana onca	Relict Leopard Frog	C			S-ESA	
Sauromalus ater	Common Chuckwall				SPC	
Sclerocactus parviflorus ssp intermedius	Intermediate Fishook Cactus				SR	
Tricardia watsonii	Three Hearts			S		
Vulpus macrotis	Kit Fox				SPC	
Xantusia vigilis	Desert Night Lizard				SPC	

Data Sources: Arizona Land Information System (ALRIS), Natural Resource Conservation Service (NRCS). *Status Definitions as Listed by Arizona Game and Fish Department, Nov. 26, 2006* *http://www.gf.state.az.us/w_c/edits/hdms_status_definitions.shtml*

(1) U.S. Endangered Species Act (ESA)

LE Listed Endangered: imminent jeopardy of extinction.

LT Listed Threatened: imminent jeopardy of becoming Endangered.

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).

(2) USFS US Forest Service (1999 Animals, 1999 Plants)

S Sensitive: those taxa occurring on National Forests in Arizona which are considered sensitive by the Regional Forester.

(3) BLM US Bureau of Land Management (2000 Animals, 2000 Plants)

S Sensitive: those taxa occurring on BLM Field Office Lands which are considered sensitive.

(4) State Status

NPL Arizona Native Plant Law (1993) Arizona Department of Agriculture

CS Species receiving special management under a conservation agreement in order to preclude the need for federal listing.

HS Highly Safeguarded: no collection allowed.

S-ESA Federally-listed or candidate species under the U.S. Endangered Species Act.

SPC Wildlife species of concern in Arizona

SR Salvage Restricted: collection only with permit.

WSC 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).

(5) State Status

Utah Sensitive Species List (2007) Utah Division of Wildlife Resources

SPC Wildlife species of concern in Utah

Resource Concern Summary

The following information is excerpted from the "*Virgin River Watershed Comprehensive Watershed Analysis*" recently completed by the U.S. Army Corps of Engineers (USACOE, 2008):

Major resource concerns, as identified with stakeholders, and confirmed in review of previous reports, include: Floodplain Management; Land Use Planning; Invasive Species; Water Availability; and River Function.

Floodplain regulations are in place and studies and projects underway throughout the watershed. However, multiple flood risks remain, particularly in the area of Saint. George, and management of that risk is an ongoing issue with technical, regulatory, environmental, communication, and education needs identified.

Communication among agencies and the public has room for improvement, inconsistencies occur across jurisdictions, lack of watershed wide plans, and lack of recognition of the relationships between uplands and floodplains. Rural communities have expressed a need for useful planning tools and data.

Invasive species include tamarisk, cheat grass, and red shiner. Although numerous individual efforts to address tamarisk are underway, and some collaboration is occurring, there is no comprehensive watershed scale coordination or sharing of data.

Water supply and water quality are important aspects of the watershed and needs are described in numerous reports. With growing populations and drought the pressures for the finite water supply will only continue to grow. Water conservation, additional water sources, and evaluation of existing sources are discussed as needs. Groundwater and surface water interaction and salinity have also been expressed as areas of concern within the watershed.

River function is a balance of sediment and water transport that results in channel morphology and associated biotic communities. It includes unusual events and is dynamic. The issue includes habitat, channel maintenance and endangered species, some of which are currently being addressed. In particular, the Fort Pearce Wash

Watershed provides habitat for several species that are in imminent jeopardy of extinction. These species include the Dwarf Bearclaw-poppy, the Paradox Milkvetch, the Gray Wolf, the Southwestern Willow Flycatcher, the Virgin Chub, and the Woundfin.

Conservation Progress/Status

Conservation progress for the previous five years in the Fort Pearce Wash Watershed has focused on addressing the following primary resource concerns:

- ✓ Soil Erosion – Wind
- ✓ Soil Condition – Rangeland Site Stability
- ✓ Water Quantity – Rangeland Hydrologic Cycle
- ✓ Water Quantity – Inefficient Water Use on Irrigated Land
- ✓ Plant Condition – Productivity, Health and Vigor
- ✓ Plant Condition – Noxious and Invasive Plants
- ✓ Fish and Wildlife – Inadequate Water
- ✓ Domestic Animals – Inadequate Quantities and Quality of Feed and Forage
- ✓ Domestic Animals – Inadequate Stock Water

The following table presents conservation accomplishments in this watershed during fiscal years (FY) 2004 through 2008, according to the NRCS Progress Reporting System.

Fort Pearce Wash Watershed (15010009) Conservation Treatment Applied	FY04-08 TOTAL
Brush Management (code 314) (acres)	18,840
Fence (code 382) (feet)	15,260
Pipeline (code 516) (feet)	46,421
Prescribed Grazing (code 528) (acres)	29,603
Range Planting (code 550) (acres)	225
Upland Wildlife Habitat Management (code 645) (acres)	6,700

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 10-digit watershed. In 1990, the mean population density for the entire watershed was 20.8 people per square mile in Utah and 1.7 people per square mile in Arizona. The Fort Pearce Wash Watershed (Utah) had the highest population mean with 46 people per square mile. Short Creek Watershed (AZ) had the highest maximum population density of 1,239 people per square mile. Fort Pearce Wash Watershed (Arizona) had the lowest density with a mean of no 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)

A population density map and table (Figure 4-2 and Table 4-2) were created from these data. The mean population density in 2000 was 30.6 people per square mile in Utah and 2.7 people per square mile in Arizona. Fort Pearce Wash Watershed (Utah) had the highest mean population density with 63.8 people per square mile. Short Creek Watershed (Arizona) had the highest maximum density of 2,260.5 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 ant Table 4-3) show population increase or decrease over the ten year time frame. Overall, mean population density increased by 1.0 people per square mile in Arizona and -15.1 people per square mile in Utah, during this ten-year time period. Short Creek Watershed (Arizona) had the largest increase in mean population at 7.1 people per sq.mi.

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 housing 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.

Housing density for the year 2000 indicates that about 77% of the watershed is classified as "undeveloped private" areas, 19.6% is classified as "rural" areas, and 2.5% is "exurban" (Figure 4-4 and Table 4-4). For 2030, Figure 4-5 and Table 4-5 project that "undeveloped private" areas are reduced to 71.8% of the watershed, "rural" areas remains about the same with 19.5% of the watershed, and "exurban" is expected to increase to 6.2%. The increase in "exurban" housing density is particularly high in Short Creek (Arizona) and Fort Pearce Wash (Arizona & Utah) where the increases were 7.9% and 4.3%, respectively.

Table 4-1: Fort Pearce Wash Watershed 1990 Population Density (people/square mile)

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Langs Run (AZ) 1501000901	266.0	0	<0.1	<0.1
Hurricane Wash (AZ) 1501000904	358.9	0	<0.1	<0.1
Clayhole Wash (AZ) 1501000902	352.0	0	0.5	<0.1
Dutchman Draw (AZ) 1501000905	301.9	0	0	0
Dutchman Draw (Utah) 1501000905	0.06	11.6	11.6	11.6
Short Creek (AZ) 1501000903	170.5	0	1,239.1	12.8
Short Creek (Utah) 1501000903	105.5	1.4	9.1	4.8
Fort Pearce Wash (AZ) 1501000906	58.0	0	0	0
Fort Pearce Wash (Utah) 1501000906	58.0	0.2	876.9	46.2
Total Fort Pearce Watershed (AZ)	1,507.3	0	1,239.1	1.7
Total Fort Pearce Watershed (Utah)	163.7	0.2	876.9	20.8

Note: Adjacent watersheds may share a grid square. Data Sources: Census block statistics for 1990 were compiled from a CD prepared by Geo-Lytics (GeoLytics, Inc.1998. Census 1990. Census CD + Maps. Release 3.0). Utah data from U.S. Census Bureau, Census Block Group 1990

** The population density for Utah was calculated at the census block group level, while the density for Arizona was calculated at the census block level due to data availability issues. Census block groups are larger than census blocks.*

Table 4-2: Fort Pearce Wash Watershed 2000 Population Density (people/square mile)

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Langs Run (AZ) 1501000901	266.0	0	0	0
Hurricane Wash (AZ) 1501000904	358.9	0	0	0
Clayhole Wash (AZ) 1501000902	352.0	0	2.6	<0.1
Dutchman Draw (AZ) 1501000905	301.9	0	0	0
Dutchman Draw (Utah) 1501000905	0.06	0	197.7	52.8
Short Creek (AZ) 1501000903	170.5	0	2260.5	19.9
Short Creek (Utah) 1501000903	105.5	0	38.8	8.0
Fort Pearce Wash (AZ) 1501000906	58.0	0	0	0
Fort Pearce Wash (Utah) 1501000906	58.0	0	215.4	63.8
Total Fort Pearce Watershed (AZ)	1507.3	0	2260.5	2.7
Total Fort Pearce Watershed (Utah)	163.7	0	215.4	30.6

Note: Adjacent watersheds may share a grid square. Data Sources: Census block statistics for 2000 were compiled from a CD prepared by Geo-Lytics (GeoLytics, Inc.1998. Census 2000. Census CD + Maps. Release 3.0). Utah data from U.S. Census Bureau, Census Block Group 2000
**The population density for Utah was calculated at the census block group level, while the density for Arizona was calculated at the census block level due to data availability issues. Census block groups are larger than census blocks.*

Table 4-3: Fort Pearce Wash Watershed Population Density Change 1990 – 2000 (people/square mile)

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Langs Run (AZ) 1501000901	266.0	<-0.1	0	<-0.1
Hurricane Wash (AZ) 1501000904	358.9	<-0.1	0	<0.1
Clayhole Wash (AZ) 1501000902	352.0	<-0.1	2.5	<0.1
Dutchman Draw (AZ) 1501000905	301.9	0	0	0
Dutchman Draw (Utah) 1501000905	<0.1	-186.2	-50.8	-118.5
Short Creek (AZ) 1501000903	170.5	-301.8	1021.5	7.1
Short Creek (Utah)	105.5	-37.2	3.74	-4.6

1501000903				
Fort Pearce Wash (AZ) 1501000906	58.0	0	0	0
Fort Pearce Wash (Utah) 1501000906	58.0	-205.2	710.6	-32.4
Total Fort Pearce Watershed (AZ)	1507.3	-301.8	1021.5	1.0
Total Fort Pearce Watershed (Utah)	163.7	-205.2	710.8	-15.1

Note: Adjacent watersheds may share a grid square. Data Sources: Derived from data from the GIS data used for tables 4-1 and 4-2.
**The population density for Utah was calculated at the census block group level, while the density for Arizona was calculated at the census block level due to data availability issues. Census block groups are larger than census blocks.*

Table 4-4: Fort Pearce Wash Watershed Housing Density 2000 (Percent of Watershed)

10-digit Watershed Name	Housing Density				
	Undeveloped Private	Rural	Exurban	Suburban	Urban
Langs Run 1501000901	95.7%	4.3%	-	-	-
Hurricane Wash 1501000904	97.0%	3.0%	-	-	-
Clayhole Wash 1501000902	94.8%	5.2%	-	-	-
Dutchman Draw 1501000905	96.6%	3.4%	-	-	-
Short Creek 1501000903	57.5%	38.0%	3.8%	0.7%	-
Fort Pearce Wash 1501000906	65.0%	20.6%	8.9%	3.3%	2.3%
Fort Pearce Wash Watershed	77.0%	19.6%	2.5%	0.6%	0.3%
Fort Pearce Wash Watershed (sq. mi.)	163	42	5	1	1

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. Ecology and Society 10(1): 32. [online] URL: http://www.ecology and society.org/vol10/iss1/art32/

Table 4-5: Fort Pearce Wash Watershed Housing Density 2030 (Percent of Watershed)

10-digit Watershed Name	Housing Density				
	Undeveloped Private	Rural	Exurban	Suburban	Urban
Langs Run 1501000901	94.0%	4.8%	1.2%	-	-
Hurricane Wash 1501000904	96.8%	2.7%	0.5%	-	-
Clayhole Wash 1501000902	94.8%	5.2%	-	-	-
Dutchman Draw 1501000905	93.6%	6.4%	-	-	-
Short Creek 1501000903	50.3%	35.5%	11.2%	2.6%	0.5%
Fort Pearce Wash 1501000906	45.3%	28.9%	13.2%	5.1%	7.4%
Fort Pearce Wash Watershed	71.8%	19.5%	6.2%	1.6%	1.0%
Fort Pearce Wash Watershed (sq. mi.)	152	41	13	3	2

Source: Theobald, D. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. Ecology and Society 10(1): 32. [online] URL: http://www.ecology and society.org/vol10/iss1/art32/

Ft. Pearce Wash 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.

Most farms in the Fort Pearce Wash Watershed (Arizona and Utah combined) are small or moderately sized. Eighty-three percent of all farms in the watershed are less than 1,000 acres in size, and 48% are less than 50 acres (Table 4-6 and Figure 4-6). Of the 136 farms that have pasture and

rangeland, 84 have 100 or more acres (Table 4-7 and Figure 4-7). Of the 140 farms that harvest crops, 85% are 49 acres or less in size (Table 4-8 and Figure 4-8).

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 zip code maps of the watershed. 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 than 100 percent.

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

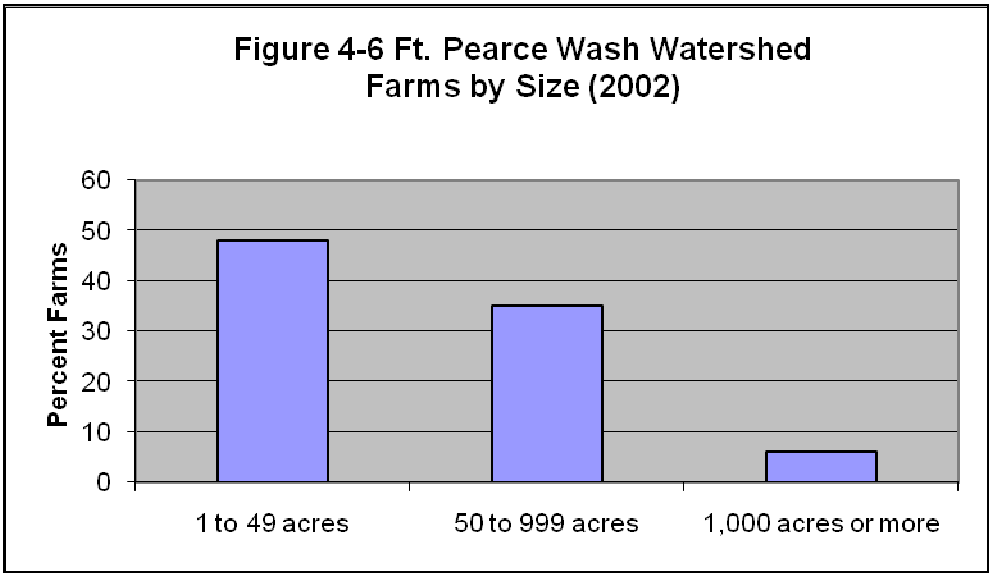

Table 4-6: Fort Pearce Wash Watershed Farms by Size

All farms	1 to 49 acres	50 to 999 acres	>1000 acres
283	48%	35%	6%

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)

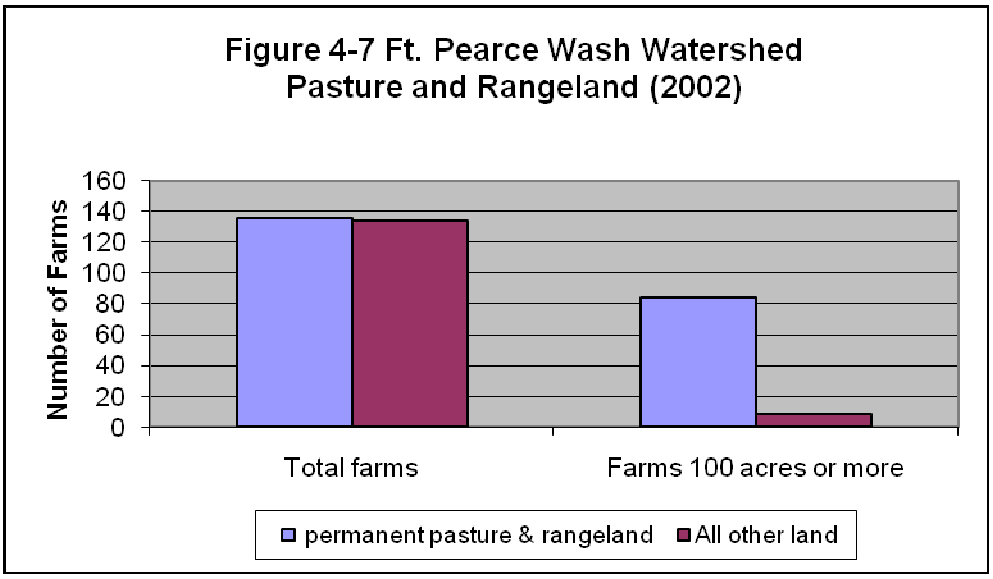

Table 4-7: Fort Pearce Wash Watershed Pasture and Rangeland (2002)

Category	Total farms	Farms 100 acres or more
Permanent pasture and rangeland	136	84
All other land	134	8

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)

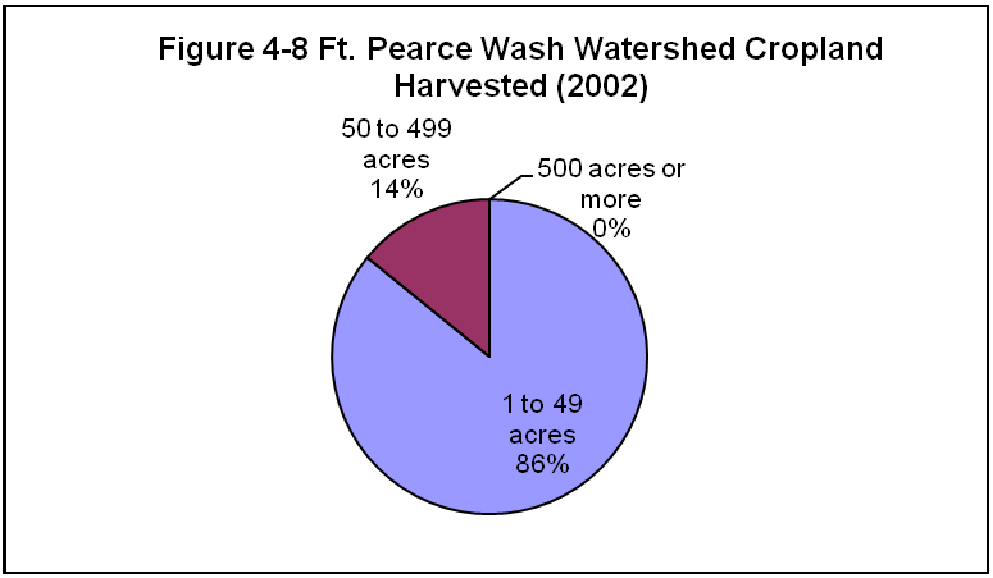

Table 4-8: Fort Pearce Wash Watershed Cropland Harvested

Total farms	1 to 49 acres	50 to 499 acres	>500 acres
140	85%	14%	0%

According to the NASS, "harvested cropland" includes all land from which crops were harvested, including: cut hay; 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 Fort Pearce Wash 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 the major land use within the watershed (range). **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.

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.

WATERSHED NAME & CODE	FORT PEARCE WASH - 15010009				LANDUSE ACRES	1,000,000		
LANDUSE TYPE	RANGE				TYPICAL UNIT SIZE ACRES	50,000		
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 Erosion – Wind	Plant Condition – Productivity, Health and Vigor	Plant Condition – Noxious and Invasive Plants	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage
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	**600,000**	**540,000**	**0**	**540,000**				
Progressive				**System Rating ->**	**0**	**0**	**0**	**0**
Fence (ft.) 382	3,000	2,700	600	3,300	0	1	0	1
Pipeline (ft.) 516	12,000	10,800	2,400	13,200	0	0	0	0
Total Acreage at Progressive Level	**300,000**	**270,000**	**60,000**	**330,000**				
RMS				**System Rating ->**	**4**	**5**	**4**	**4**
Brush Management (ac.) 314	5,000	5,000	1,500	6,500	1	5	5	3
Fence (ft.) 382	2,000	2,300	300	2,600	0	1	0	1
Pipeline (ft.) 516	8,000	9,200	1,200	10,400	0	0	0	0
Prescribed Grazing (ac.) 528	100,000	100,000	30,000	130,000	5	5	4	5
Range Planting (ac.) 550	5,000	5,000	1,500	6,500	4	5	4	5
Upland Wildlife Habitat Management (ac.) 645	5,000	5,000	1,500	6,500	0	4	4	1
Total Acreage at RMS Level	**100,000**	**100,000**	**30,000**	**130,000**				

WATERSHED NAME & CODE	FORT PEARCE WASH - 15010009				LANDUSE ACRES	1,000,000	
LANDUSE TYPE	RANGE				TYPICAL UNIT SIZE ACRES	50,000	
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								
Fence (ft.) 382	600	$900	$0	$180	$1,080	$900	$36	$1,056
Pipeline (ft.) 516	2,400	$9,600	$0	$1,920	$11,520	$9,600	$384	$11,263
Subtotal	**60,000**	**$10,500**	**$0**	**$2,100**	**$12,600**	**$10,500**	**$420**	**$12,318**
RMS								
Brush Management (ac.) 314	1,500	$90,000	$0	$18,000	$108,000	$90,000	$1,800	$97,793
Fence (ft.) 382	300	$450	$0	$90	$540	$450	$18	$528
Pipeline (ft.) 516	1,200	$4,800	$0	$960	$5,760	$4,800	$192	$5,631
Prescribed Grazing (ac.) 528	30,000	$22,500	$0	$4,500	$27,000	$22,500	$0	$22,500
Range Planting (ac.) 550	1,500	$45,000	$0	$9,000	$54,000	$45,000	$900	$48,897
Upland Wildlife Habitat Management (ac.) 645	1,500	$0	$5,850	$1,170	$6,480	$0	$1,950	$3,132
Subtotal	**30,000**	**$162,750**	**$5,850**	**$33,720**	**$201,780**	**$162,750**	**$4,860**	**$178,481**
Grand Total	**90,000**	**$173,250**	**$5,850**	**$35,820**	**$214,380**	**$173,250**	**$5,280**	**$190,799**

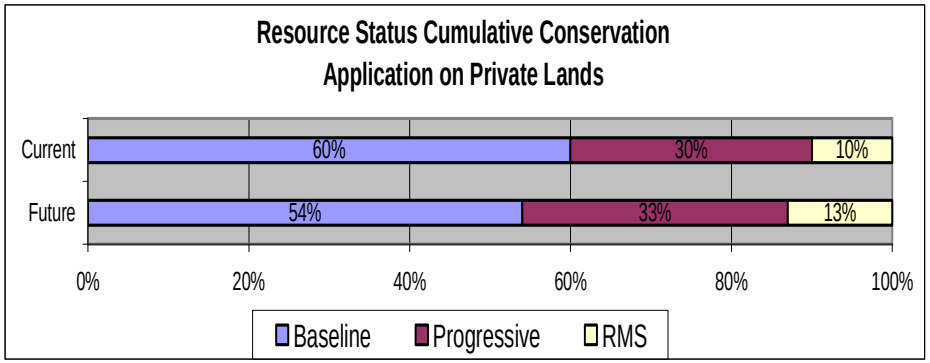

Chart Refers To	
Landuse Type	RANGE
Calculated Participation Rate	10%

Average PV Costs per Ac		
System	Federal	Private
Prog	$0.21	$0.21
RMS	$6.73	$5.95

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GLOSSARY

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℃ (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℃ (46℉). **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℃ (41°F). **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℃ (72℉) or more and >5℃ (41°F) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface. **Thermic** is a soil temperature regime that has mean annual soil temperatures of 15℃ (59℉) or more but <22℃ (72℉), and >5℃ (41°F) difference between mean summer and mean win ter soil temperatures at 50 cm (20 in.) below the surface. **Mesic** A soil temperature regime that has mean annual soil

	temperatures of 8℃ (46℉) or more but <15℃ (59℉) , and >5℃ (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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