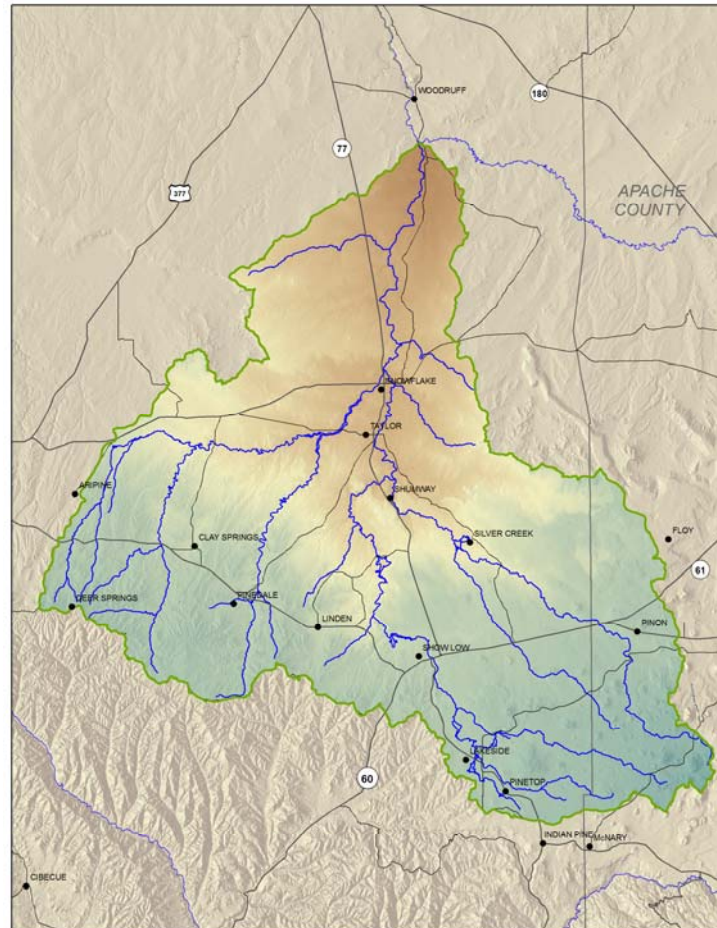


Silver Creek Watershed – Arizona

Rapid Watershed Assessment

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**Silver Creek Watershed – 15020005
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 watershed planning.

General Description of the Silver Creek Watershed

The Silver Creek watershed is an eight-digit HUC subbasin located in the east-central portion of the state of Arizona (Figure 1-1). The basin comprises 606,720 acres (948 square miles) and is located in Navajo and Apache Counties. Forty-seven percent of the land is managed by the Forest Service, 41% is private land, and 10% is State Trust land. The remaining 2% of the land is managed by Bureau of Land Management (BLM) or the White Mountain Apache Tribe.

Major towns in the watershed include Snowflake, Show Low, Lakeside and Pinetop. The NRCS Field Offices for the area are located in Holbrook and Springerville. Conservation assistance is provided through the Apache and Navajo County Natural Resource Conservation Districts.

The area ranges in elevation from 5,400 to 7,200 feet. Rainfall amounts in this area range from 10 to 20 inches per year. The area in lower elevations is

made up of undulating plains and low hills, with an occasionally deeply incised, steep sided drainage way. Some buttes and mesas rise abruptly above the level of the plains. At higher elevation the landscape is generally made up of level plains with hills and low mountains. This area supports a mixture of forest and grassland plant communities.

The majority of this watershed is used for cattle and sheep grazing. Rangeland and grazable forestland comprise over 90 percent of the area, while about 3 percent is used for cropland. The crops produced are corn, alfalfa, small grains and vegetable crops which are usually grown for local consumption. Scattered acreage of dry cropland occurs at the higher elevations.

Resource concerns in the watershed include soil erosion, rangeland site stability, rangeland hydrologic cycle, excessive runoff (causing flooding or ponding), inefficient water use on irrigated land, aquifer overdraft, water quality concerns for ground water (pesticides, nutrients and organics) and surface water (pesticides, nutrients, organics, suspended sediment and turbidity), plant condition – productivity, health and vigor, noxious and invasive plants, wildfire hazard, fish and wildlife habitat fragmentation, domestic animals – inadequate quantities and quality of feed, forage, and stock water.

Section 2: Physical Description

Watershed Size

The Silver Creek Watershed covers approximately 948 square miles, representing less than 1% of the state of Arizona. The watershed has a maximum width of about 40 miles east-west, and a length of about 37 miles north-south.

The Silver Creek 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 (HUC) number 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 Silver Creek Watershed has an 8-digit HUC of 15020005 and contains the following 10-digit HUCs:

- 1502000501 (Show Low Creek);
- 1502000502 (Upper Silver Creek);
- 1502000503 (Cottonwood Creek); and,
- 1502000504 (Lower Silver Creek) (Figure 1-2).

Geology

The Silver Creek Watershed is on the top ridge of the Mogollon Rim escarpment, the southern boundary of the Colorado Plateau Uplands physiographic province in the northeastern corner of the state. This

province covers the northern 2/5 of the state of Arizona and is characterized by mostly level, horizontally stratified sedimentary rocks that have been eroded into canyons and plateaus, and by some high volcanic mountains.

The edge of the Mogollon Rim exposes a sequence, nearly 3,000 feet thick, of Paleozoic sedimentary rocks (Parker and Flynn, 2000). The overall vertical displacement of the Rim varies, but in some multiple fault zones near the Verde River it is estimated at approximately 6,000 feet (Feth et al., 1954). This exposure, in addition to the downcutting of the Colorado River in the Grand Canyon provides a visible cross section of the layered sedimentary rocks of the region.

Compared with the rest of Arizona geology, the Plateau Uplands seems easy to understand, the rocks are flat-lying sedimentary strata set in sequences of oldest (bottom) to youngest (top). At land surface, the Moenkopi formation overlays (in descending order) the Kaibab Limestone Formation, the Permian age Coconino Sandstone, and the older red siltstone and fine sandstone rocks of the Supai Formation. Ancient marine and coastal deposits include a wide range of rock types – limestone, claystone, mudstone, sandstone, and conglomerate – through out the sequence.

The 240 million year-old Moenkopi formation, which is exposed across the land surface of much of the watershed, can be traced from New Mexico, north to Nevada, and west to California. In northern Arizona, fossil vertebrate fauna have been described throughout the

formation, including freshwater sharks, coelacanths, and lungfish. Fossil footprints and several fragmentary body fossils have been found throughout.

Nearly a third of the watershed is covered by dark colored lava flows, cinder cones, and associated volcanic rocks of the White Mountain Volcanic Fields. The volcanic fields originated from a central volcano, Mt. Baldy (11,490 feet above sea level) to the south east of the Silver Creek Watershed. Mt. Baldy’s slopes, and the rest of the volcanic region that extends across this part of the Mogollon Rim, were built by eruptions as recent as the past 10,000 years. Figure 2-1 shows the geology of the Silver Creek Watershed.

Soils

Soils within the Silver Creek 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) 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 covered by the following NRCS Soil Surveys: “Soil Survey of Navajo County Area, AZ,

Central Part” and “Soil Survey of Apache County, AZ, Central 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 Silver Creek Watershed is comprised of four Common Resource Areas (Figure 2-2 and Table 2-1).

Table 2-1: Silver Creek Watershed - Common Resource Areas

Common Resource Area Type	Area (sq. mi.)	Percent of Watershed
35.1 Colorado Plateau Mixed Grass Plains	276	29%
35.2 Colorado Plateau Shrub - Grasslands	23	3%
35.7 Colorado Plateau Woodland - Grassland	362	38%
39.1 Mogollon Plateau Coniferous Forests	286	30%

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

The lower portion of the watershed is comprised of CRA 35.2 “Colorado Plateau Shrub – Grasslands” with elevations ranging from 3500-5500 feet and precipitation averaging 6 to 10 inches per year. Vegetation includes shadscale, fourwing saltbush, mormon tea, blackbrush, Indian ricegrass, galleta, blue grama, and black grama. 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, moderately fine and fine-textured, soils occur on floodplains. Shallow and deep, moderately coarse to moderately fine-textured, soils occur on sandstone and shale plateaus.

Moving up the watershed, CRA 35.1 “Colorado Plateau Mixed Grass Plains” occurs at elevations ranging from 5100 to 6000 feet and precipitation averaging 10 to 14 inches per year. Vegetation includes *Stipa* species, Indian ricegrass, galleta, blue grama, fourwing saltbush, winterfat, and cliffrose. The soils in the area have a mesic soil temperature regime and an ustic aridic soil moisture regime. The dominant soil orders are Aridisols and Entisols. Shallow and deep, moderately coarse to moderately fine-textured, soils occur on sandstone and shale plateaus.

The middle portion of the watershed is comprised of CRA 35.7 “Colorado Plateau Woodland – Grassland” with elevations ranging from 5000 to 7000 feet and precipitation averaging 14 to 18 inches per year. Vegetation includes one-seed juniper, Colorado pinyon, Stansbury cliffrose, Apache plume, four-wing saltbush, Mormon tea, sideoats grama, blue grama, black grama, galleta, bottlebrush squirreltail, and muttongrass. The soils in the area have

a mesic soil temperature regime and an aridic ustic soil moisture regime. The dominant soil orders are Alfisols and Mollisols. Deep, coarse to moderately fine-textured, soils occur on plains. Deep, gravelly, medium and fine-textured, soils occur on dissected uplands. Shallow to deep, gravelly, cobbly and stony, fine-textured, soils occur on basaltic plains, mesas and hills.

The upper portion of the watershed is comprised of CRA 39.1 “Mogollon Plateau Coniferous Forests” with elevations ranging from 7000 to 12,500 feet and precipitation averaging 20 to 35 inches per year. Vegetation includes ponderosa pine, Gambel oak, Arizona walnut, sycamore, Douglas fir, blue spruce, Arizona fescue, mountain muhly, muttongrass, pine dropseed, and dryland sedges. The soils in the area have a mesic to frigid soil temperature regime and a typic ustic to udic ustic soil moisture regime. The dominant soil orders are Alfisols, Mollisols, and Entisols. Shallow to deep, gravelly and cobbly, moderately coarse and fine-textured, soils occur on mountains and hills. Moderately deep and deep, medium and moderately fine-textured, soils occur on mountains.

These four Common Resource Areas (CRA 35.2, 35.1, 35.7, 39.1) occur within the Colorado Plateau Physiographic Province which is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin.

Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. Approximately 9% of the Silver Creek Watershed has a slope greater than 15%, while about 63% of the watershed has a slope less

than 5%. Lower Silver Creek is comparatively flat, with only 2% of its area over 15% slope, and 83% less than 5% slope. The Cotton Wood Creek and Show Low Creek Watersheds are relatively steeper, with 16% and 11% of the area greater than 15% slope, respectively (Table 2-2 and Figure 2-3).

Table 2-2: Silver Creek Watershed Slope Classifications.

Watershed Name	Area (sq. mi.)	Percent Slope		
		0-5%	5-15%	>15%
Show Low Creek 1502000501	227	56%	33%	11%
Upper Silver Creek 1502000502	185	65%	27%	7%
Cottonwood Creek 1502000503	284	49%	35%	16%
Lower Silver Creek 1502000504	251	83%	15%	2%
Silver Creek Watershed	948	63%	28%	9%

Data Sources: Derived from DEM, obtained from U.S. Geological Survey, April 8, 2003
<http://edc.usgs.gov/geodata/>

Streams, Lakes and Gaging Stations

The locations of active and inactive US Geological Survey (USGS) gaging stations, and their respective annual mean stream flow, are found in Table 2-3.1. The Silver Creek Watershed has three active gages. The site with the largest streamflow is located on Show Low Creek near Lakeside. The gage has recorded an annual mean stream flow of 13 cfs. Table 2-3.2 lists major

lakes and reservoirs in the watershed, as well as their watershed location, surface area, elevation and dam name. The unknown lake on Cotton Wood Creek is the largest surface water body in the watershed with an area of about 388 acres. Table 2-3.3 lists the major streams and their lengths. Listed stream lengths range from about 53 miles for Show Low Creek to about 8 miles for Linden Wash.

Table 2-3.1: Silver Creek Watershed USGS Stream Gages and Annual Mean Stream Flow.

USGS Gage ID	Site Name	Begin Date	End Date	Annual Mean Stream Flow (cfs)
<i>Active gages</i>				
09390500	Show Low Creek Nr Lakeside	1/1/1954	12/31/2005	13
09391000	Show Low Lake Nr Show Low*	1/1/1987	12/31/2001	4
09392000	Show Low C BL Jacques Dam, Nr Show Low	1/1/1956	12/31/2004	9

USGS Gage ID	Site Name	Begin Date	End Date	Annual Mean Stream Flow (cfs)
	Inactive gages			
09392500	Show Low Creek at Show Low	10/1/1945	09/30/1954	9
09390000	Silver Creek Nr Shumway	1/1/1945	12/31/1954	12
09393000	Silver Creek at Snowflake			
09393400	Cottonwood Wash at Snowflake	10/1/1982	09/30/1983	9
09393500	Silver Creek Nr Snowflake	N/A	N/A	-
09394000	Silver Creek Nr Wooddruff	01/1/1929	12/31/1952	28

*Discontinuous years of data Data Sources: USGS website, National Water Information System <http://waterdata.usgs.gov/nwis/>

Table 2-3.2: Silver Creek Watershed Major Lakes and Reservoirs.

Lake Name	Watershed	Surface Area (acre)	Elevation (feet above mean sea level)	Dam Name (if known)
Unknown	Cotton Wood Creek 1502000503	388	5709	Unknown
Unknown	Show Low Creek 1502000501	227	5938	Lone Pine Dam
White Mountain Lake	Upper Silver Creek 1502000502	208	5971	Daggs Dam
Fools Hollow Lake	Show Low Creek 1502000501	152	6266	Fool Hollow Dam
Upper Tank	Cotton Wood Creek 1502000503	13	6234	Unknown

Data Sources: GIS data layer "Lakes", and GIS data layer "DEM" 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: Silver Creek Watershed Major Streams and Lengths.

Stream Name	Watershed	Stream Length (miles)
Show Low Creek	Show Low Creek	53
Silver Creek	Lower Silver Creek; Upper Silver Creek; Show Low Creek	51
Cottonwood Wash	Cotton Wood Creek; Lower Silver Creek	48
Brown Creek	Upper Silver Creek	25
Dodson Wash	Cotton Wood Creek	23
Day Wash	Cotton Wood Creek	20
Sevenmile Draw	Lower Silver Creek	11
Linden Wash	Show Low Creek	8

Data Sources: GIS data layer "Streams", Arizona State Land Department, Arizona Land Resource Information System (ALRIS), October, 10, 2002. <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 Silver Creek Watershed (Figure 2-5).

Rocky Mountain Lower Montane Riparian Woodland and Shrubland is the only type of riparian vegetation that is found in the Silver Creek Watershed. Riparian areas encompass approximately 2 acres in the watershed (Table 2-4).

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 Silver Creek Watershed, Table 2-5 identifies Colorado Plateau Pinyon-

Juniper Woodland as the most common land cover type over the entire watershed, encompassing about 43% of the watershed.

The next most common types are Rocky Mountain Ponderosa Pine Woodland (25%), Southern Rocky Mountain Montane-Subalpine-Grassland (9%), Intermountain Basins Semi Desert Grassland (9%), Intermountain Basins Juniper Savanna (8%), and Intermountain Basins Semi Desert Shrub Steppe (8%).

Note: There are a total of 26 GAP vegetation categories present within the Silver Creek 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 13 grouped GAP vegetation categories, as shown on Table 2-5.

Table 2-4: Silver Creek Watershed Riparian Vegetation (acres) by 10-digit Watershed.

Riparian Vegetation Community	Show Low Creek 1502000501	Upper Silver Creek 1502000502	Cottonwood Creek 1502000503	Lower Silver Creek 1502000504	Silver Creek Watershed
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	-	-	2	-	2
Total Area (acres)	0	0	1.78	0	2

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

Table 2-5: Silver Creek Watershed GAP Analysis Project Land Cover, Percent of 10-digit Watershed

Watershed	Lower Silver Creek 1502000504	Cotton Wood Creek 1502000503	Show Low Creek 1502000501	Upper Silver Creek 1502000502	Percent Of Total
Agriculture*	3%	<1%	1%	<1%	1%
Colorado Plateau Shrub land	4%	1%	<1%	<1%	1%
Developed	2%	1%	8%	1%	3%
Colorado Plateau Pinion-Juniper Woodland	26%	43%	40%	72%	43%
Intermountain Basins Juniper Savanna	18%	6%	1%	4%	8%
Intermountain Basins Mixed Salt Desert Scrub	1%	<1%	<1%	<1%	<1%
Intermountain Basins Semi Desert Grassland	25%	7%	2%	<1%	9%
Intermountain Basins Semi Desert Shrub Steppe	18%	7%	2%	1%	8%
Intermountain Basins Volcanic Rock and Cinder Land	<1%	---	---	<1%	<1%
Open Water	<1%	<1%	<1%	<1%	<1%
Rocky Mountain Ponderosa Pine	6%	34%	45%	20%	25%
Rocky Mountain Forest and Woodland	---	---	<1%	<1%	<1%
Southern Rocky Mountain Montane-Subalpine Grassland	---	<1%	7%	.17%	9%
Area (Sq. mi.)	251	284	227	185	948

**Not necessarily irrigated land. Data Sources: GIS data layer "Arizona Gap Analysis Project Vegetation Map", University of Arizona, Southern Arizona Data Services Program, 2004*

<http://sdrsnet.snr.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 Silver Creek Watershed was about 21 inches (Table 2-6 and Figure 2-7). The Show Low Creek Watershed at Pinetop received the most rainfall with 23.17 inches of rain in an average year, while the Upper Silver Creek Watershed and Cotton Wood Creek Watersheds typically received about 23 and 19 inches, respectively. Average Temperature for the Silver Creek Watershed ranged from about 52.05 °F at Lower Silver Creek to about 48.8 °F at Pinedale.

Table 2-6: Silver Creek Watershed Meteorological Stations, Temperature (°F) and Precipitation (in/yr) with Recent Long-term Records.

10-digit Watershed Name	Meteorological Stations and Map ID	Temperature (°F)			Precipitation (in/yr)		
		Min.	Max.	Avg.	Min.	Max.	Average
Lower Silver Creek 1502000504	Snowflake	34.5	69.6	52.05	9	19	14
Cottonwood Creek 1502000503	Snowflake 15W	37.3	66.2	51.75			
	Clay Springs	34.6	65.6	50.1	13	25	18.75
	Pinedale	32.6	65.0	48.8			
Show Low Creek 1502000501	Show Low Airport	37.6	65.9	51.75			
	Pinetop	34.6	63.7	49.15	13	33	23.17
Upper Silver Creek 1502000502	Silver Creek Ranch	--	--	--	13	33	23
	Vernon 4 SSW	--	--	--			
Silver Creek Watershed	--	--	--	--	9	33	21

Data Sources: Western Regional Climate Center (WRCC), Temperature data. July 15, 2004.
<http://www.wrcc.dri.edu/summary/climsmaz.html>

Land Ownership/Management

There are 6 different land ownership/management entities in the Silver Creek Watershed (Figure 2-8 and Table 2-7). U.S. Forest Service land is the largest category, representing about 47% of the watershed, followed by the Private land with about 41%, and State Trust land with about 10%. The BLM and, Indian Reservation and “Other” manage the remaining, small amounts of land in the watershed.

Table 2-7: Silver Creek Watershed Land Ownership/Management (Percent of each 10-digit Watershed)

Land Owner	Show Low Creek 1502000501	Upper Silver Creek 1502000502	Cottonwood Creek 1502000503	Lower Silver Creek 1502000504	Silver Creek Watershed
BLM	-	<1%	<1%	7%	2%
US Forest Service	71%	47%	69%	-	47%
Indian Reservation	1.0%	-	-	-	<1%
Other	<1%	1%	-	-	<1%
Private	27%	37%	26%	73%	41%
State Trust	1%	15%	6%	20%	10%
Area (square miles)	227	185	284	251	948

Data Sources: GIS data layer “ownership”, Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2002 <http://www.land.state.az.us/alris/index.html>

Land Use

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, 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; and,
- 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 in the Silver Creek Watershed is Range which makes up about 71% of the watershed. Forest is the next most common type with about 25% of the total area.

Table 2-8: Silver Creek Watershed Land Use, Percent of 10-digit Watershed

Land Cover - Location	Crop	Forest	Urban	Range	Water	Area (sq miles)
Lower Silver Creek	3%	<1%	2%	95%	<1%	251
Cottonwood Creek	<1%	34%	1%	65%	<1%	284
Show Low Creek	1%	45%	8 %	46%	<1%	227
Upper Silver Creek	<1%	20%	1%	78%	<1%	185
Percent of Silver Creek Watershed	1%	25%	3%	71%	<1%	948

Data Sources: GIS data layer "sil_newgapveg", Arizona State Land Department, Arizona Land Resource Information System (ALRIS 2004) <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 Silver Creek Watershed. The most common types of mines in the watershed are pumice (17), unknown (13), and sand and gravel (11).

Table 2-9: Silver Creek Watershed Mines – Primary Ores.

Ore Type	Total Number of Mines
Pumice	17
Unknown	13
Sand & Gravel	11
Coal	2
Gypsum	1
Iron	1
Clay	1

Note: If a mine contains more than one ore, only the major ore is noted.

Data Source: Natural Resource Conservation Service (NRCS).

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 Silver Creek 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 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.

Soil Condition

Soil condition is a resource concern whenever soil tilth is poor or soil compaction is excessive. Poor soil tilth results whenever unsuitable combinations of minerals, air, water, and organic matter occur, resulting in low microbial activity and chemical reactions. Soil compaction results from excessive compressing of soil particles and aggregates by machines or livestock, thus affecting plant-soil-moisture-air relationships. Soil condition can become a problem whenever a field is excessively tilled or tilled when the soil is wet, lack of crop rotation, and lack of addition of organic matter. Poor soil condition reduces root growth and plant productivity.

Conservation practices applied to address this resource concern are generally those that improve plant cover, improve soil organic matter, improve soil microbial activity, reduce tillage operations, or mechanically break up compacted soils. Practices may include deep tillage, conservation cover, conservation crop rotation, cover & green manure crop, irrigation water management, mulching, nutrient management, pest management, residue management, tree and shrub establishment, and waste utilization. Reduced tillage passes and addition of organic matter from cover crops or residue will improve soil condition.

Table 3-1: Silver Creek Watershed Priority Resource Concerns by Land Use

Resource Category	Cropland Concerns	Rangeland Concerns	Forest Concerns	Urban Concerns
Soil Erosion		Sheet & Rill Erosion	Sheet & Rill Erosion	Roads & Construction Sites
Soil Condition	Soil Compaction & Organic Matter Depletion	Rangeland Site Stability	Rangeland Site Stability	
Water Quality	Excessive Nutrients & Organics & Pesticides in Ground Water	Excessive Suspended Sediment in Surface Water	Excessive Suspended Sediment in Surface Water	Excessive Nutrients & Organics & Pesticides in Ground Water
Water Quantity	Inefficient Use on Irrigated Land & Aquifer Overdraft	Rangeland Site Stability	Rangeland Site Stability	Inefficient Use on Irrigated Land & Aquifer Overdraft
Air Quality				
Plant Condition		Plant Productivity, Health & Vigor	Plant Productivity, Health & Vigor	
Noxious & Invasive Plants		Noxious & Invasive Plants	Noxious & Invasive Plants	
Domestic Animals		Inadequate Quantities & Quality of Feed & Forage & Water	Inadequate Quantities & Quality of Feed & Forage & Water	
Fish and Wildlife		Habitat Fragmentation	Habitat Fragmentation	
Species of Concern		T&E Species & Declining Species & Species of Concern		

(NRCS, 2007)

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. 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.

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 indicates the following status of surface waters in the Silver Creek Basin (Figure 3-1).

- Billy Creek, from headwaters to Show Low Creek. 15020005-019. 18.5 miles. Attaining some uses. E. coli bacteria exceedance in 1 of 8 samples. (01 Show Low Creek Sub-Basin)
- Porter Creek, from headwaters to Show Low Creek. 15020005-246. 4.4 miles. Attaining all uses. (01 Show Low Creek Sub-Basin)
- Rainbow Lake. 15020005-1170. 110 acres. Not attaining (impaired) by nutrients and high pH. These conditions lead to occasional fish kills. (01 Show Low Creek Sub-Basin)
- Show Low Creek, from headwaters to Linden Wash. 15020005-012. 41.7 miles. Attaining all uses. No exceedances. (01 Show Low Creek Sub-Basin)
- Silver Creek, from headwaters to Show Low Creek. 15020005-013. 33.6 miles. Attaining all uses. No exceedances. (02 Upper Silver Creek Sub-Basin)

(Data collected on other stream reaches or lakes was insufficient to determine if impaired or attaining any designated use.)

Water Quantity

It is estimated that ground water satisfies 90% of the water demand in this area of the Little Colorado River Watershed (ADWR, 2006). Ground water is pumped from several large regional aquifers of sedimentary formations of sandstone and limestone, stacked on top of one another and generally separated by impermeable shales and siltstones.

The Silver Creek Watershed has two predominant stream types: perennial and ephemeral/intermittent. The definitions for the three different stream types are below:

- Perennial surface water means surface water that flows continuously throughout the year, with base flow maintained by ground water discharged into the channel;
- Intermittent surface water means a stream or reach of a stream that flows continuously only at certain times of the year; such as when it receives water from a seasonal rainfall, a spring, or from another source, such as melting spring snow; and,
- Ephemeral streams are at all times above the elevation of the ground water table, has no base flow, and flows only in direct response to precipitation.

Three streams in the Silver Creek Watershed contain perennial segments: Brown Creek with a little over three miles of the nearly 25 miles length, or 12.9% of the creek; Show Low Creek

with 15 miles out of 52 miles mapped as perennial, or 29%; and, Silver Creek, the entire length of 48 miles are perennial.

Most streams in Arizona are intermittent or ephemeral. Some of the stream channels in the Little Colorado Watershed are dry for years at a time, but are subject to flash flooding during high-intensity storms (Gordon et al., 1992).

Air Quality

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

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. 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.

Based on an analysis of the Forest Service GIS data for bark beetle occurrence, approximately 857 acres of lands in the Silver Creek Watershed have been affected by bark beetles, or about 0.14 percent. The dominant vegetation communities in this watershed are also the dominant vegetation types where bark beetles occur: Rocky Mountain Ponderosa Pine Woodland and Colorado Plateau Pinyon-Juniper Woodland.

The Climate Assessment for the Southwest (CLIMAS) website (www.ispe.arizona.edu/climas) provides information on Arizona's drought status. Recent precipitation events have placed the area of Arizona that encompasses the Silver Creek Watershed in moderate drought status. However, the watershed remains abnormally dry, and the long term drought status remains moderate.

The Southwest Coordination Center (gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm) places the Silver Creek Watershed in the Normal category for significant wildland fire activity potential due to favorably moist conditions.

The upper portion of the Silver Creek Watershed is comprised primarily of the Rocky Mountain ponderosa pine woodland vegetation type. Most of this area was moderately to severely burned during the massive Rodeo-Chediski wildfire of 2002. This event killed many of the pine trees along with most of the ground vegetation, thereby leaving the soils within much of the upper watershed unprotected and subject to runoff and erosion.

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. 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)

threatened (LT), or species of concern (SC), under the U.S. Endangered Species Act (Table 3-2).

The Silver Creek Watershed contains 13 species that are either listed as

Table 3-2: Silver Creek 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
Northern Goshawk	Accipiter gentilis	SC	S		WSC	1998
Gila Longfin Dace	Agosia chrysogaster chrysogaster	SC		S		2001
California Floater	Anodonta californiensis	SC	S			1995
Golden Eagle	Aquila chrysaetos					2005
Desert Sucker	Catostomus clarki	SC		S		2001
Little Colorado Sucker	Catostomus sp. 3	SC	S		WSC	1999
Designated Critical Habitat for Mexican spotted owl	CH for Strix occidentalis lucida	Y				
Bald Eagle	Haliaeetus leucocephalus (wintering pop.)	LT,PDL	S		WSC	2005
Little Colorado Spinedace	Lepidomeda vittata	LT	S		WSC	1993
Arizona Myotis	Myotis occultus	SC		S		1986-PRE
Fringed Myotis	Myotis thysanodes	SC		S		1993
Osprey	Pandion haliaetus				WSC	1994
Paper-spined Cactus	Pediocactus papyracanthus	SC			SR	1994
Springerville Pocket Mouse	Perognathus flavus goodpasteri	SC	S			1986-PRE
Chiricahua Leopard Frog	Rana chiricahuensis	LT	S		WSC	1972
Northern Leopard Frog	Rana pipiens		S		WSC	1972
Speckled Dace	Rhinichthys osculus	SC		S		2001

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

(1) Proposed for Listing: **(USEA) Federal U.S. Status** ESA Endangered Species Act (1973 as amended) US Department of Interior, Fish and Wildlife Service

(2) Listed:

LT Listed Threatened: imminent jeopardy of becoming Endangered.

PDL Proposed for Delisting

Candidate (Notice of Review: 1999):

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).

(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.

(5) **State Status**

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).

Resources Concern Summary

The Silver Creek Watershed is a mosaic of federal, state, tribal and private lands where logging, livestock grazing, agriculture and recreation are the primary land uses. The upper portion of the watershed is primarily managed by the U.S. Forest Service, while the lower portion of the watershed is primarily private lands. Livestock grazing and agriculture are the primary land use activities on the private land, while livestock grazing and logging occur on the U.S. Forest Service lands, in the higher elevations. The watershed has

two areas with significant development: the Show Low to Pinetop corridor and the communities of Taylor and Snowflake.

The Silver Creek Watershed is recognized as an important wildlife area in the state. Fishing, hunting, and motor touring are the primary recreational activities. Silver Creek is considered to be one of the best sport fisheries in Arizona, especially for rainbow and Apache trout. The Arizona Game and Fish Silver Creek Hatchery is located near Show Low. The endangered Little Colorado spinedace (*Lepidomeda*

vittata) and Chiricahua leopard frog (*Rana chiricahuensis*) have been found within the watershed. The aquatic species of concern are Gila longfin dace (*Agosia chrysogaster chrysogaster*), desert sucker (*Catostomus clarki*), speckled dace (*Rhinichthys osculus*), and northern leopard frog (*Rana pipiens*). Water quality and instream flow are fishery concerns on Silver Creek.

Hunting is another important activity within the watershed, with game species including turkeys, deer and elk. Special status species observed on the Silver Creek Watershed include the northern goshawk (*Accipiter gentiles*), bald eagle (*Haliaeetus leucocephalus*), Arizona myotis (*Myotis occultus*), fringed myotis (*Myotis thysanodes*), and osprey (*Pandion haliaetus*). The area has also been designated as critical habitat for the Mexican spotted owl (*Strix occidentalis lucida*). The Silver Creek area is also noted for its large concentration of archaeological sites.

Forest health and fire prevention are issues on the U.S. Forest Service lands especially near the communities of Linden, Show Low and Pinetop. With access to winter sports and a mild climate, the area is likely to see increased development in the near future with potential water quality and quantity impacts. There have already

been reports of decreased summer low flows related to increased groundwater pumping, and water quality concerns in the vicinity of Pinetop and Lakeside. As the area continues to grow, low impact development and water conservation practices should be considered to alleviate the potential impacts of development on the important aquatic resources found in the Silver Creek Watershed.

Conservation Progress/Status

Conservation progress for the previous five years in the Silver Creek 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: Silver Creek Watershed Conservation Treatment Applied

Silver Creek Watershed (15020005) Conservation Treatment Applied	FY02-06 TOTAL
Brush Management (acres)	2,475
Fence (feet)	66,918
Irrigation Water Management (acres)	100
Pipeline (feet)	33,423
Prescribed Grazing (acres)	39,893

(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 25 people per square mile. Show Low Creek had the highest population mean with about 48 people per square mile. Lower Silver Creek had the highest maximum population density with 899 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 40 people per square mile. Show Low Creek had the highest mean population density with 87 people per square mile. Lower Silver Creek had the highest maximum density of 1894 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 showed a mean increase of 16 people per square mile during this ten-year time period. Show Low Creek had the highest mean increase in population density at 34 people per square mile.

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, Silver Creek Watershed Housing Density for 2000, identifies that about 407 sq. miles of housing is located in “undeveloped private” areas, while about 204 sq. miles is located in “exurban” areas. Figure 4-5 and Table 4-5, Housing Density for 2030, projects “undeveloped private” areas decreasing to about 345 sq. miles and “exurban” areas increasing to 214 sq. miles.

Table 4-1: Silver Creek Watershed 1990 Population Density (people/square mile)

10-digit Watershed Name	Area (sq. mile)	Population Density (people/sq.mile)		
		Min	Max	Mean
Show Low Creek - 1502000501	227	0	609	48
Upper Silver Creek - 1502000502	185	0	99	6
Cottonwood Creek - 1502000503	285	0	779	15
Lower Silver Creek - 1502000504	251	0	899	26
<i>Total Silver Creek Watershed</i>	<i>948</i>	<i>0</i>	<i>899</i>	<i>25</i>

Note: Adjacent watersheds may share a grid square. 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.)

Table 4-2: Silver Creek Watershed 2000 Population Density (people/square mile)

10-digit Watershed Name	Area (sq. mile)	Population Density (people/sq.mile)		
		Min	Max	Mean
Show Low Creek - 1502000501	227	0	1467	87
Upper Silver Creek - 1502000502	185	0	142	13
Cottonwood Creek - 1502000503	285	0	757	21
Lower Silver Creek - 1502000504	251	0	1894	37
<i>Total Silver Creek Watershed</i>	<i>948</i>	<i>0</i>	<i>1894</i>	<i>40</i>

Note: Adjacent watersheds may share a grid square. 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.)

Table 4-3: Silver Creek Watershed Population Density Change 1990-2000 (people/square mile)

Watershed Name	Area (sq. mile)	Population Density (people/sq. mile)		
		Min	Max	Mean
Show Low Creek - 1502000501	227.4	-106	508	34
Upper Silver Creek - 1502000502	185.1	-38	101	7
Cottonwood Creek - 1502000503	284.4	-40	241	6
Lower Silver Creek - 1502000504	251.1	-813	1894	11
Total Silver Creek Watershed	948	-813	1894	16

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.

Table 4-4: Silver Creek Watershed Housing Density 2000 (Percent of Watershed)

Housing Density	Show Low Creek 1502000501	Upper Silver Creek 1502000502	Cottonwood Creek 1502000503	Lower Silver Creek 1502000504	Silver Creek Watershed	Silver Creek Watershed (sq. miles)
Undeveloped Private	28%	18%	57%	54%	43%	407
Rural	14%	54%	19%	39%	33%	308
Exurban	44%	28%	24%	7%	22%	204
Suburban	9%	1%	<1%	<1%	2%	21
Urban	4%	<1%	<1%	<1%	1%	8

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.ecologyandsociety.org/vol10/iss1/art32/>

Table 4-5: Silver Creek Watershed Housing Density 2030 (Percent of Watershed)

Housing Density	Show Low Creek 1502000501	Upper Silver Creek 1502000502	Cottonwood Creek 1502000503	Lower Silver Creek 1502000504	Silver Creek Watershed	Silver Creek Watershed (sq. miles)
Undeveloped Private	50%	11%	48%	50%	36%	345
Rural	40%	54%	23%	40%	35%	330
Exurban	9%	31%	28%	9%	23%	214
Suburban	1%	4%	1%	1%	5%	48
Urban	<1%	<1%	<1%	<1%	1%	12

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.ecologyandsociety.org/vol10/iss1/art32/>

Silver Creek 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 Silver Creek Watershed is comprised of livestock grazing and a few apiary (honey bee) locations. Of the 96 farms that have pasture and rangeland, 30% have 100 or more acres. Seventy-seven percent of all farms in the watershed are less than 1,000 acres in size. Of the 56 farms that harvest crops, 88% 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 than 100 percent.

Tables Include data from zip codes both contained within the watershed and zip codes crossing watershed boundaries. Silver Creek Watershed has four contained zip codes and 12 crossed zip codes.

Three zip codes in the Silver Creek Watershed contained no information about agricultural practices in the NASS database. NASS assumes that no information for those areas means that there was no agricultural activity taking place within that zip code area.

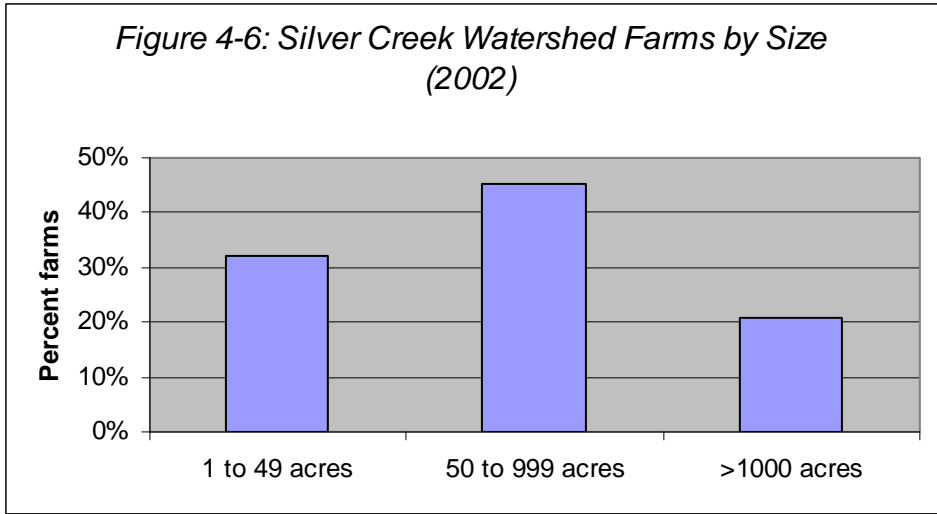


Figure 4-6: Silver Creek Watershed Farms by Size (2002)

All farms	1 to 49 acres	50 to 999 acres	>1000 acres
53	32%	45%	21%

Percents rounded.

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

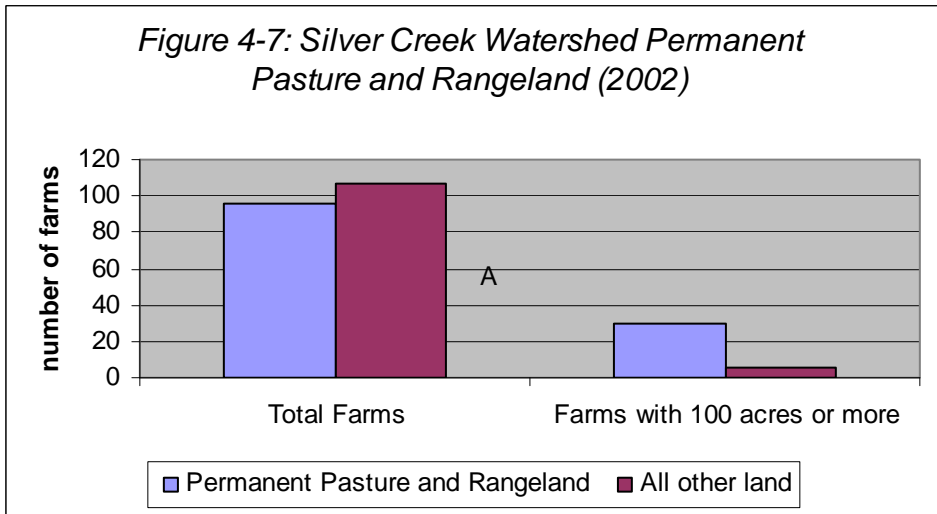


Table 4-7: Silver Creek Watershed Pasture and Rangeland (2002)

Category	Total farms	Farms 100 acres or more
Permanent pasture and rangeland	96	30%
All other land	107	6%

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

Figure 4-8 : Silver Creek Watershed Cropland Harvested (2002)

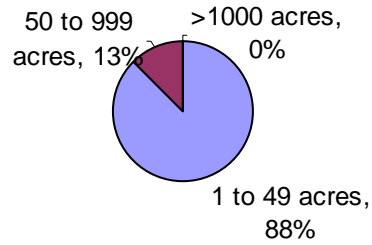


Table 4-8: Silver Creek Watershed Cropland Harvested (2002)

Total farms	1 to 49 acres	50 to 999 acres	>1000 acres
56	88%	137%	0%

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 Silver Creek 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 (crop, range, forest, 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		SILVER CREEK - 15020005		LANDUSE ACRES		6,532		
LANDUSE TYPE		CROP		TYPICAL UNIT SIZE ACRES		1,000		
ASSESSMENT INFORMATION		Benchmark Conditions		Future Conditions		CALCULATED PARTICIPATION		
		Total Units	Existing Unchanged Units	New Treatment Units	Total Units	25%		
Conservation Systems by Treatment Level				System Rating ->		RESOURCE CONCERNS		
					Soil Condition – Organic Matter Depletion	Water Quality – Excessive Nutrients and Organics in Groundwater		
					Water Quantity – Inefficient Water Use on Irrigated Land	Air Quality – Particulate Matter less than 10 micrometers in diameter (PM 10)		
Baseline					1	5	2	0
Irrigation Land Levelling (ac.)	464	1,225	919	0	0	4	0	0
Irrigation System, Surface and Subsurface (ac.)	443	4,899	3,674	0	3,674	4	0	0
Irrigation Water Conveyance, Ditch and Canal Lining (ft.)	428	4,899	3,674	0	3,674	4	2	0
Irrigation Water Conveyance, Pipeline (ft.)	430	2,450	1,837	0	1,837	5	3	0
Structure for Water Control (no.)	587	5	4	0	4	3	0	0
Total Acreage at Baseline		4,899	3,674	0	3,674			
Progressive					System Rating ->	5	4	3
Conservation Crop Rotation (ac.)	328	980	735	735	1,470	3	1	3
Irrigation Land Levelling (ac.)	464	490	551	184	735	4	0	0
Irrigation System, Surface and Subsurface (ac.)	443	490	735	0	735	4	0	0
Irrigation Water Conveyance, Ditch and Canal Lining (ft.)	428	4,899	4,409	2,939	7,349	4	2	0
Irrigation Water Conveyance, Pipeline (ft.)	430	980	1,102	367	1,470	5	3	0
Irrigation Water Management (ac.)	449	980	735	735	1,470	5	5	3
Residue Management, Seasonal (ac.)	344	490	367	367	735	1	-1	3
Structure for Water Control (no.)	587	5	4	3	7	3	0	0
Total Acreage at Progressive Level		980	735	735	1,470			
RMS					System Rating ->	5	4	3
Conservation Crop Rotation (ac.)	328	653	898	490	1,388	4	1	3
Irrigation Land Levelling (ac.)	464	653	898	490	1,388	0	0	0
Irrigation System, Microirrigation (ac.)	441	65	65	73	139	0	0	0
Irrigation System, Sprinkler (ac.)	442	65	65	73	139	4	0	0
Irrigation System, Surface and Subsurface (ac.)	443	653	1,266	122	1,388	0	0	0
Irrigation Water Conveyance, Ditch and Canal Lining (ft.)	428	6,532	8,247	5,634	13,881	4	2	0
Irrigation Water Conveyance, Pipeline (ft.)	430	1,306	1,796	980	2,776	2	3	0
Irrigation Water Management (ac.)	449	653	898	490	1,388	4	5	3
Nutrient Management (ac.)	590	653	653	735	1,388	3	1	5
Pest Management (ac.)	595	653	653	735	1,388	0	0	1
Residue and Tillage Management, Mulch Till (ac.)	345	327	327	367	694	3	-1	0
Residue Management, Seasonal (ac.)	344	327	449	245	694	3	1	3
Structure for Water Control (no.)	587	7	8	6	14	0	-1	0
Total Acreage at RMS Level		653	653	735	1,388			

WATERSHED NAME & CODE		SILVER CREEK - 15020005		LANDUSE ACRES		6,532			
LANDUSE TYPE		CROP		TYPICAL UNIT SIZE ACRES		1,000			
CONSERVATION COST TABLE		FUTURE		FEDERAL		CALCULATED PARTICIPATION			
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									
Conservation Crop Rotation (ac.) 328		735	\$0	\$22,046	\$4,409	\$24,052	\$0	\$7,349	\$11,312
Irrigation Land Leveling (ac.) 464		184	\$91,856	\$0	\$18,371	\$110,228	\$91,856	\$5,511	\$115,072
Irrigation System, Surface and Subsurface (ac.) 443		0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428		2,939	\$11,758	\$0	\$2,352	\$14,109	\$11,758	\$470	\$13,739
Irrigation Water Conveyance, Pipeline (ft.) 430		367	\$1,837	\$0	\$367	\$2,205	\$1,837	\$73	\$2,147
Irrigation Water Management (ac.) 449		735	\$0	\$22,046	\$4,409	\$24,052	\$0	\$7,349	\$11,312
Residue Management, Seasonal (ac.) 344		367	\$0	\$6,614	\$0	\$7,216	\$0	\$2,205	\$3,394
Structure for Water Control (no.) 587		3	\$441	\$0	\$0	\$529	\$441	\$18	\$515
Subtotal		735	\$105,892	\$50,705	\$31,319	\$182,389	\$105,892	\$22,974	\$157,490
RMS									
Conservation Crop Rotation (ac.) 328		490	\$0	\$14,697	\$2,939	\$16,034	\$0	\$4,899	\$7,541
Irrigation Land Leveling (ac.) 464		490	\$244,950	\$0	\$48,990	\$293,940	\$244,950	\$14,697	\$306,859
Irrigation System, Microirrigation (ac.) 441		73	\$55,114	\$0	\$11,023	\$66,137	\$55,114	\$5,511	\$78,330
Irrigation System, Sprinkler (ac.) 442		73	\$62,462	\$0	\$12,492	\$74,955	\$62,462	\$2,498	\$72,987
Irrigation System, Surface and Subsurface (ac.) 443		122	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Irrigation Water Conveyance, Ditch and Canal Lining (ft.) 428		5,634	\$22,535	\$0	\$4,507	\$27,042	\$22,535	\$901	\$26,332
Irrigation Water Conveyance, Pipeline (ft.) 430		980	\$4,899	\$0	\$980	\$5,879	\$4,899	\$196	\$5,724
Irrigation Water Management (ac.) 449		490	\$0	\$14,697	\$2,939	\$16,034	\$0	\$4,899	\$7,541
Nutrient Management (ac.) 590		735	\$0	\$22,046	\$4,409	\$24,052	\$0	\$7,349	\$11,312
Pest Management (ac.) 595		367	\$0	\$22,046	\$4,409	\$24,052	\$0	\$7,349	\$11,312
Residue and Tillage Management, Mulch Till (ac.) 345		245	\$0	\$9,369	\$0	\$10,222	\$0	\$3,123	\$4,808
Residue Management, Seasonal (ac.) 344		245	\$0	\$4,409	\$0	\$4,810	\$0	\$1,470	\$2,262
Structure for Water Control (no.) 587		6	\$845	\$0	\$0	\$1,014	\$845	\$34	\$987
Subtotal		735	\$390,805	\$87,263	\$95,614	\$564,171	\$390,805	\$52,926	\$535,996
Grand Total		1,470	\$496,697	\$137,968	\$126,933	\$746,561	\$496,697	\$75,900	\$693,487

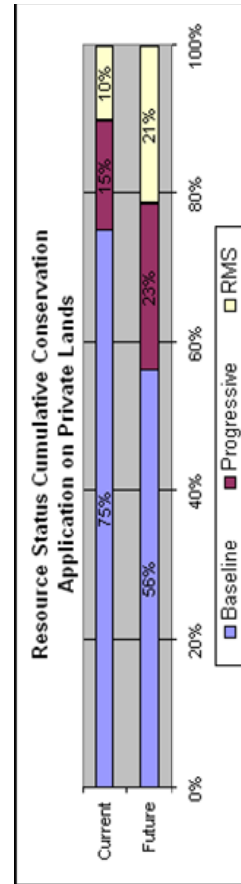


Chart Refers To	
Landuse Type	CROP
Calculated Participation Rate	25%

Average PV Costs per Ac	
System	Private
Prog	Federal
RMS	\$248.20
	\$767.74
	\$729.40

WATERSHED NAME & CODE		SILVER CREEK - 15020005				LANDUSE ACRES		429,164	
LANDUSE TYPE		RANGE				TYPICAL UNIT SIZE ACRES		50,000	
CONSERVATION COST TABLE									
		FUTURE		FEDERAL		CALCULATED PARTICIPATION		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		19,312	\$28,969	\$0	\$5,794	\$34,762	\$28,969	\$1,159	\$33,850
Pipeline (ft.) 516		19,312	\$77,250	\$0	\$15,450	\$92,699	\$77,250	\$3,090	\$90,266
Prescribed Burning (ac.) 338		4,828	\$120,702	\$0	\$24,140	\$144,843	\$120,702	\$2,414	\$130,871
Prescribed Grazing (ac.) 528		48,281	\$36,211	\$0	\$7,242	\$43,453	\$36,211	\$0	\$36,211
Watering Facility (no.) 614		10	\$4,828	\$0	\$966	\$5,794	\$4,828	\$290	\$6,048
Subtotal		48,281	\$267,959	\$0	\$53,592	\$321,551	\$267,959	\$6,952	\$297,246
RMS									
Brush Management (ac.) 314		4,828	\$289,686	\$0	\$57,937	\$347,623	\$289,686	\$5,794	\$314,091
Fence (ft.) 382		37,015	\$55,523	\$0	\$11,105	\$66,628	\$55,523	\$2,221	\$64,878
Pipeline (ft.) 516		37,015	\$148,062	\$0	\$29,612	\$177,674	\$148,062	\$5,922	\$173,009
Prescribed Burning (ac.) 338		3,219	\$80,468	\$0	\$16,094	\$96,562	\$80,468	\$1,609	\$87,247
Prescribed Grazing (ac.) 528		32,187	\$24,140	\$0	\$4,828	\$28,969	\$24,140	\$0	\$24,140
Range Planting (ac.) 550		4,828	\$144,843	\$0	\$28,969	\$173,811	\$144,843	\$2,897	\$157,045
Upland Wildlife Habitat Management (ac.) 645		48,281	\$0	\$188,296	\$37,659	\$205,431	\$0	\$62,765	\$96,618
Watering Facility (no.) 614		35	\$17,703	\$0	\$3,541	\$21,244	\$17,703	\$1,062	\$22,177
Wildlife Watering Facility (no.) 648		10	\$4,828	\$0	\$966	\$5,794	\$4,828	\$97	\$5,235
Subtotal		48,281	\$765,253	\$188,296	\$190,710	\$1,123,735	\$765,253	\$82,367	\$944,442
Grand Total		96,562	\$1,033,212	\$188,296	\$244,302	\$1,445,286	\$1,033,212	\$89,320	\$1,241,687

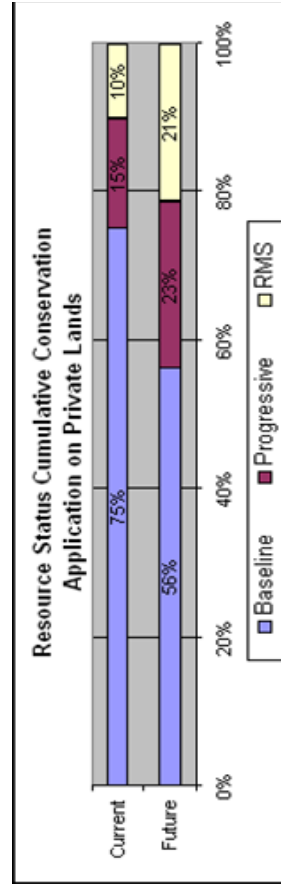


Chart Refers To	
Landuse Type	RANGE
Calculated Participation Rate	25%

Average PV Costs per Ac	
System	Private
Prog	Federal
RMS	\$6.66
	\$23.27
	\$19.56

WATERSHED NAME & CODE		SILVER CREEK - 15020005				LANDUSE ACRES		151,383
LANDUSE TYPE		FOREST				TYPICAL UNIT SIZE ACRES		50,000
ASSESSMENT INFORMATION						CALCULATED PARTICIPATION		10%
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Water Quality – Excessive Sediment and Turbidity in Surface Water	Plant Condition – Productivity, Health and Vigor	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage
				System Rating ->				
Baseline					1	3	0	0
Fence (ft.) 382	15,138	13,624	0	13,624	0	1	1	1
Pipeline (ft.) 516	15,138	13,624	0	13,624	3	3	0	0
Watering Facility (no.) 614	30	27	0	27	0	4	1	0
Total Acreage at Baseline	151,383	136,245	0	136,245				
Progressive				System Rating ->	4	3	4	4
Fence (ft.) 382	0	757	3,028	3,785	0	1	1	1
Pipeline (ft.) 516	0	757	3,028	3,785	3	3	0	0
Prescribed Burning (ac.) 338	0	0	757	757	1	1	4	4
Prescribed Grazing (ac.) 528	0	0	7,569	7,569	5	3	5	5
Watering Facility (no.) 614	0	2	2	3	0	4	1	0
Total Acreage at Progressive Level	0	0	7,569	7,569				
RMS				System Rating ->	5	4	5	3
Brush Management (ac.) 314	0	0	757	757	4	4	5	3
Fence (ft.) 382	0	757	6,812	7,569	0	1	1	1
Pipeline (ft.) 516	0	757	6,812	7,569	3	3	0	0
Prescribed Burning (ac.) 338	0	0	757	757	1	1	4	4
Prescribed Grazing (ac.) 528	0	0	7,569	7,569	5	3	5	5
Tree/Shrub Establishment (ac.) 612	0	0	757	757	5	1	4	-3
Upland Wildlife Habitat Management (ac.) 645	0	0	7,569	7,569	0	0	4	1
Watering Facility (no.) 614	0	2	6	8	0	4	1	0
Wildlife Watering Facility (no.) 648	0	0	2	2	0	0	0	0
Total Acreage at RMS Level	0	0	7,569	7,569				

WATERSHED NAME & CODE		SILVER CREEK - 15020005				LANDUSE ACRES		151,383
LANDUSE TYPE		FOREST				TYPICAL UNIT SIZE ACRES		50,000
CONSERVATION COST TABLE		CALCULATED PARTICIPATION						10%
Conservation Systems by Treatment Level	FUTURE	FEDERAL		PRIVATE		Total Present Value Cost	Annual O & M + Mgt Costs 100%	Total Present Value Cost
		Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Installation Cost 50%			
Progressive								
Fence (ft.) 382	3,028	\$4,541	\$0	\$908	\$5,450	\$4,541	\$182	\$5,307
Pipeline (ft.) 516	3,028	\$12,111	\$0	\$2,422	\$14,533	\$12,111	\$484	\$14,151
Prescribed Burning (ac.) 338	757	\$18,923	\$0	\$3,785	\$22,707	\$18,923	\$378	\$20,517
Prescribed Grazing (ac.) 528	7,569	\$5,677	\$0	\$1,135	\$6,812	\$5,677	\$0	\$5,677
Watering Facility (no.) 614	2	\$757	\$0	\$151	\$908	\$757	\$45	\$948
Subtotal	7,569	\$42,009	\$0	\$8,402	\$50,411	\$42,009	\$1,090	\$46,600
RMS								
Brush Management (ac.) 314	757	\$45,415	\$0	\$9,083	\$54,498	\$45,415	\$908	\$49,241
Fence (ft.) 382	6,812	\$10,218	\$0	\$2,044	\$12,262	\$10,218	\$409	\$11,940
Pipeline (ft.) 516	6,812	\$27,249	\$0	\$5,450	\$32,699	\$27,249	\$1,090	\$31,840
Prescribed Burning (ac.) 338	757	\$18,923	\$0	\$3,785	\$22,707	\$18,923	\$378	\$20,517
Prescribed Grazing (ac.) 528	7,569	\$5,677	\$0	\$1,135	\$6,812	\$5,677	\$0	\$5,677
Tree/Shrub Establishment (ac.) 612	757	\$3,595	\$0	\$719	\$4,314	\$3,595	\$72	\$3,898
Upland Wildlife Habitat Management (ac.) 645	7,569	\$0	\$29,520	\$5,904	\$32,206	\$0	\$9,840	\$15,147
Watering Facility (no.) 614	6	\$3,028	\$0	\$606	\$3,633	\$3,028	\$182	\$3,793
Wildlife Watering Facility (no.) 648	2	\$757	\$0	\$151	\$908	\$757	\$15	\$821
Subtotal	7,569	\$114,862	\$29,520	\$28,876	\$170,040	\$114,862	\$12,894	\$142,874
Grand Total	15,138	\$156,871	\$29,520	\$37,278	\$220,451	\$156,871	\$13,984	\$189,474

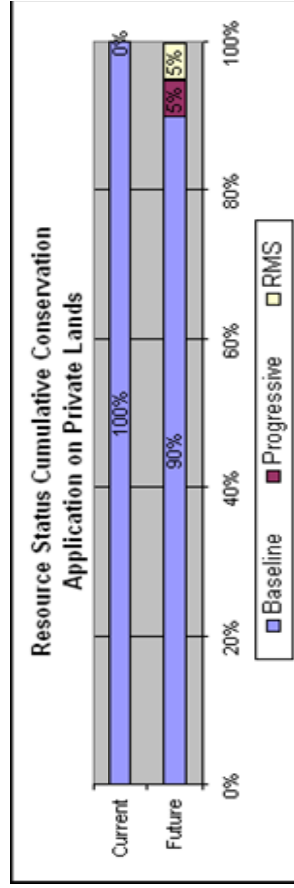


Chart Refers To	
Landuse Type	FOREST
Calculated Participation Rate	10%

Average PV Costs per Ac	
System	Federal
Prog	\$6.66
RMS	\$22.46
	Private
	\$6.16
	\$18.88

WATERSHED NAME & CODE		SILVER CREEK - 15020005		LANDUSE ACRES		18,801
LANDUSE TYPE		URBAN		TYPICAL UNIT SIZE ACRES		10
ASSESSMENT INFORMATION				CALCULATED PARTICIPATION		22%
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions		RESOURCE CONCERNS		
	Total Units	Existing Unchanged Units	New Treatment Units	Soil Condition – Organic Matter Depletion	Water Quality – Excessive Nutrients and Organics in Groundwater	Air Quality – Particulate matter less than 10 micrometers in diameter (PM 10)
Baseline						
No Conservation Practices being applied at this level	0	0	0	0	0	0
Total Acreage at Baseline	16,921	13,537	0	13,537		
Progressive						
Irrigation System, Surface and Subsurface (ac.) 443	470	235	846	1,081	0	0
Irrigation Water Management (ac.) 449	940	470	1,692	2,162	4	5
Total Acreage at Progressive Level	940	470	1,692	2,162		
RMS						
Atmospheric Resource Quality Management (ac.) 370	940	940	2,162	3,102	2	0
Irrigation System, Microirrigation (ac.) 441	94	94	216	310	0	0
Irrigation System, Sprinkler (ac.) 442	94	94	216	310	0	0
Irrigation System, Surface and Subsurface (ac.) 443	940	1,175	1,927	3,102	0	0
Irrigation Water Management (ac.) 449	940	1,410	1,692	3,102	4	5
Nutrient Management (ac.) 590	940	940	2,162	3,102	3	1
Pest Management (ac.) 595	940	940	2,162	3,102	0	0
Total Acreage at RMS Level	940	940	2,162	3,102		

WATERSHED NAME & CODE		SILVER CREEK - 15020005		LANDUSE ACRES		18,801		
LANDUSE TYPE		URBAN		TYPICAL UNIT SIZE ACRES		10		
CONSERVATION COST TABLE								
FUTURE				FEDERAL		PRIVATE		
Conservation Systems by Treatment Level		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	846	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Irrigation Water Management (ac.) 449	1,692	\$0	\$50,763	\$10,153	\$55,382	\$0	\$16,921	\$26,047
Subtotal	1,692	\$0	\$50,763	\$10,153	\$55,382	\$0	\$16,921	\$26,047
RMS								
Atmospheric Resource Quality Management (ac.) 370	2,162	\$0	\$38,918	\$7,784	\$42,460	\$0	\$12,973	\$19,970
Irrigation System, Microirrigation (ac.) 441	216	\$162,159	\$0	\$32,432	\$194,590	\$162,159	\$16,216	\$230,466
Irrigation System, Sprinkler (ac.) 442	216	\$183,780	\$0	\$36,756	\$220,536	\$183,780	\$7,351	\$214,746
Irrigation System, Surface and Subsurface (ac.) 443	1,927	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Irrigation Water Management (ac.) 449	1,692	\$0	\$50,763	\$10,153	\$55,382	\$0	\$16,921	\$26,047
Nutrient Management (ac.) 590	2,162	\$0	\$64,863	\$12,973	\$70,766	\$0	\$21,621	\$33,283
Pest Management (ac.) 595	2,162	\$0	\$64,863	\$12,973	\$70,766	\$0	\$21,621	\$33,283
Subtotal	2,162	\$345,938	\$219,408	\$113,069	\$654,501	\$345,938	\$96,703	\$557,793
Grand Total	3,854	\$345,938	\$270,170	\$123,222	\$709,883	\$345,938	\$113,624	\$583,840

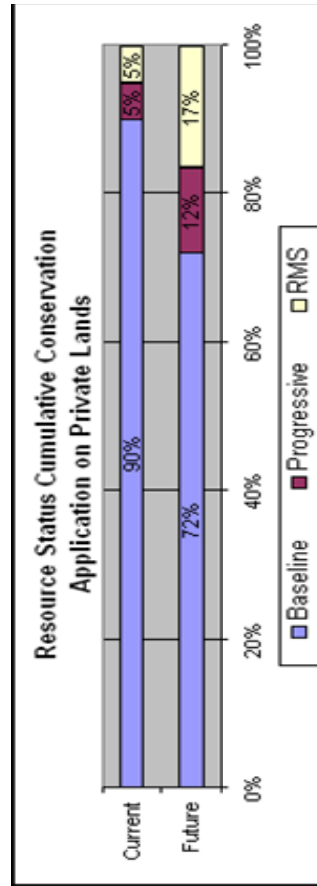


Chart Refers To	
Landuse Type	URBAN
Calculated Participation Rate	22%

Average PV Costs per Ac	
System	Private
Prog	\$15.39
RMS	\$302.71

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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. The Hydrologic Unit Code (HUC) of a Drainage Basin is a 6-digit HUC.
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	<p>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.).</p> <p>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.).</p> <p>Ustic is a soil moisture regime that is intermediate between the aridic and udic regimes and common in temperate sub humid 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.</p>
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.

<p>Soil Temperature Regimes</p>	<p>Hyperthermia 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.</p> <p>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.</p> <p>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.</p>
<p>Surface Water</p>	<p>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.</p>
<p>Watershed</p>	<p>The area of land that contributes surface run-off to a given point in a drainage system and delineated by topographic divides. The Hydrologic Unit Code (HUC) of a Drainage Basin is an 8-digit HUC.</p>

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