The San Antonio Creek Watershed:

AN AGRICULTURAL AND RURAL RESIDENTIAL LAND PROTECTION STUDY

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PREFACE – the purpose of this report

This study was developed in collaboration with the Ventura County Watershed Protection District (VCWPD), the United States Department of Agriculture Natural Resources Conservation Service (NRCS), and the Ventura County Resource Conservation District (VCRCD) to evaluate natural resources and concerns in the Ventura River Watershed. The NRCS agreed to evaluate the San Antonio Creek portion of the Ventura River Watershed because it works closely with the VCRCD in addressing resource concerns on agricultural lands, which are particularly important in this watershed. This assistance is being provided under authority of the Conservation Technical Assistance program, authorizing the agency to provide technical assistance to individual landowners, landowner groups, non-governmental organizations, and local governments or districts.

Specific items that the VCWPD requested the NRCS to include are the following products:

1) An evaluation of approximated flooding hazards in the watershed, focused on rural areas not mapped by the Federal Emergency Management Agency.

2) General geomorphic maps and a sediment production report, to assist the VCWPD in its planning efforts with more quantitative information about sediment hazards in the watershed.

3) A general watershed characterization with maps, including groundwater status, agricultural practices, wildfire hazards and species habitat information.

4) Develop alternatives for rural area residents and agricultural managers to address resource concerns in the watershed.

5) And, initiate outreach to the public, to receive public input on these planning products, and to provide information to the general public.

This report presents the results of our work in a format intended to be accessible to the general public, and is offered in partial fulfillment of our agreement to provide alternatives to and to initiate outreach with residents of the watershed. Several sections of this report and **Appendix A** (watershed atlas) collectively provide a general characterization of the watershed. **Appendix B** presents estimated sediment yields from subwatersheds of the San Antonio Creek Watershed, and **Appendix C** presents a summary of our approximated flood hazard analysis of the major streams in the San Antonio Creek Watershed. Alternative management approaches are discussed in the **OPPORTUNITIES** section and in the **Conservation Planning** and **Best Management Practices** sub-sections, supported by more detailed information in **Appendix D** (funding opportunities), **Appendix E** (streamlined permitting), and **Appendix F** (conservation practices).

EXECUTIVE SUMMARY

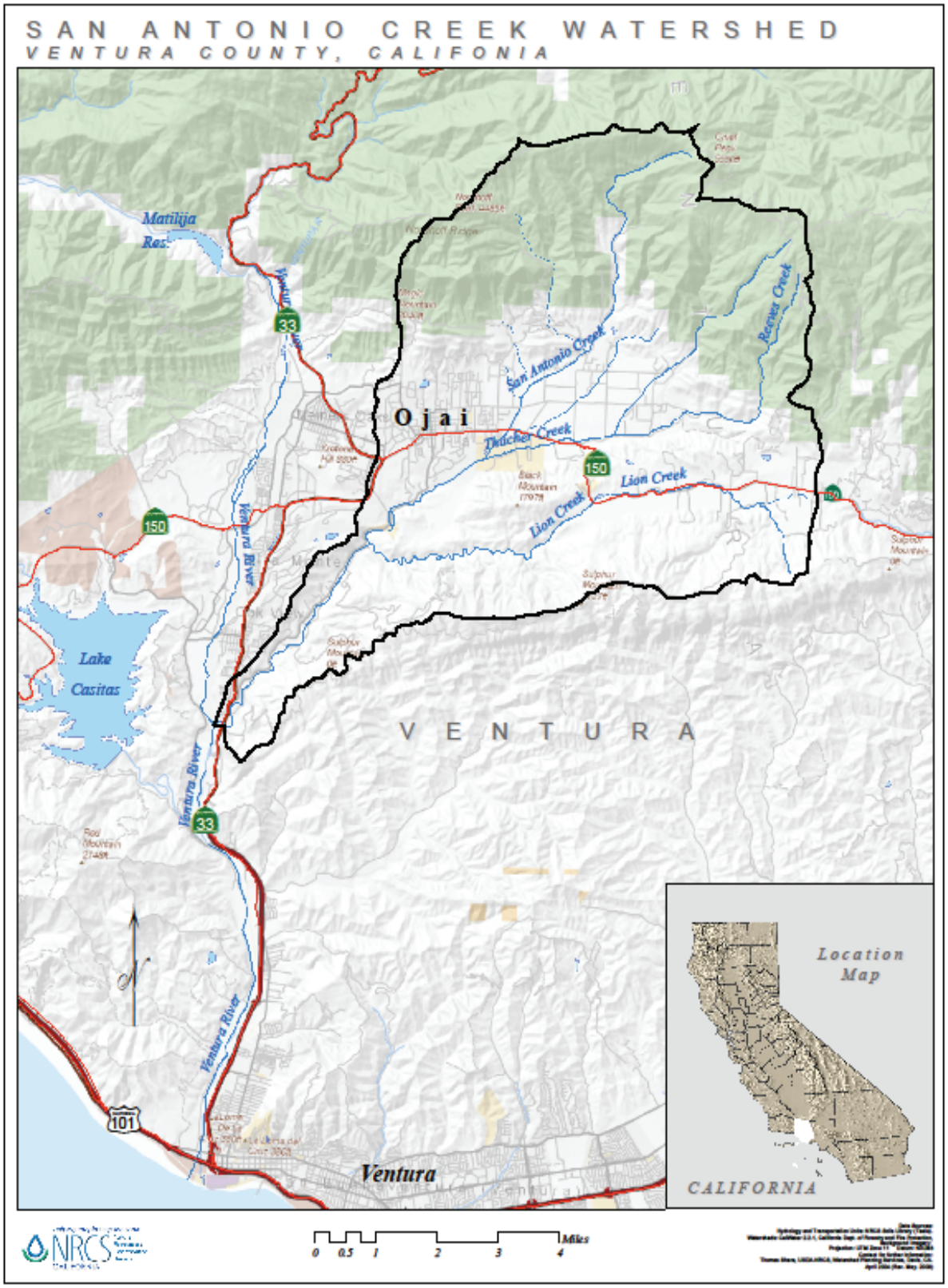
The principal resource concern identified by NRCS was frequent flooding resulting in erosion and deposition in the San Antonio Creek Watershed (see Map 1). Frequent flooding has negatively affected agriculture, rural residences, urban and wild-lands adjacent to riparian areas, associated infrastructure (including residences temporarily isolated by washed-out stream crossings), and critical anadromous fish habitat (southern-run steelhead, *Oncorhynchus mykiss irideus*). Other resource concerns, including fire safety, water quality, and manure and pasture management were also identified and discussed in this report.

The information in this study is intended to support a broader watershed study of the Ventura River Watershed, conducted by the VCWPD with grant support from the California Department of Water Resources. San Antonio Creek is a tributary of the Ventura River, in Ventura County, California. The San Antonio Creek Watershed is approximately 33,000 acres (50.1 square miles) in size, including most of the City of Ojai, the Ojai Basin, the Upper Ojai Basin, and adjoining mountain slopes. The Ojai Basin supports considerable orchard development, mostly citrus and avocado. Numerous rural residences are located near San Antonio Creek, along Thacher Creek in the Ojai Basin, and in the Upper Ojai Basin. Approximately one third of the watershed, the highest and steepest part north of Ojai and the Ojai Basin, is publically owned and administered by the United States Forest Service.

Several practices for addressing resource concerns are potentially available to individual landowners and are identified in this report. A format based on the NRCS conservation planning and implementation process is followed. Conservation planning begins with a resource inventory, including identification of soil and other characteristics and resource concerns, and proceeds to identification of alternative practices to address these concerns.

Conservation practices discussed in this report include: habitat improvement, irrigation water management, fuel management (for fire protection), mulching, cover crops, storm-water diversion, storm-water drainage, and considerations for: access roads, (private) bridges (for home-owners), home protection from sediment and fire; and, management practices for horses.

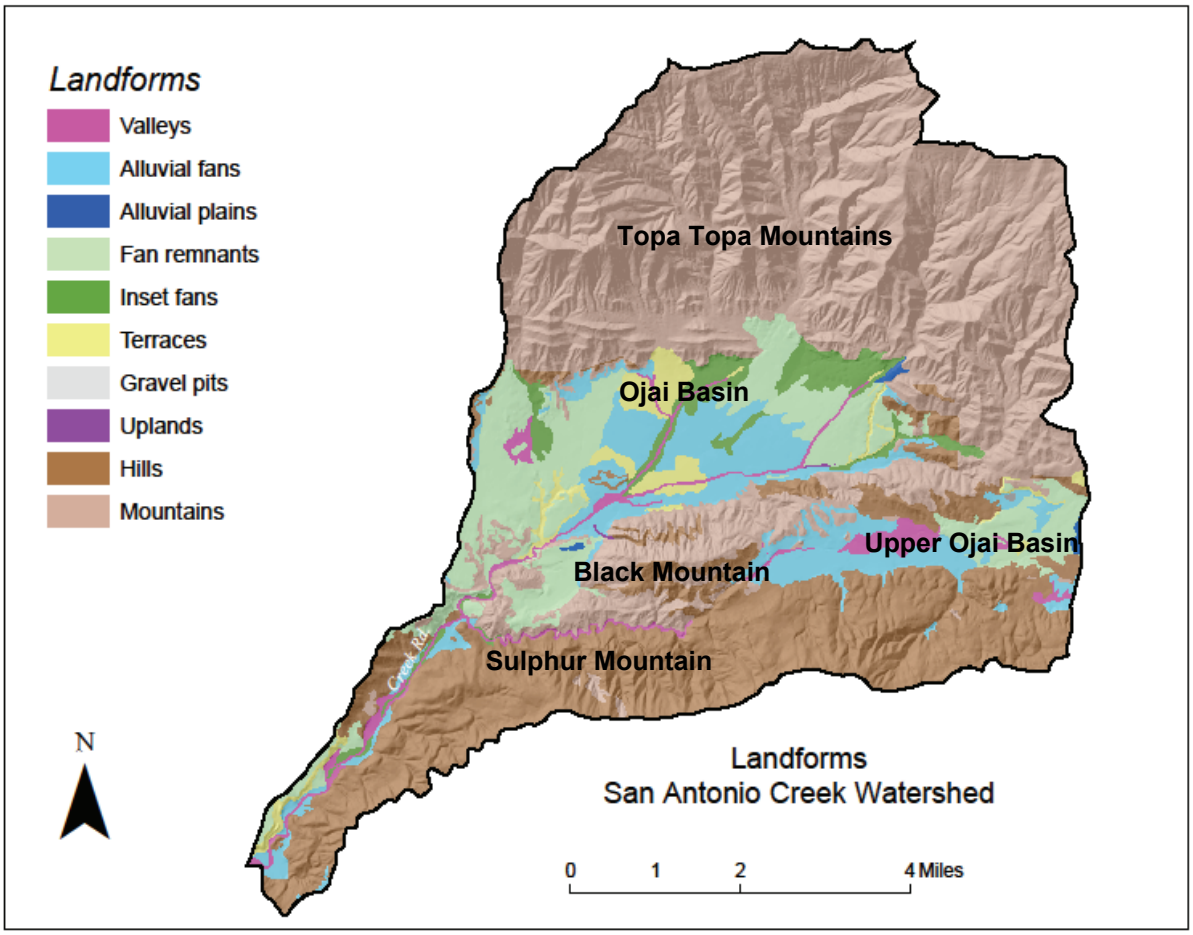
Included as appendices are: a watershed atlas, folio maps of various resource concerns and conditions in the watershed; descriptions of sediment production and flood hazard analyses; a description of potential funding sources for implementation of practices identified in this report; information regarding an exemplary streamlined permitting process (Calleguas Creek watershed), which may also aid in conservation implementation; and, detailed descriptions of some practices.



***Map 1**: Location of the San Antonio Creek Watershed.*

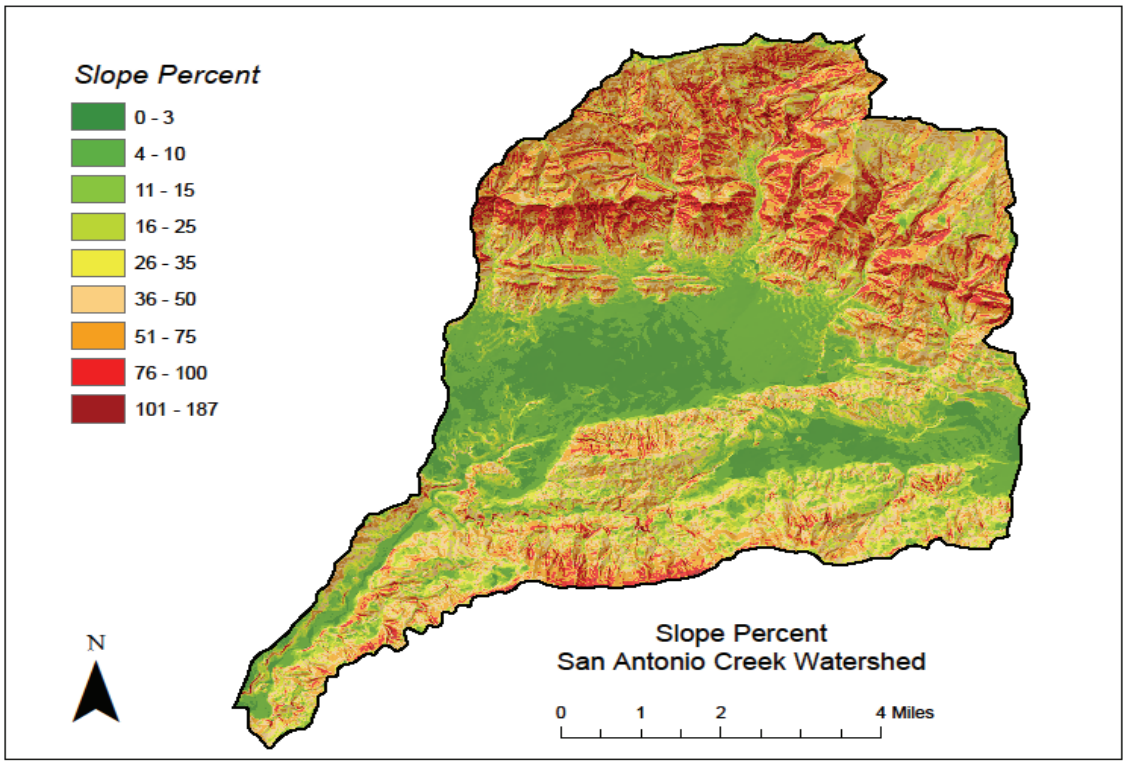
WATERSHED PHYSICAL FEATURES

San Antonio Creek is a tributary of the Ventura River, in Ventura County, California. The watershed is approximately 33,000 acres (50.1 square miles) in size, including most of the City of Ojai, the Ojai Basin, the Upper Ojai Basin, and adjoining mountain slopes.



***Map 2**: Landforms of the San Antonio Creek Watershed. Most maps displayed in the main body of this report are also displayed as full-page figures in **Appendix A**: Watershed Atlas.*

As shown in Maps 2 and 3, the topography of the San Antonio Creek Watershed is highly variable. Steep areas across the north are the Topa Topa Mountains, with flatter areas (in green) further south representing the Ojai Basin and the Upper Ojai Basin, with the Black Mountain area dividing the Ojai Basin from the Upper Ojai Basin, and the Sulphur Mountain area defining the southern border of the watershed.



***Map 3**: Slopes (percent) in the San Antonio Creek Watershed. Most maps displayed in the main body of this report are also displayed as full-page figures in **Appendix A**: Watershed Atlas.*

AGRICULTURE

This section describes the predominant agricultural land uses in the watershed, discusses some of the principal resource concerns with these agricultural lands, and proposes some locally appropriate conservation practices potentially available to individual land owners in the watershed.

High-value agricultural developments, particularly citrus and avocado orchards, are concentrated in the Ojai Basin, many of them prone to flooding, bank erosion, and sedimentation associated with San Antonio Creek and its tributaries across the basin. Maps and other information in **APPENDICES A** (watershed atlas), **B** (evaluation of sediment sources) and **C** (flood awareness mapping), describe and approximate the extent of potential resource concerns in the watershed. The installation of measures to prevent or repair flooding and related damage is complex due to the permit process, in part caused by environmental concerns, including the quality of stream habitats. Ideas for streamlining permit processes are discussed in the **OPPORTUNITIES** section and in **APPENDIX E**.

Many orchards in the Ojai Basin depend on local wells for irrigation, which are vulnerable to extended droughts affecting the aquifer's limited capacity. Agricultural producers and other land owners away from the relatively flat and intensively developed Ojai Basin face hazards from floods, erosion, and fires. Particularly for properties adjacent to streams, wildlife habitat (especially steelhead trout), invasive species (especially arundo), and water quality (especially nutrients) issues provide challenges for land stewardship.

In this section, several alternative conservation practices are introduced in the context of the NRCS conservation planning process. Conservation planning consists of several iterative steps, from resource inventory, identification of resource concerns, and implementation of practices to address identified concerns. Potential funding sources for implementation assistance are discussed in the **OPPORTUNITIES** section and in **APPENDIX D**, of this report.

Information from other sources are included as attachments with hard-copy versions of this report, including additional information about specific practices from our electronic field guide (efotg): http://www.nrcs.usda.gov/technical/efotg/; and general information about conservation planning from our state (NRCS website): http://www.ca.nrcs.usda.gov/technical/consplan.html.

Soil survey information presented in this section is very general, since soil properties vary considerably over short distances. Specific properties can be identified and their soils mapped using our agency's Web Soil Survey interactive mapping tool: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

Agricultural land uses

Intensive agricultural production is concentrated in the Ojai Basin east of The City of Ojai. Much of the Upper Ojai Basin is controlled by a relatively few farms and ranches, and except for some walnut orchards is less intensively farmed than the Ojai Basin.

There are 3,280 acres of orchard in the watershed. Some orchard crops, particularly avocados, are planted on steep slopes. Slopes overall vary from zero to one hundred percent (with 'one hundred percent' being slopes where one foot of elevation is gained per foot of horizontal distance, or 45 degrees). The predominant orchard crops in this area are (in order of abundance): oranges, comprising the majority of the orchard area; avocado, lemon, walnut, and other orchard crops (Workforce Investment Board of Ventura County - WIB, 2006, pg 6). .

There are about 1,500 acres of 'cropland' (crop and pasture land) in the study area, with an average slope of eight percent, mostly located in the Upper Ojai Basin, which also contains most of the walnut acreage in the study area (WIB, 2006, page 6).

Using county-wide crop yield and market data from the Ventura County Agricultural Commissioner (VCAC, 2008), the estimated gross annual value of orchard products in the basin is about $4,500 per acre, based on county-wide average values for 2006 and 2007. This does not take into account the possibility that crop yields may differ among regions in the county, or that prices per unit, hence gross income, may vary considerably among crops over time.

Generally speaking, agricultural production in Ventura County is strong, supporting real gross incomes of over $1 billion per year for the county over the past few decades (WIB, 2006, page 5), making Ventura consistently one of California's top producing counties. 'Real gross' income is corrected for inflation to allow comparison with past years, but includes only direct income to agricultural producers (not income to farm workers, farm suppliers, etc.).

Soils Interpretations

Exclusive of the area in the Los Padres National Forest, soil types in the watershed can be placed into six regional types (Soil Conservation Service - SCS, 1970, *Soil Survey Ventura Area*):

- Soils of the Ojai Basin's lower fans and terraces. Representative soil series: Anacapa, well-drained sandy loam or gravelly sandy loam, more than 60 inches deep, 0-9% slopes; used for citrus, vegetable and field crops and for range (unirrigated grazing).

- Soils of the lower valleys, fans and terraces of the Upper Ojai Basin. Representative soil series: Mocho, well-drained loam, gravelly loam, or clay loam, 60 inches or more deep, slopes 0-9%; used for citrus, avocadoes, walnuts, vegetables, and field crops.

- Soils of the fans and terraces below the Topa-Topa Mountains in the Ojai Basin. Representative soil series: Ojai, well-drained very-fine-sandy loam or stony fine-sandy loam over a sandy clay loam subsoil, 60 inches or more deep, slopes 0-30%; used for avocadoes, citrus, and range.

- Soil of the foothills of the Sulphur Mountain area. Representative soil series: Linne, well-drained silty clay loam, 24 to 48 inches deep, over soft shale and sandstone, slopes 9-50%; used for lemons and for range.

- Soils of the upper slopes of the Sulphur Mountain area. Representative soil series: Gazos well-drained silty clay loam, 24-46 inches deep, over fractured shale, on 15-75% slopes; some areas are used for range.

- Soils of the Black Mountain area. Representative soil series Sespe well-drained clay loam, 24-48 inches deep over hard sandstone and shale, slopes 15-75% slopes; some areas with gentler slopes used for citrus or range.

Irrigation Water Sources

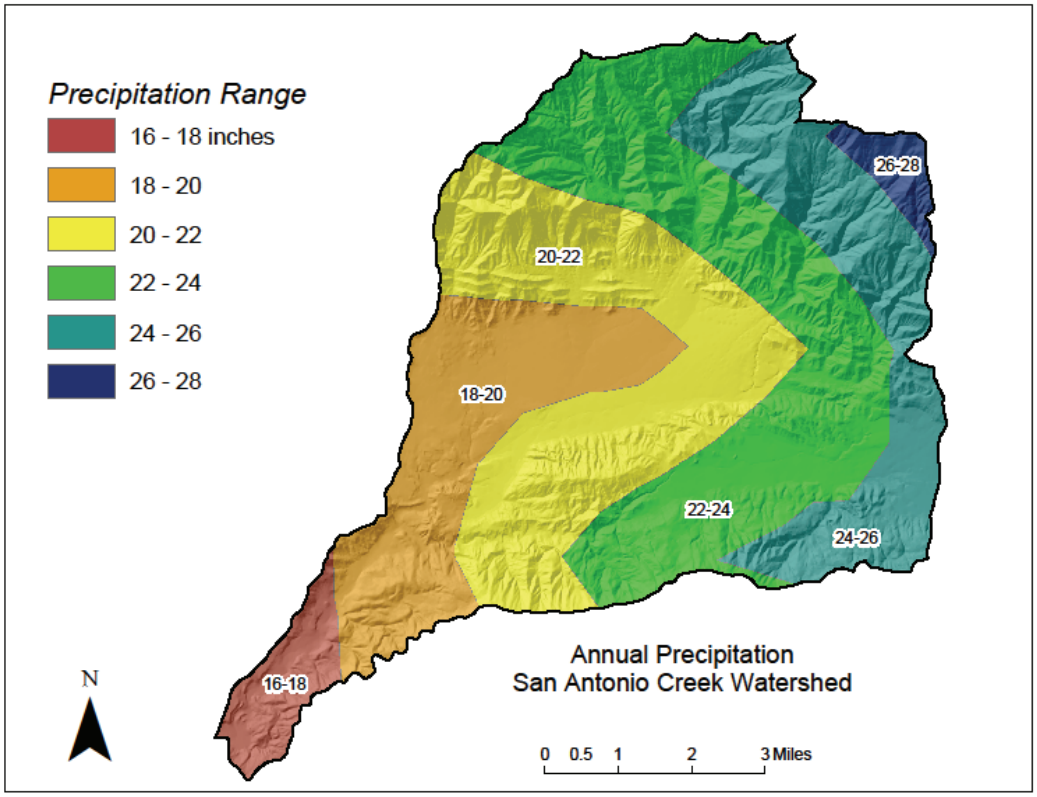
Water usage is in three categories (Ojai Basin Groundwater Management Authority - OBGMA, 2007):

1) Urban use (pumped from the Ojai groundwater basin by the Golden State Water Company for use in and around Ojai, averaging approximately 2000 acre feet per year in the period 2000 to 2007. An acre foot is enough water to cover one acre (43,560 square feet) to a depth of one foot.

2) Well water used for irrigation (primarily orchards) and rural residential use, averaging about 3000 acre feet per year in the period 2000 to 2007.

3) Surface water imports into the basin from the Casitas Reservoir, mainly for orchard irrigation, averaging about 3500 acre feet per year in the period 2000 to 2007.

Rainfall has varied from 5 to 48 inches annually over the last 50 years (Kear, 2007), with an average of 22 inches. Groundwater basin storage is limited and highly dependent on recent rainfall (see table 1).



***Map 4**: Precipitation patterns in the San Antonio Creek Watershed.*

Estimated total groundwater capacity is 70,000 to 85,000 acre feet (California Department of Water Resources - CDWR, 2004), with a “safe yield” to groundwater extraction of 7,000 to 8,000 acre feet per year (CDWR, 2004). Safe yield refers to the quantity of groundwater that can be extracted over time without water levels in area wells permanently dropping. The total of groundwater extractions for urban, irrigation and rural residential uses is about 5,000 acre feet per year (combining items 1 and 2 above).

The Ojai Basin Groundwater Management Agency implements conservation measures when estimated groundwater basin storage falls below 50,000 acre feet (OBGMA, 2007b), and it could potentially only take one or two drought years to force conservation measures (note year 2007, table below). This vulnerability to drought is moderated by agriculture’s dependence on 3,000 acre feet per year of imported water into the basin from the Casitas Reservoir, but production would be affected by any factor that may reduce this importation, including drought in the watershed above the reservoir.

***Table 1**: Annual rainfall versus basin storage (from OBGMA, 2007)*

year	Annual rainfall (inches)	Groundwater basin storage (acre-feet)
2002	no data	63,000
2003	20	57,000
2004	13	55,000
2005	44	80,000
2006	24	63,000

Updated records (OBGMA, 2008)

2007	7	49,570
2008	21	59,000

Typical agricultural practices in orchards within the San Antonio Watershed (2009)

(source: field observations and personal interviews)

General practices:

Irrigation: predominantly micro-sprinkler (below-canopy sprinklers, high application efficiency).

Mulch is applied on some orchards, a soil improvement and erosion prevention practice. At times sufficient quality and quantity of mulch material in the watershed may not be available, as the watershed is distant from major sources, such as Los Angeles-area yard and street wastes, which are used in other parts of Ventura County.

Photograph 1*: Citrus orchard with recent mulch application. Mulch reduces soil erosion, improves soil fertility and tilth, improves water use efficiency and provides weed control.*

Orchard soils in the Ojai Basin are generally coarse and well-drained, not requiring subsurface or irrigation drainage.

Few orchards in the watershed employ cover crops.

Few orchards use vegetative buffers around creeks.

Particularly in walnut orchards disc cultivation is used to control weeds, which conserves moisture by removing weeds' competition for water in the soil. Walnut orchards are mainly found in the Upper Ojai Basin. Soils of the Upper Ojai Basin typically have finer textures, higher water holding capacity, and is less well-drained than is generally the case in the Ojai Basin. Some walnut orchards may be dry-land (without irrigation), which increases the importance for conserving soil water, achieved in part by preventing weed growth by frequent discing.

Flooding and bank erosion protection:

Numerous orchards adjacent to streams have non-engineered levees built up over time to provide flood protection. In some areas, ditches are used to direct overland flood-flows around and away from orchards.

Photograph 2*: an Ojai Basin stream is in the foreground. A citrus orchard protected by temporary embankments of coarse sediment is in the background.*

Flood and associated erosion hazards

The upland portions of the watershed include canyons and steep terrain. This portion of the watershed produces large volumes of debris and sediment due to its steep slopes, higher rainfall intensity, and potential for vegetative cover changes resulting fire or drought. Vegetation in upland areas of the watershed is predominantly chamise and chaparral, with some coastal oak woodland at lower elevations and in the canyons.

Photograph 3*: A San Antonio Creek tributary, Topa Topa Mountains in the background.*

Cropland damages from flooding would be heavily concentrated on citrus groves on alluvial fans and flood plains in the Ojai Basin. Floods in alluvial fans are not highly predictable (United States Army Corps of Engineers - ACE, 1973), as they tend to break through and form new channels in loose fan sediments, delivering water to unexpected locations from unexpected directions. This is exacerbated by channel obstructions in the fan-areas.

In the plains and lower alluvial fans of the Ojai Basin, stream channels are well defined, but tend to meander. Stream banks are formed from coarse cobble material which is easily eroded. Debris and sediment are deposited in the stream, forcing both low and high flows to be directed into the stream banks, causing stream-bank erosion.

The

Photograph 4*: A San Antonio Creek tributary, through alluvial fan remnants below the Topa Topa Mountains (background).*

cha nne l of San Antonio Creek downstream of Ojai is relatively confined, with limited floodplain development and sediment storage. Woody riparian vegetation along the lower portion of the creek is well established and helps promote a stable stream cross-section, although the storms of January 2005 caused widespread flooding and bank erosion along this reach.

Photograph 5*: Lower San Antonio Creek, May, 2007.*

Watershed Management: Proposed Ojai Valley Streambed Optimization Study

The Ojai Water Conservation District (PO BOX 1779, Ojai, CA 93024) has offered a conceptual proposal to optimally balance flood control, aquifer basin recharge, and environmental values in the streambeds of San Antonio Creek and its tributaries in the Ojai Valley (Ojai Basin). In summary:

- Basin streambeds provide a means for brief winter rains to replenish a limited groundwater basin (see **Irrigation Water Sources** section).
- Infrastructure development, such as roads, orchards, and rural homes are impinging on Ojai Basin streams' natural tendency to deposit coarse sediment, meander, and spread out (see **Flooding, Sediment and Erosion** section).
- These streambeds also provide habitat and passage corridors for wildlife, and are vulnerable to infestation by invasive plant species such as *Arundo donax* (see **Invasive Weeds and Riparian Habitat** section).

The Ojai Water Conservation District proposes the development of a comprehensive area-wide plan to address three concerns in a simultaneous process: 1) optimize groundwater recharge, 2) protect life and property from floods and bank erosion, and 3) maintain an attractive and sustainable environment along stream channels. Development of this plan will require additional research and development, and the district proposes to solicit funds to pursue this.

As also discussed in **Streamlined Permitting Process** and **Appendix E**, implementation will require a cooperative approach between local entities and regulatory agencies. This approach would be cemented by a common understanding regarding the importance of optimizing the three values (recharge, flood protection, and habitat maintenance) simultaneously. To guard against activities that may enhance one value at the expense of another, frequent communication by residents and agency personnel with this common understanding will be essential for successful implementation of a genuine watershed approach to managing streambeds in the Ojai Basin

Photograph 6*: a San Antonio Creek bridge crossing.*

Soil erosion (this section is intended for use in combination with the **Soils Interpretations** section)

These interpretations are for the purpose of preventing upland sheet, rill and gully erosion. Other forms, such as stream bed or bank erosion, slumps and slides, and dry ravel, are discussed in other sections of this report.

Some generalizations regarding soil erosion potential and appropriate land uses are based on percent slope (SCS, 1970):

- Areas with slopes over 50% ('very steep') are not considered suitable for any use other than recreation, wildlife, etc.
- Areas with slopes between 30% and 50% ('steep') might be suitable for range production with soil conservation measures, but not for cultivation without supporting structures.
- Areas with slopes between 9% and 30% ('slight' at 9%) may be suitable for cultivation with major soil conservation measures.
- Areas with slopes between 2% and 9% (slope might be barely perceptible at 2%) may be suitable for cultivation with moderate soil conservation measures.
- Areas with slopes below 2% (slope is probably imperceptible) may be suitable for cultivation with few or no soil conservation measures.

Some other generalizations can be made on the basis of soil texture and landform:

- Ojai Basin (representative soils Anacapa and Ojai): most of the areas suitable for intensive agriculture (generally on slopes below 30%) are on alluvial fans and terraces, generally featuring high water infiltration rates. Effective conservation practices typically focus on maintaining ground cover to protect soils from direct impact of raindrops and to add to the tensile strength of living roots to the soil; and on incorporating organic materials to increase water infiltration, indirectly decreasing the erosiveness of these soils.
- Upper Ojai Basin (representative soil Mocho): most of this area is on alluvial fans and valley bottom, with slower water infiltration rates. Soils here would tend to have more tensile strength, but a lower infiltration rate may lead more often to sheet erosion than that which occurs in the Ojai Basin. In addition to maintaining soil cover, structural practices such as contour planting, grassed waterways, or berms to slow down overland flows may be effective for erosion control.
- Sulphur Mountain area (southern and lowest parts of the watershed) (representative soils Linne and Gazos) and Black Mountain area (generally the mountainous area between San Antonio and Lion Creeks) (representative soil Sespe): most of this area is too steep to cultivate without major structural measures such as terracing. The soil texture is similar to that of soils in the Upper Ojai Basin, and conservation practices on areas with less severe slopes would be similar. For range, the most important conservation practices would involve grazing and brush management to maintain plant cover that will provide forage, protect the soil from direct rain impact and overland flow, and minimize fire hazard.

Hillside Erosion Control Ordinance

(Based on information provided by the Ventura County Resource Conservation District - VCRCD)

Ventura County has two ordinances intended to control erosion from land disturbing activities. One, a grading ordinance, requires a permit to excavate or use as fill more than 50 cubic yards of material (one cubic yard equals 27 cubic feet), unless the work-area is in an isolated and self-contained area. Inquiries about this permit can be directed to the Ventura County Public Works Agency.

The Hillside Erosion Control Ordinance (HECO) addresses new agricultural developments and major changes to existing agricultural developments in areas where soil erosion is a concern. Official county Erosion Maps displaying the areas covered by the ordinance are available for viewing at the Ventura County Public Works Agency and the Ventura County Resource Conservation District. The ordinance requires a conservation plan be developed for approval by the conservation district. Exceptions may be granted by the district, if;

- the area affected is less than 10% of the land parcel, or is less then 25 contiguous acres (the smaller of the two areas is the one that applies);
- the work is authorized by a valid grading, building, well, or conditional use permit (you don't need a conservation plan if the activity is completely covered by a separate permit); or,
- the district determines that a specific proposal does not require an erosion control (conservation) plan.

The hillside erosion control plan is prepared by the landowner or by a consultant (either a Professional Engineer or an Agricultural Contractor). The plan is reviewed by the district using a process governed by the ordinance:

- An application, including a description of the proposed project, should be submitted to the district several months before beginning work.
- The district will determine if a plan is required.
- If so, a plan is required and must be approved by the district before work commences.

Violations of the HECO ordinance may lead to a fine. If work occurs in violation of the ordinance and the violator does not abate the problem, it may be abated by the county and the cost charged to the violator or to the property owner. A (re-created) blank application form is provided in Figure 1.

VENTURA COUNTY RESOURCE CONSERVATION DISTRICT

Hillside Erosion Control Plan Application

Ventura County Hillside Erosion Control Ordinance No. 3539 and 3683

Name: _____
Landowner or Operator [please print clearly]

Address: _____
_____
City: _____
State/Zip: _____/_____
Email: _____
Resource Conservation Agreement: Date Signed _____

NOTE: IF OTHER THAN REGISTERED LANDOWNER DOUCMENTATION IS REQUIRED THAT THE OPERATOR HAS RIGHT TO POSSESS AND OPERATE

---

1. Location of Property (Attach Map) Total Acres: _____
2. Assessors Parcel Number: _____ Book: ___Page: _____
3. Planned Agricultural usage _____
4. Type of Development: (Attach detail)
5. Land Preparation Practices Proposed: (Attach detail)
6. Tentative Work Schedule: (Attach detail)
   NOTE: Must be completed within one (1) year from date of approved plan or may be amended by an approved change order, action of the Board of Directors, or result of natural disaster

7: Check Type of Technical Assistance:

- ☐ Professional Engineer and/or Agricultural Contractor
- ☐ Individual Owner/Lessee-Operator
- ☐ Resource Conservation District

I/We the undersigned hereby state that we are the landowners[s] and/or lessee-operator[s] of the above referenced property. Further we request this application and required documentation be processed and agree to forward to the VCRCD **a $2,500 deposit of which $500 is non-refundable** upon VCRCD Board Approval of this application. We also agree to pay all additional fees associatied with the processing of the HECO Plan in accordance with the attached fee schedule.

Signed: _____ Date: _____

Signed: _____ Date: _____

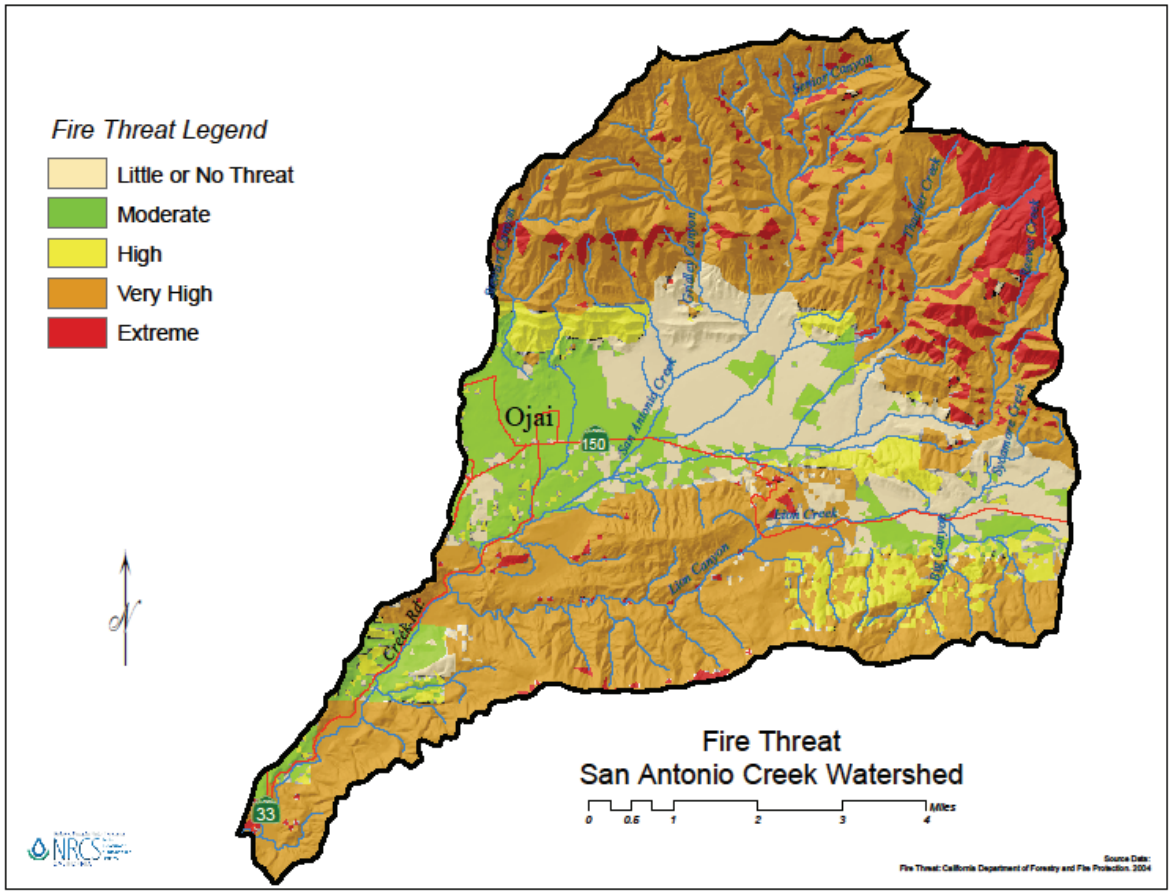
P.O. Box 147 Somis, CA 93066, 3380 Somis Road, Somis, CA 93066
805.386.4489

REVISED JULY 2008

***Figure 1**: HECO application form.*

Fire and Debris Flows

In common with other parts of Ventura County, wildfire is frequent in the San Antonio Creek Watershed. Steep slopes, flammable vegetation, and the local Mediterranean climate all combine to create an environment where vegetation burns frequently.



***Map 5**: Fire Threat Levels in the San Antonio Watershed.* [Data from FRAP (Calfire), 2009.](#)
(FRAP - Fire and Resource Assessment Program)

Following a fire, vegetation re-grows, accumulates dead wood, and increases the hazard of fires in the future. In addition to the immediate threat to life and property, the after-effects of fire also result in increased runoff, erosion, movement of sediment and flooding hazards.

Fire consumes vegetation, leaving soil vulnerable to rain drop impact. The soil may also be chemically or physically affected by the heat of fire. These factors combine to decrease rainwater infiltration, thereby increasing surface runoff.

Fires consume branches, stems, logs, and woody materials that protect soil on hill slopes. Woody debris also slows overland flows. Also, after a fire and before the first rain, loose sediment previously held in place by vegetation can move down-slope due to gravity. This material is called dry ravel.

When the first rain after a fire falls, increased flows of water and sediment into channels already choked by dry ravel leads to increased flows down-slope of both water and sediment in comparison to rainfall on slopes not affected by recent fires.

In extreme events, debris flows can occur. These flows, composed of dry ravel and other sediment suddenly activated by rainfall runoff, have enough force to move boulders, vehicles, and bridges. Debris flows caused by rain following fire affected Stewart and Senior Canyons in 1969 (VCWPD, 2004, page 3-18). The Stewart Canyon debris basin was constructed in 1963 and is actively maintained by the VCWPD (Hawks and Associates, 2006). The Senior Canyon debris basin was constructed following the 1985 Wheeler Fire (Hawks and Associates, 2006).

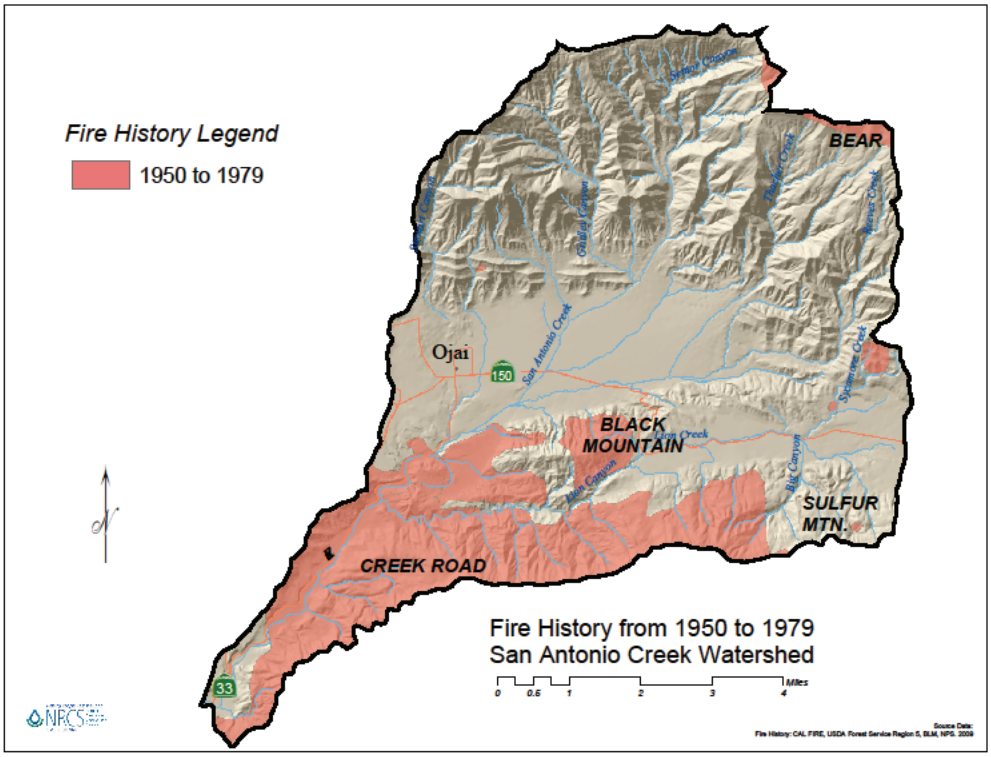
Fire History

Most of the watershed area featuring 'wildland' vegetation: herbaceous, woodland, and shrub, has burned at least once over the last 60 years. The length of time since an area has burned is a major factor in its fire threat level today, along with topography, land use and climate. Notable fires affecting the watershed are tabulated in **Table 2** and **Figures 6**, and **7** below (more maps in larger format are displayed in **Appendix A**: Watershed Atlas.

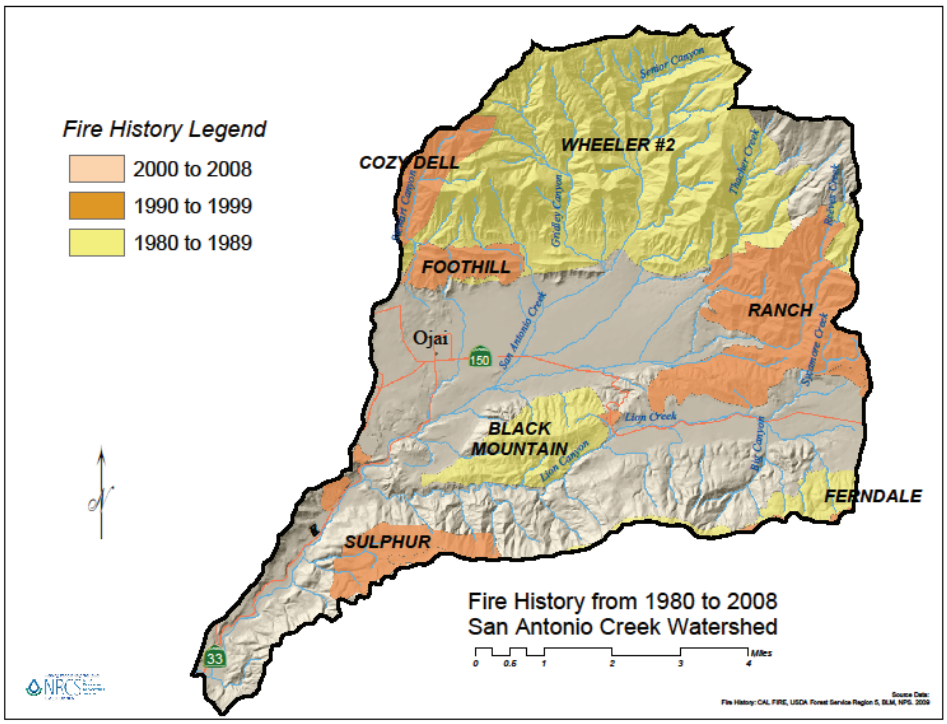
***Table 2**: Notable Fires in the San Antonio Creek Watershed.*

year	Fire name	Acres
1962	Black Mountain	485
1963	Creek Road	929
1972	Bear	17,150
1985	Black Mountain	1,324
1985	Wheeler #2	122,727
1985	Ferndale	46,810
1990	Cozy Dell	2,975
1990	Foothill	585
1992	Sulphur	903
1999	Ranch	4,371

Calfire's FRAP (Fire and Resource Assessment Program) maintains data for historical fire acreages (table above) and perimeters (maps below). Acres are for perimeter of entire burn area, not exclusive to the San Antonio Creek Watershed.



***Map 6**: Fire History of the San Antonio Watershed, 1950 to 1979.*



***Map 7**: Fire History of the San Antonio Watershed, 1980 to 2008.*

Habitat

This section focuses on areas in and around riparian areas and flood plains in the San Antonio Watershed. Potential, and sensitive, steelhead habitat covers much of the area of interest. Other species and habitats of concern in the watershed: Dulzura pocket-mouse, southwestern pond turtle, red-legged frog, and the Southern Coast Live Oak Riparian Forest (habitat type), may be present in the watershed, but in very limited areas (See table 3, next page).

Habitat for steelhead trout (*Oncorhynchus mykiss* irideus), is an over-riding issue of native species habitat in the watershed. Local steelhead trout numbers are now so reduced that they are difficult to count, and reference is usually made to 'potential' habitat, because surveyors may or may not be able to find any at a given time and place. This leads to some uncertainty as to what stream segments in the watershed are actual habitat, or influence habitat further downstream. Downstream effects would include the effects of upland conditions on water quantity and quality further downstream, with sediment delivered into channels by dry ravel being one example.

General criteria for evaluating potential habitat are discussed in the **Steelhead habitat** sub-section. Apparent minimum flow requirements and migration barriers suggest viable habitat in most years, but might be limited to the main segment of San Antonio Creek, approximately up to its confluence with Thacher Creek, and to lower Lion Creek (Lion Canyon area). However, the possibility of wetter than average years and the potential removal of migration barriers suggest that segments which seem unsuitable as habitat at this time may play a greater role in the future. Upland areas and ephemeral stream segments that do not directly support steelhead habitat may play a role in the quality of habitats further downstream, as sources of water, sediment, and pollution.

In addition to flow requirements, other habitat requirements include factors related to the morphology of the channel, such as pool depth, stream temperature as controlled by shade, and water quality. All of these and other factors can at least partly be affected by management of upland and riparian areas of the watershed. Of particular concern in the San Antonio Watershed are nutrients (nitrogen and phosphorus), which contribute to algal blooms in the perennial portions of the San Antonio and Lion Creeks. This is discussed in further detail in the **Water quality** sub-section.

Finally, there is a brief discussion of invasive species and their management, including effects on native species in riparian habitats (**Riparian habitat and invasive weeds** sub-section).

Species and habitats of concern

(based on CNDDB (CA Department of Fish and Wildlife, October 2008, see definitions below)

***Table 3**: Species and Habitats of Concern in the San Antonio Creek Watershed.*

Common species or habitat **name**	**Scientific name**	**type**	**Status***	**Habitat note**
Dulzura pocket mouse	*Chaetodipus californicus* femoralis	mammal	Of concern	Very limited occurrence in the watershed, in upland areas.
Red-legged frog	*Rana aurora* draytonii	amphibian	Threatened	Limited occurrence in the watershed, may be present where streams are, or nearly are, perennial.
Southwestern pond turtle	*Emmys* (=Clemmys) *marmorata* pallida	reptile	Of concern	Very limited occurrence in watershed, may be present in perennial, or nearly perennial, freshwater pools.
Southern California steelhead stream	*Oncorhynchus mykiss* irideus	fish	Endangered	Numerous locations in the watershed potentially suitable for steelhead habitation.
Southern Coast Live Oak Riparian Forest	dominated by *Quercus agrifolia*	plant	Of concern	Very limited occurrence in the watershed: a vegetation complex dominated by live oak, in a special (riparian) habitat.

*Species and habitats included only if listed as threatened or endangered by US Fish and Wildlife Service, or listed as a species of concern by California Department of Fish and Game (CDF&G).

Definitions for use with Table 3:

CNDDB: California Natural Diversity Database. Updated and managed by CDF&G.

Upland: A habitat that does not seem to be affected by abundant surface or subsurface water.

Riparian: Vegetation and habitat obviously influenced by its proximity to a stream.

Species: A distinct breeding population (for purposes of the Endangered Species Act).

Habitat: A location possessing characteristics supportive of a species or a suite of species.

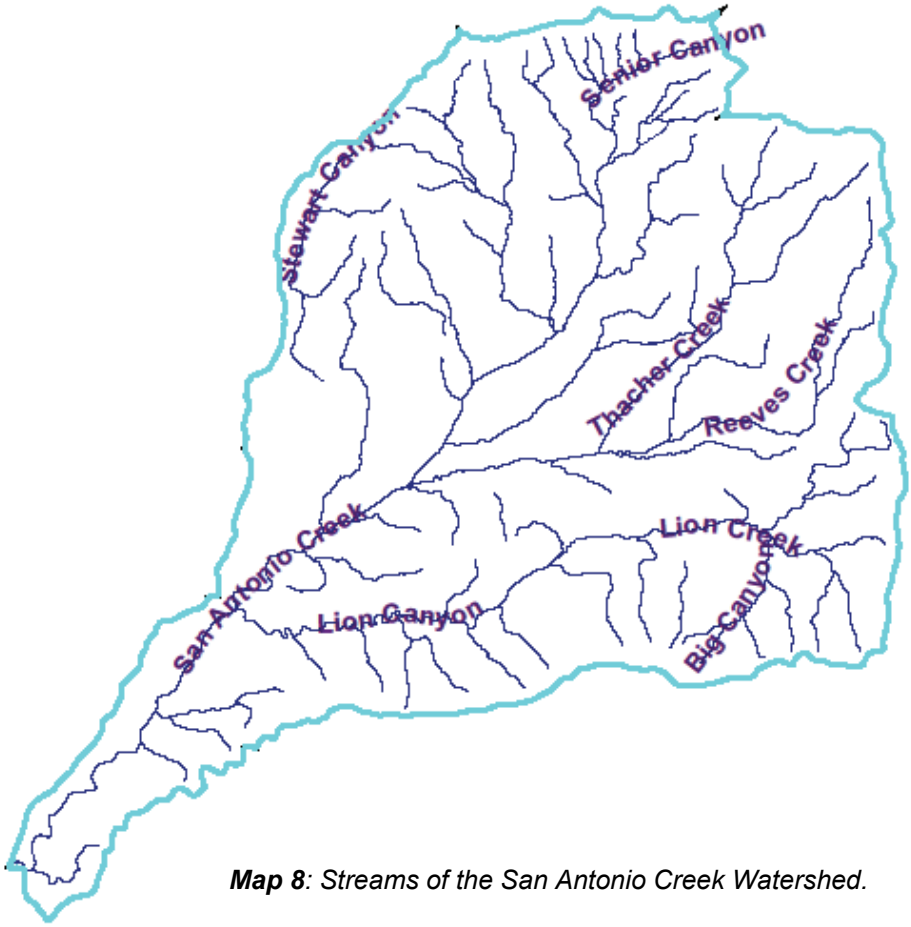
Endangered: A species in danger of extinction throughout all or a significant part of its range.

Threatened: A species likely to become endangered within the foreseeable future.

Species of concern: Species of small or declining numbers, or otherwise considered vulnerable.

Steelhead habitat

Based on a CNDDB report (see **Habitat** this report), potentially viable Southern California Steelhead habitats in the San Antonio Watershed are located in areas as follow:



***Map 8**: Streams of the San Antonio Creek Watershed.*

San Antonio Creek lower segment: from confluence with the Ventura River to the confluence with Lion Creek (about 5-6 stream-miles).

San Antonio Creek middle segment: from Lion Creek to Thacher Creek (about 3 stream-miles).

San Antonio Creek upper segment: from Thacher Creek to Senior Canyon/Gridley Canyon (about 2 stream-miles).

Lion Canyon (lower Lion Creek), from San Antonio Creek to a point where the topography flattens out in the Upper Ojai Basin (about 4-5 stream miles).

Thacher Creek, to its confluence with Reeves Creek (about 2 stream-miles).

Reeves Creek, from Thacher Creek to some point after it enters a canyon upstream (about 3 stream-miles).

Steelhead habitat **limiting factors** are as follow (based on David Magney Environmental Consulting (DMEC), 2005, pg 22)

STREAMFLOW: Steelhead return and spawn in winter or spring when stream-flows are highest (most favorable). Streams that flow for about five months per year can potentially support spawning, but juveniles can only survive if they can migrate to perennial sections. Stream segments that only flow for a short time after individual storms are typically not viable habitat.

FISH PASSAGE BARRIERS: Adult steelhead can jump six to nine feet high, provided they have sufficient pools to jump from and to, to cross barriers. A suggested minimum pool depth to jump height ratio is 1.25 to 1 to accommodate adult steelhead attempting to swim upstream to spawning areas.

WATER QUALITY: Steelhead need relatively clear, cool, well-oxygenated water, which occurs during the winter or spring peak flows. Suggested minimum standards are, temperature: below 16° Centigrade (C) in summer, and below 11° C in winter; and for dissolved oxygen above 8 milligrams per liter (mg/L) is ideal, below 6 is poor.

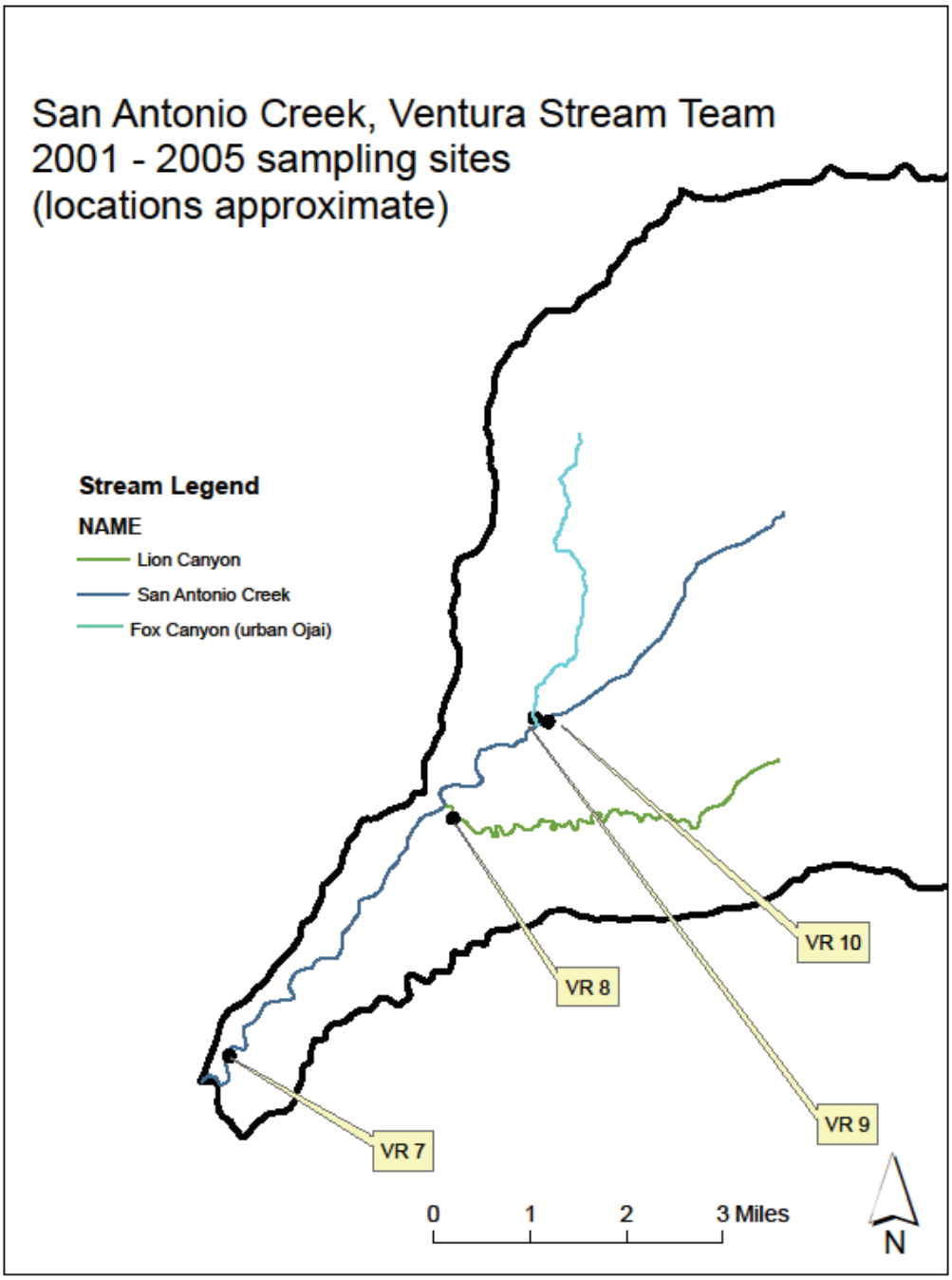
TURBIDITY: over the short term, very high turbidity reduces the ability of fish to see and feed; over the long term, fine sediments settle on gravel substrates, reducing their quality for spawning.

SUBSTRATE FOR SPAWNING: Gravel with diameters between 0.2 and 0.4 inches, and less than five percent sand and silt, are ideal for spawning.

SHADE/COVER/POOLS/TEMPERATURE: Shade is considered potentially limited due to cover and temperature effects when it is less than 76%. Riparian vegetation, boulders, logs, root wads, and under-cut banks create habitat diversity. The presence of less than three habitat types is considered limiting. Deep pools, such as created by boulders etc., provide refuge from high temperatures and provide cover that reduces predation.

Water quality

Selected items of concern identified by the Ventura River Stream Team (affiliate: Santa Barbara Channelkeepers - SBCK) are discussed below, based on results from four sampling points in the San Antonio Creek Watershed, 2001-2005 (Leydecker and Grabowski, 2006).



***Map 9**: Ventura River (VR) Stream Team sampling sites in the San Antonio Creek Watershed. Data is for 2001 to 2005.*

Nitrate: The suggested goal for this region is less than 0.38 mg/L (milligrams per liter) total nitrogen (United States Environmental Protection Agency - USEPA, 2000). Water samples collected by the Stream Team frequently exceeded this limit. Suggested sources are livestock wastes, septic systems, and fertilizers.

Phosphate: The suggested goal for this region is less than 0.03 mg/L phosphate (USEPA, 2000). All Stream Team sample sites had median phosphate levels well above this level. Livestock waste and marine-originated sediment (natural background) are suggested sources.

Dissolved oxygen (DO): For resident steelhead trout, a dissolved oxygen level above 8 mg/L is suggested. Minimum DO levels at Stream Team sample sites in the watershed were much too low by this standard. Dissolved oxygen is reduced by excessive algal growth, in turn induced by excessive nutrient concentrations. Dissolved oxygen is also reduced by higher water temperatures.

Analyses from across all Ventura River sample sites over time suggest that algae reduces dissolved oxygen most in late summer and early fall. The first major stream flows in the fall tend to flush much of the algae out, and algal re-growth is suppressed by both high water flows and low temperatures until spring. This seasonal effect suggests it is uncertain what effects algae and DO have on steelhead survival and reproduction.

Photograph 7*: San Antonio Creek near Ventura River, July 2008 (from SBCK, 2008 figure 10).*

Riparian habitat and invasive weeds

The Ventura County Resource Conservation District recently completed a riparian vegetation survey of the watershed (VCRCD, 2008). A total of 97 miles of stream (738 acres) were surveyed, including San Antonio Creek, Lion Canyon, Thacher Creek, Gridley Creek, Senior Canyon, Stewart Canyon, and Reeves Creek.

The primary purpose of the survey was to document the extent of Arundo (*Arundo donax*) infestation, particularly in regards to its effects on steelhead trout habitat. Arundo is an invasive weed common to California streams. Its negative effects (based on page 6, VCRCD, 2008) include using large amounts of water, thereby outcompeting native plants and reducing biodiversity; creating an unsuitable structure for forage or nesting sites for native animals; increased water temperature due to displacement of trees (reducing shade); increased fire risk due to excessive dry material production; increased bank erosion due to its shallow root system; and channel blockage, leading to bank erosion and flooding, due to its excessive biomass.

Arundo is found from the confluence of San Antonio and Thacher Creeks, to the confluence with the Ventura River, affecting 351 acres in the watershed (page 8, VCRCD, 2008). As a dominant vegetation type, Arundo is found along with twelve other vegetation series (defined by VCRCD (2008) as areas covering 15 acres or more).

Vegetation types include (categorized by dominant over-story species, scientific name omitted for brevity) coast live oak, California sycamore, mule fat, red willow, riverwash (minimal vegetation), arroyo willow, white alder, California black walnut, 'disturbed/developed,' 'recently cleared,' and blue gum (a non-native species). Of 172 plant species observed, 58 were non-native, including tree of heaven, artichoke thistle, fountain grass, yellow star thistle, and tamarisk.

Restoration of habitat by removal of invasive species may involve passive recruitment, with native species allowed to colonize cleared areas at their own pace, or it may involve active planting of native species (based on page 25, VCRCD, 2008). Cleared areas must be monitored and treated to prevent arundo re-sprouting. Given the overlapping presence of arundo and potential steelhead trout habitat in lower San Antonio Creek (roughly from Ojai to the Ventura River confluence), this area could be a focus for landowners' riparian habitat restoration efforts, with smaller infestations further upstream treated on a watershed-basis.

Photograph 8*: Typical view of Lower San Antonio Creek.*

Conservation Planning: Resource Inventory

Conservation planning begins with a resource inventory, including identification of soil and other characteristics and resource concerns, as displayed in Table 4 below, and proceeds to identification of alternative practices to address these concerns.

Resource Management Systems (RMS) effectively resolve all resource concerns to the limit of technical feasibility. For example, an RMS plan for a typical Ojai Basin orchard, may, after field verification, include practices intended to address all resource concerns identified, such as: bank erosion (if near an affected stream), flood damage (if in a flood plain), irrigation efficiency, water quality, noxious weeds, and wildlife habitat.

Table 4 also lists potential resource concerns likely to be associated with major soil types associated with major landscape features of the watershed, which are described in more detail in the **Soils Interpretation** section.

***Table 4**: Major soil types of the San Antonio Creek Watershed with associated probable resource concerns.*

Representative soil type (see soils interpretations this report)	Anacapa	Ojai	Mocho	Sespe etc.
Soil type description	sandy loam	sandy loam	loam or clay loam	clay loam
Typical soil type location	Ojai Basin	below Topa Topa Mountains	Upper Ojai Basin	Black Mountain
Slope (flat: less than 2%, steep: more than 2%)	flat	steep	flat or steep	steep
Common landuse (other crop: pasture, grains, dryland orchard; rangeland: exclusively used for dryland grazing)	irrigated orchard	irrigated orchard	other crops	rangeland

Probable resource concerns by associated soil type:

Sheet/rill/gully erosion		**X**	**X**	**X**
Bank erosion	**X**	**X**		
Soil mass movement		**X**		**X**
Flood damage	**X**		**X**	
Irrigation efficiency	**X**	**X**		
Water quality	**X**	**X**	**X**	**X**
Noxious weeds	**X**	**X**	**X**	**X**
Fuel/fire hazard		**X**	**X**	**X**
Wildlife habitat	**X**	**X**	**X**	**X**

Conservation Planning: implementation

The Natural Resources Conservation Service and the Ventura Resource Conservation District provide technical (planning) and (when available) financial assistance to landowners seeking to implement conservation on their properties. This assistance is confidential, non-regulatory, and voluntary. The initial steps of conservation planning typically occur as follows:

1) A landowner (or tenant, or manager) requests assistance.

2) A soil conservationist or other specialist meets with the landowner to review the operation and to identify resource concerns.

3) The landowner and specialist(s) discuss resource concerns, opportunities, and goals of the landowner.

The conservation plan will include a resource inventory, which includes: property location, soils, cropping, vegetation, etc., and a map or sketch including infrastructure (roads, fences, etc.). It also includes an inventory of resource concerns (see **Conservation Planning**: resource concerns); a record of decision as to which conservation practices have been selected; and, finally, a schedule for practice implementation.

Some considerations for implementation may include the following:

- Permits and other environmental requirements (also discussed in **Streamlined Permitting** Process and **Appendix E**).

- Practice implementation standards and specifications: the NRCS has developed standardized guidance for implementation of several practices (several individual practices discussed in **Appendix F** and elsewhere). These standards and specifications must be used in order to receive cost-share funding from NRCS programs.

- Operation and Maintenance requirements, in order to achieve the intended life-span of an implemented practice (also discussed for individual practices elsewhere).

- Implementation assistance. There are never any guarantees, but possession of a current conservation plan can be helpful when requesting technical assistance or applying for financial assistance from NRCS or from other entities.

NRCS-CPA-261
(Rev. 11/97)

CONSERVATION PLAN

U.S. DEPARTMENT OF ACRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

Cooperating with

_____
Resource Conservation District

Owner _____ Plan No._____ Date _____

Operator _____ Scale _____ (Approximate) Acres _____ (Approximate)

_____ (County) _____ (State) _____ (Assisted By) Photo No. _____

Location _____

LEGEND

(2) Field No.

Property Boundary

Land use bdy

Soil boundary

Road

— X — Fence

Stream

RECORD OF COOPERATOR'S DECISIONS AND PROGRESS IN APPLICATION

Field No.	PLANNED		APPLIED		LAND USE AND TREATMENT
	Amount	Year	Amount	Date	

***Figure 2**: NRCS CPA (form#) 261 Conservation Plan. Actual forms and procedures may vary depending on individual circumstances.*

Conservation Practices - Introduction

This section presents introductions to several practices selected for their applicability to resource concerns in the San Antonio Watershed. The Natural Resources Conservation Service (NRCS) organizes practice implementation information as follows: each defined practice has a unique numerical code; most practices have defined standards and specifications for implementation; and specific instances of a practice implementation have unique practice requirements, which provide more specific instructions for implementation based on individual circumstances. Most of these documents are housed on a variety of websites, including the following: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

As a convenience to the reader, introduction statements for some practices relevant to local resource concerns are inserted into **Appendix F**. Information about other practices can be obtained at the website listed above, and at the NRCS' Electronic Field Office Technical Guide (http://www.nrcs.usda.gov/technical/efotg/index.html).

***Table 5**: Sample Conservation Practices, with descriptions in **Appendix F**.*

Flooding/debris	326 342 362 410 580	Clearing and Snagging Critical Area Planting Diversion Grade Stabilization Stream-bank and Shore Protection
Soil erosion	340 342 484	Cover Crop Critical Area Planting Mulching
Fire	314	Brush Management
Habitat	645	Upland Wildlife Habitat Management
Water management	449 558 554	Irrigation Water Management Roof Runoff Structure Drainage Water Management

RURAL-RESIDENTIAL Resource Issues and Best Management Practices

This report separates rural residential from agricultural resource concerns as they are different in some ways, but also tries to recognize the considerable overlap between the two, such that a member of one group might benefit from reviewing information from the other section. In the **AGRICULTURE** section the following local resource concerns are discussed: flooding and flood-related damage; soil erosion; wildfire; and environmental concerns such as steelhead trout habitat stream water quality, and invasive weeds.

Practices to address resource concerns are also often similar for rural residential and agricultural properties. Conservation planning and implementation (**AGRICULTURE** section, this report) consists of a resource inventory, identification and evaluation of alternatives for addressing resource concerns, a decision by the landowner, and implementation. A number of specific, generally agriculture-oriented, practices are enumerated in the **Conservation Practices - Introductions** section of this report.

Photograph 9*: Access bridge across San Antonio Creek, 2008.*

Specific resource concerns, more oriented to the needs of rural home-owners, are discussed in this section of the report. These concerns include flooding and home access, an introduction to the Ojai Community Defense Zone Project, and large animal impacts on the environment. Best

Management Practices to address these resource concerns, and others discussed in the **AGRICULTURE** section of this report, include discussions of better designs for access roads, bridges for home access, protecting the home from soil mass movement, fire safety in the home, and good horse-keeping practices.

In the **OPPORTUNITIES** section of this report, issues related to securing permits, financial assistance, and more information (**Outreach**) are discussed. **Appendix A** is a detailed watershed atlas displaying local resource conditions, **Appendix B** is a report of a detailed sediment study performed by NRCS as part of this study, **Appendix C** is a report of a flood hazard analysis performed as a part of this study, **Appendix D** provides a more detailed description of potential funding sources, **Appendix E** describes the streamlined permit-process utilized in the Calleguas Creek Watershed, and **Appendix F** provides more detailed descriptions of some conservation practices. Finally, selected information from other sources is provided as a series of attachment to this report.

Resource Issue - Flooding and home access

Home owners who live in rural settings often have limited access to and from their homes. Some home owners access their property on private roads through low water crossings, or fords, as shown in Photograph 10. When large storm events occur, these low water crossings are impassible. Particularly in light of the floods in lower San Antonio Creek in 2005, this is a major concern for home owners in parts of the watershed.

Photograph 10*: Concrete low water crossing in the San Antonio Creek Watershed.*

Low water crossings are feasible for home owners because they are relatively inexpensive and require minimal maintenance. However, over time, the channel bed immediately downstream of the crossing tends to cut down, potentially causing a barrier for anadromous fish and other species. San Antonio Creek, from its confluence with the Ventura River to Ojai (Polakovic and Cooper, 1999), is known to support the anadromous Southern Steelhead Trout (*Oncorhynchus mykiss* irideus), an endangered subspecies (see **Steelhead Trout** section, this report).

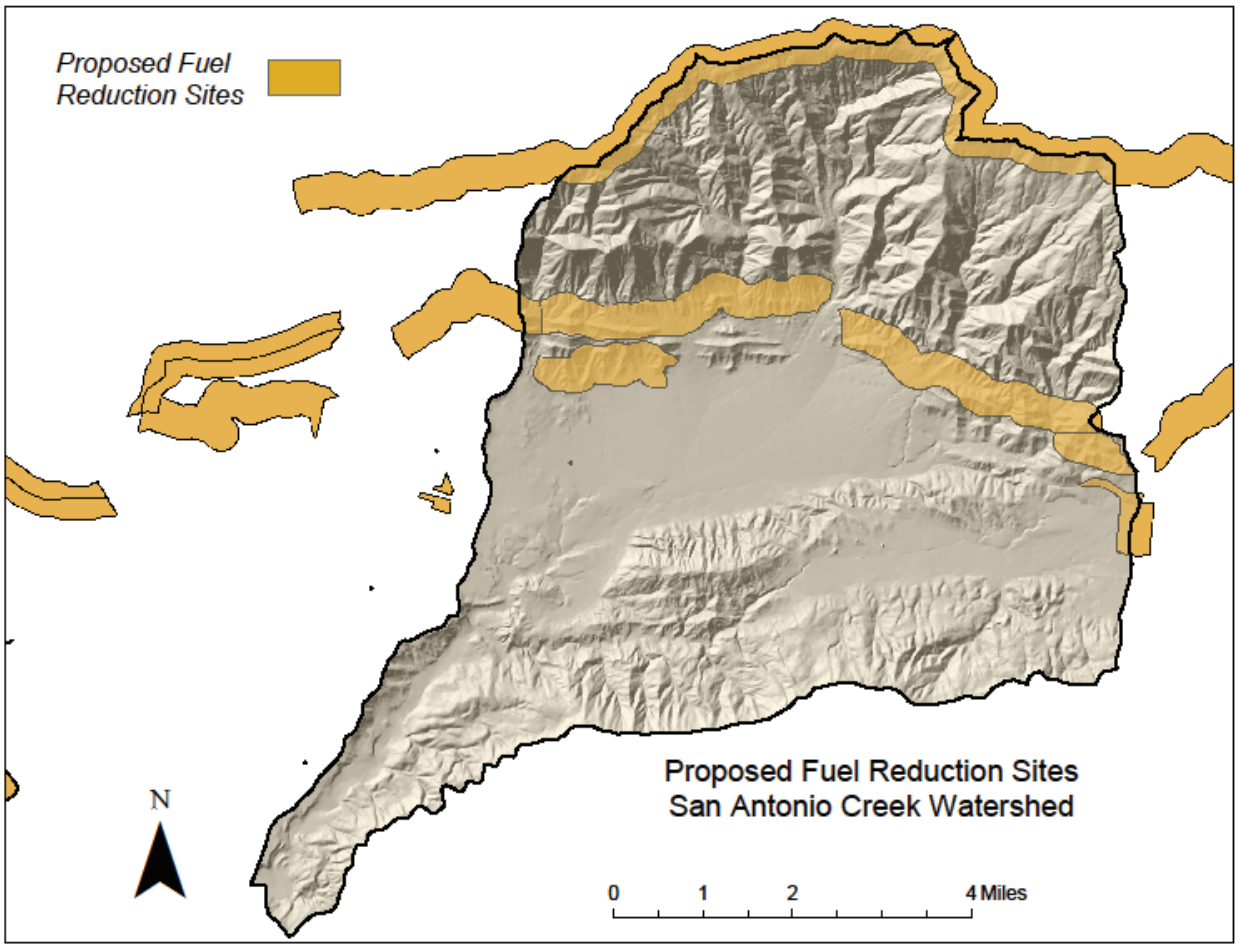
Photograph 11*: Trail crossing, confluence of Ventura River and San Antonio Creek. It is designed to allow water to flow under the structure, minimizing scouring and down-cutting downstream from the structure.*

Home owners who do not have private roads which cross streams are often impacted as well during large storm events when public roads are inundated, as shown in Photograph 12. So, flooding and access is a community, as well as a private, concern.

Photograph 12*: An inundated road during a large storm in the watershed.*

Resource Issue - The Ojai Community Defense Zone Project

Since vegetation buildup affects fire intensity, an important component of fire safety is vegetation (fuel) management. On that basis, community-scale fuel management projects are being implemented to improve fire safety. Recent fuel management plans have been compiled into a master-plan in the area of the San Antonio Creek Watershed, known as the "Ojai Community Defense Zone Project" (US Forest Service (USFS), 2008). This plan was developed and is being implemented by the Los Padres National Forest (Ojai Ranger District), the California Department of Forestry and Fire Protection (Calfire), the Ventura County Fire Department, the Ojai Valley Fire Safe Council, and individual property owners.



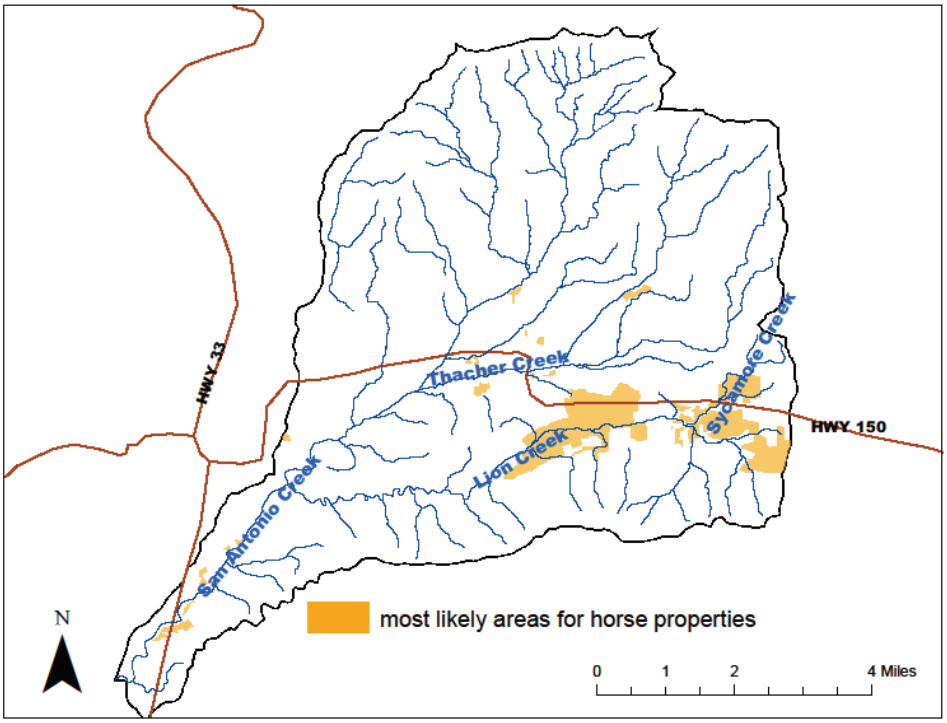
***Map 10**: Treatment areas displayed, using unpublished information provided by the Ventura County Fire Department (2008), are similar to but may not exactly match maps prepared by USFS (2008).*

The purpose of this project is as follows (from USFS, 2008, page 2)

- Reduce the threat of wildfire to the urban interface of Ojai, Meiners Oaks, and Upper Ojai Valley.
- Create safer conditions for the public and firefighters in a wildfire.
- Protect watershed values and water quality of Lake Casitas and Ventura and Santa Clara Rivers.
- Reduce potential impacts of high intensity wildfire on wildlife habitats and other valuable resources.
- Increase the efficiency and cost effectiveness of fire suppression.

The Community Defense Zone Project focuses on maintaining existing fire breaks by removing vegetation through mechanical treatment, hand cutting, piling and burning, and burning (of cut vegetation) in place. Mechanical treatments include discing, crushing, and use of a brush rake or grappling hook (USFS, 2008, page 4). Creation and maintenance of fuel breaks slows down and reduces the intensity of wildfire in strategic areas, making it easier during a fire event to contain fires with a minimum of damage and hazard to human life.

Resource Issue - Large Animal Impacts



***Map 11**: Areas most likely to support horse properties, based on land-use and vegetative cover analyses.*

Impacts associated with large animal (livestock) enterprises, including horse-keeping (see **Good horsekeeping** section) include erosion and sediment from grazing and forage cultivation, erosion and sediment from access roads, stream impacts from grazing and trampling, and water quality impacts from sediment and manure. More localized problems may be dust, odor, and flies. In addition, large animals have their own resource concerns, including access to a healthy environment with an adequate quantity and quality of shelter, food and water.

***Photograph 13**: Gully erosion in pasture (Kansas, 2002).*

Because of the potential impacts to wildlife habitat and water quality, streams and riparian areas are particularly sensitive to livestock impacts. In particular, where stream channels intersect properties supporting livestock, their impacts may need to be buffered, using fencing to control livestock access to streams. This will prevent manure and sediment from entering stream channels, and riparian vegetation is protected from over-grazing.

***Photograph 14**: Buffered stream in pasture (Sonoma County, CA, 2000).*

Best Management Practice - Access roads

Access roads are designed to provide a safe, stable surface for vehicles to operate on, while protecting adjacent areas from erosion and sedimentation.

The issue of properly designed and maintained access roads is important in the San Antonio Creek Watershed because of its recent history of storms and floods, which strand, isolate and nearly isolate residents. Those who live near, or must pass over, a stream between their homes and a major road, or who live on dirt or graveled roads, are most at risk. A particularly tragic incident in nearby Sespe Creek led to the deaths of several people in 1969 (Beitler, 1969).

Roads, even seldom-used dirt roads, are typically compacted. Because of that, storm-water tends to run across and down them. When this water is not accommodated by properly designed structures, such as water-bars, the results can be pot-holes, gullies, and erosion downstream where the water exits the road. This can threaten the road, nearby structures, and downstream values affected by sediment.

Photograph 15: *Eroded orchard access road, Michigan, 2002.*

The NRCS has practice standards and specifications for properly constructed access roads, to minimize maintenance and repair costs, ensure emergency access, and minimize environmental damage from eroding road surfaces. Links to other information is provided in the **Outreach** section and **Appendix F** of this report. Companion practices often recommended to support this practice are: Critical Area Planting, Stream Crossing, and Structures for Water Control.

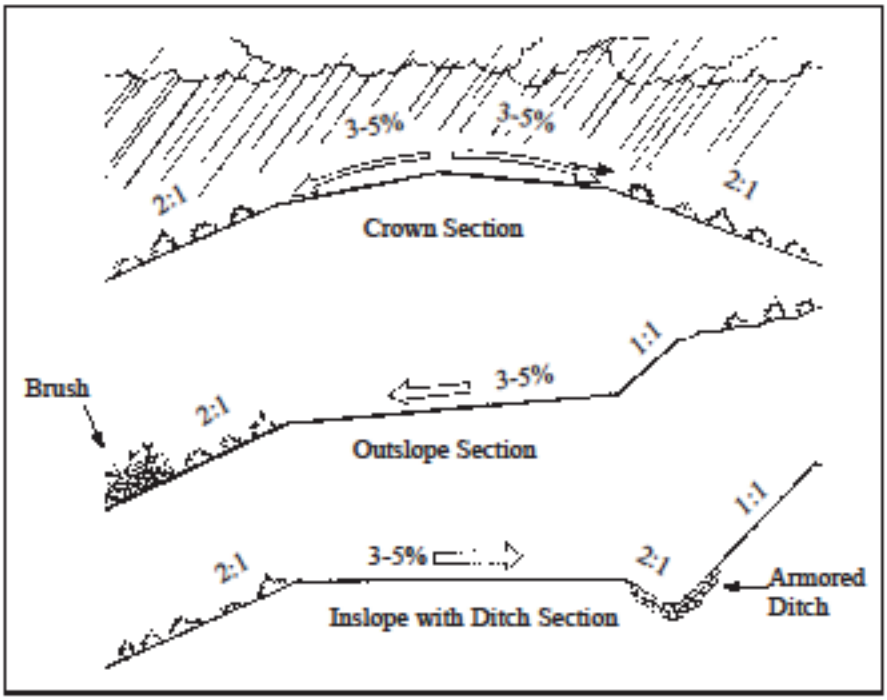


Figure 3: *From Gordon & Sherar, (2003), page 54.*
http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.htm

Photograph 16: *From Gordon & Sherar, (2003), page 54.*
http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.htm

Best Management Practice - Bridges (improved home access)

Bridges offer one alternative for improving access to residences that have private roads which cross streams or drainages. Bridges are typically constructed using concrete, steel, or wood. Often in rural settings, rail cars are retrofitted as the main bridge component. In all cases, locating bridges in a suitable location is the first key factor in achieving an all weather, permanent crossing. Suitable bridge locations may not be in the same area as the existing low water crossing. Bridges should be located in stream reaches which are vertically and horizontally stable. Concrete abutments are needed to support the bridge in all conditions as well as withstand all flow conditions, including resistance to damage from floating and submerged debris.

In all cases, the bridge design should be checked and approved by a professional engineer to ensure that it can withstand the anticipated loads.

***Photograph 17**: Example of a railcar bridge, from outside of the San Antonio Creek Watershed.*

Best Management Practice - home protection using diversions and debris racks

Homes located on alluvial fans are subject to some risk of damage from debris and sedimentation, particularly during major storms. Home sites immediately at the base of steep slopes or near existing drainages typically have the highest risk of damage. An alternative for protecting homes and structures includes the installation of diversions. The figure below depicts a proposed diversion used for protecting homes from sediment and debris (Barrows, et al., 2003; Hollingsworth and Kovacs, 1981):

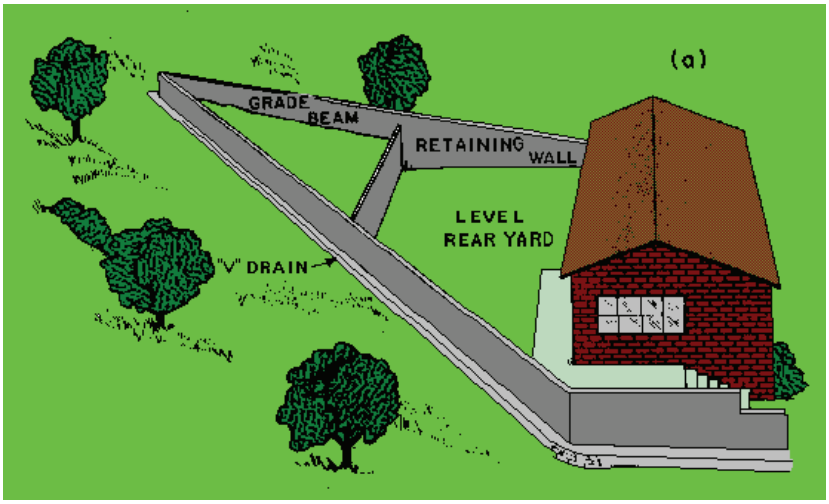


***Figure 4**: Diversion to protect home from sediment and debris, from Barrows etal., 2003, third page* ftp://ftp-fc.sc.egov.usda.gov/CA/programs/EWP/MudslideHazards.pdf

In other situations where debris and sediment loads are determined to be greater or require more strength, trash racks can be used to protect homes and property, as shown below:

***Photograph 18**: A trash rack providing emergency protection to areas downstream (example from outside of the San Antonio Creek Watershed).*

Best Management Practice - Fire Safety in the Home

Fire breaks are a typical practice for controlling wildfire in the San Antonio Creek Watershed. Fire breaks may be placed across the landscape, such as those planned with the **Community Defense Zone Project**. Breaks may be cut along roads to make emergency evacuations and staging of fire equipment easier and safer, providing community-wide protection. Other practices include thinning and pruning trees or brush across large areas to reduce intensity and rate of spread of wildfire. Vegetative thinning can be done around homes and other buildings on a smaller scale to improve the chances of surviving a wildfire. Practices that should be observed around any homes at risk from wildfire include the following: (from: Brush Clearance Guide, Ventura County Fire Department)

Landscape (Ornamental)

• Remove all flammable vegetation and other combustible growth within 100 feet of any structure. Single trees, ornamental shrubbery or cultivated ground covers may be permitted provided they are maintained in a manner that they do not readily transmit fire from native vegetation to the structure.

• Special Attention should be given to the use and maintenance of ornamental plants known or thought to be high hazard combustible plants when used in close proximity to structures. Some of these known plants are, but not limited to acacia, cedar, cypress, eucalyptus, juniper, pine, and pampas grass. Planting of ornamentals should be properly maintained and should not be planted in mass plantings and groups. They should not be planted in such a manner that they could transmit fire from brush to the structure.

• The Ventura County Fire Department strongly recommends increasing brush clearance from 100' to 200' if any of the following apply to your property: House located on/or at the top of a slope, old brush not recently burned, east or south facing aspect, wood shake roof, limited access for Fire Department, ornamental shrubbery next to house, older construction, historical fire pattern in your area, heavy chaparral fuels, limited or private water supply, or more than 5 miles from a Fire Station.

• Space tree canopies and place shrubs a minimum of 15' from other shrubs or trees. All trees and shrubs need to be trimmed up off the ground 2 feet or 1/3 the height of the tree which ever is less. Maintain all plants by regularly removing all dead fall and litter.

Yard Maintenance

• Stack wood at least 30 feet from structures. Remove flammable vegetation within 10 feet of woodpile.

• Remove all stacks of construction materials, pine needles, leaves and debris.

• Locate fixed butane/propane tanks at least 10 feet from any structure and give them 10 feet of brush clearance.

Roof Maintenance

• Remove dead branches overhanging the roof.

• Clean all dead leaves from roofs and rain gutters.

• Cover chimney outlets with a spark arrestor consisting of a metal or non-flammable screen of ½ inch or smaller.

Best Management Practice - Good Horse-keeping

(Based in part on http://www.rcdsantacruz.org/PDF/Resources/Fact%20Sheets/Horse_Keeping.pdf.)

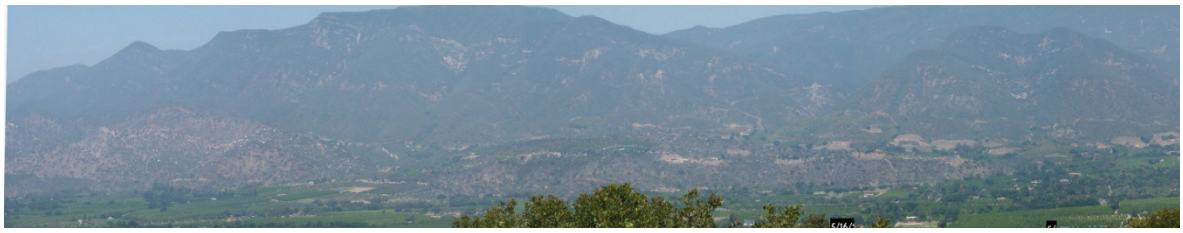
The columns across the top of Table 6 list several resource concerns that horse-property owners in the San Antonio Creek Watershed may be experiencing. The column on the left of Table 6 lists some of the practices that are supported (with specifications and other information) by the Natural Resources Conservation Service and the Ventura County Resource Conservation District (see **Appendix F**, this report). An "X" indicates which resource concern is addressed by a given practice. More information about supported practices, and links to other reference materials, is provided in the **Outreach** section, this report.

***Table 6**: Horse-keeping matrix of resource concerns and best practices.*

	Erosion (paddocks and pastures)	Erosion (streams, if present)	Erosion (road-related)	Dust control	Flies (manure management)	Odor (manure management)	Water quality (manure and sediment)	Mud (poor drainage)	Pasture management	Irrigation water use on pastures
Access road (proper design and maintenance)			X							
Critical area planting (also includes specifications for erosion control blanket, straw mulch)	X	X	X				X	X	X	
(drainage water) Diversion								X		
Fencing		X							X	
Irrigation water management							X	X		X
Irrigation system (usually sprinkler or flood, including conveyance systems)										X
Heavy Use Area Protection	X		X	X						
Nutrient management							X		X	
Prescribed grazing									X	
Streambank protection		X								
Watering facility										
Waste management					X	X	X			
Waste utilization					X	X	X		X	

OPPORTUNITIES

Opportunities for conservation implementation may be limited by information, permits and other procedural matters, and funding. This report attempts to address some of the information needs for the San Antonio Creek Watershed. The **Outreach** section below provides links to other information sources. Ideas about streamlining permitting and environmental review are discussed briefly below (**Streamlined Permitting Process**) and in **Appendix E**. Although residents of the watershed are confronted with severe environmental problems and resource constraints; good planning, cooperation, and leveraging of potential **funding sources** offer opportunities for improvement in the watershed (also see **Appendix D**).



Photograph 19*: Panorama of the Topa Topa Mountains.*

Photograph 20*: Panorama of the Ojai Basin.*

Photograph 21*: Thacher Creek, Ojai Basin.*

A Stream-lined Permitting Process

A process for streamlining the permitting process is discussed in **Appendix E** of this report (Calleguas Creek Watershed Permit Coordination example). The following elements are helpful:

- There is a consensus view in the community, that, when implemented with the necessary controls, a suite of practices provide mutual benefits to landowners and the general public.
- There is a consensus view, among regulatory and other agencies, that a streamlined conservation implementation process, when properly performed, is to the mutual benefit of their varied missions.
- There is a lead agency (or agencies), able to take on the technical, administrative, and ultimately, some of the financial burdens of developing and managing a programmatic agreement among agencies to implement a streamlined permitting process.
- The lead agency has good communications with and is trusted by local personnel of regulatory agencies.
- The lead agency has similarly good relations with landowners and other potential participants in the affected area.
- There are reasonably abundant and accessible sources of implementation assistance available to participants. To justify the burdens of administration taken by the lead agency, there should be assurance that the process will be used enough to justify its development and support.

An analogous program in the San Antonio Creek Watershed would probably focus on in or near-stream work to conserve water, reduce flood impacts, protect banks from erosion, and improve habitat. As with the Calleguas Creek Process, a San Antonio Creek Process would likely include a limited number of practices with purposes, restrictions and limits agreed to by all regulatory agencies. Either the VCRCD or an equivalent local entity would likely serve as the administrator, with NRCS and potentially other entities providing technical assistance. Financial assistance, from a variety of sources, would likely be encouraged when potential funders are aware that a streamlined process for implementation is in place.

Funding Sources

A few potential funding sources are discussed in more detail in **Appendix D** of this report. Information presented there is oriented in three ways:

1) The Natural Resources Conservation Service provides technical and financial assistance, including United States Department of Agriculture Farm Bill programs. Farm Bill programs potentially applicable for landowners in the watershed are discussed at the following website:

http://www.ca.nrcs.usda.gov/programs/

2) Programs supportive of wildlife habitat improvements, particularly of anadromous fish, are also available. The presence of steelhead trout habitat in and near perennial and perennial-pool stream segments in the San Antonio Creek Watershed is commonly viewed as leading to regulatory barriers to implementation of some practices that would reduce the consequences of flooding, erosion and sediment in the watershed. On the other hand, popular interest in anadromous fish habitat also creates special funding opportunities, including dual-purpose projects, such as replacement of low-flow stream crossings with all-weather bridges. Links to two sources of habitat improvement funding assistance are provided here:

http://www.dfg.ca.gov/fish/Administration/Grants/FRGP/ *(CA Department of Fish and Game)*

http://www.fws.gov/partners/ *(United States Fish and Wildlife Service (USF&WS))*

3) Potential funding sources useful to individual landowners. It is presumed here that local governments and non-governmental organizations have a better sense of their own needs, capabilities, and potential funding sources than can be conveyed in this report. Potential sources of conservation implementation funding to local governments are provided here:

http://www.fws.gov/grants/local.html *(USF&WS)*

http://www.firesafecouncil.org/about/index.cfm *(Fire Safe Councils of California)*

http://www.waterboards.ca.gov/water_issues/programs/grants_loans/ *(CA Water Resources Board)*

http://www.rurdev.usda.gov/rd/nofas/index.html *(USDA Rural Development)*

Outreach

Outreach refers to relevant information from other sources beyond the scope of this report. The print version of this report includes several items as attachments. Those items readily available on-line are listed below.

Available at the Santa Cruz County Resource Conservation District (SCCRCD) website:

(http://www.rcdsantacruz.org/):

A home drainage guide:

http://www.rcdsantacruz.org/PDF/Resources/Brochures/HomeDrainageGuide.v25.pdf

A private road maintenance guide:

http://www.rcdsantacruz.org/PDF/Resources/Brochures/PrivateRoadMaintenanceGuide_7-2004.pdf

A fire safety guide for rural landowners:

http://www.rcdsantacruz.org/PDF/Resources/Brochures/LivingwithFireinSantaCruzCounty_6-2004.pdf

A land conservation guide for small-scale livestock owners:

http://www.rcdsantacruz.org/PDF/Resources/Brochures/livestockandlandbrochure.pdf

(provided by) Council of Bay Area Resource Conservation Districts, posted on the SCCRCD website:

A land conservation guide for horse owners:

http://www.rcdsantacruz.org/PDF/Resources/Fact%20Sheets/Horse_Keeping.pdf

A manure management guide for small-scale livestock owners:

http://www.rcdsantacruz.org/PDF/Resources/LivestockPublications/Manurebooklet_-_Draft_Final.pdf

Available on the Santa Barbara County Fire Department website:

(http://www.sbcfire.com/):

A fire safety guide for rural landowners:

http://www.sbcfire.com/fp/guides/Living_with_Wildfire.pdf

Available on the Ventura County Fire Department website:

(http://fire.countyofventura.org/):

A brochure describing the Ventura County *Rangeland Assistance Program*:

http://fire.countyofventura.org/LinkClick.aspx?fileticket=pUdvgp1fTjA%3D&tabid=58

Available on USDA NRCS website (conservation planning):

(http://www.ca.nrcs.usda.gov/technical/consplan.html):

A brochure describing the conservation planning process:

ftp://ftp-fc.sc.egov.usda.gov/CA/intranet/techres/cpi/CA_Planning_Brochure.pdf

A homeowner's erosion control brochure:

ftp://ftp-fc.sc.egov.usda.gov/CA/programs/EWP/2007/eEC.pdf

A homeowner's mudslide prevention and survival brochure:

ftp://ftp-fc.sc.egov.usda.gov/CA/programs/EWP/MudslideHazards.pdf

A brochure for homeowners describing the effects of fire on flooding hazards, with recommendations for home protection.

ftp://ftp-fc.sc.egov.usda.gov/CA/programs/EWP/2007/BAER_flooding_brochure.pdf

SUMMARY

The San Antonio Creek Watershed features several landforms and resource issues typical of the more mountainous terrains of coastal Southern California: steep brush-covered slopes susceptible to fire and erosion, with adjacent lowlands vulnerable to damaging droughts, floods, erosion and sediment deposition. Agricultural and rural residential landowners of the watershed must contend with risks of property damage, potential loss of access to their properties, and environmental quality concerns and associated regulations.

Resource management alternatives for agricultural property managers are presented in the NRCS Conservation Planning format, which should facilitate implementation by bringing selected alternatives into a context familiar to NRCS and other agencies that may be able to provide technical or financial assistance. Alternatives for rural residential landowners are presented in a format of Best Management Practices, familiar to the general public and to agencies also in a position to provide technical or financial assistance to residential landowners. Both approaches use the processes of resource inventory, identification and evaluation of alternatives, and implementation of selected alternatives.

Instead of specific recommendations, alternatives for consideration are presented in this report, both to remain in keeping with the deliberate and property-specific planning process promoted here, and in recognition that the technical and financial barriers to implementation of many alternatives are hard and need to be considered carefully by the individuals or entities directly involved. Two over-arching proposals for consideration discussed in this report would be consideration of establishing a streamlined permitting process to facilitate appropriate practices to conserve resources and protect property; and considering looking for dual-purpose property protection and stream habitat improvement practices, such as fish-and-homeowner friendly access bridges to replace low water crossings.

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Appendix A: Watershed Atlas, Tom Share, Engineering Technician, WPS.

Appendix B: Sediment Analysis, Julia Grim, Geologist, Engineering Section, same address.

Appendix C: Flood Awareness Map, Greg Norris, Hydrologist, WPS.

Appendix D: Funding Opportunities, Steve Hill, Natural Resources Manager, WPS.

Appendix E: Streamlined Permitting, Steve Hill.

Appendix F: Conservation Practices, introduction, Steve Hill.

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