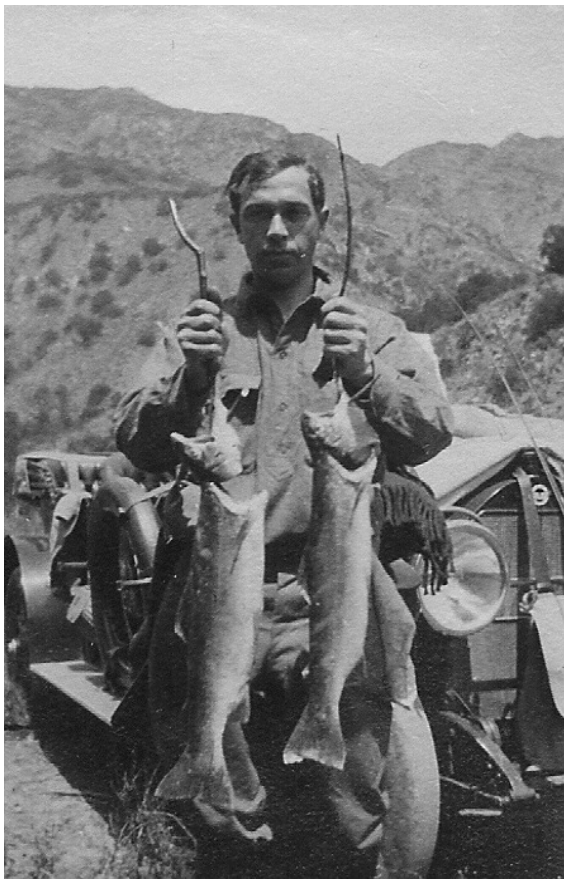
Santa Clara River Steelhead Trout: Assessment and Recovery Opportunities



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STOECKER ECOLOGICAL™
NATURAL RESOURCE ASSESSMENT AND RESTORATION SERVICES

and

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Prepared For:
The Santa Clara River Trustee Council and The Nature Conservancy

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Projection Datum: NAD 1983, UTM Zone 11N
To install project on your computer: create folder c:/SCRtrout and place all GIS project files there

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Abbreviations

ACOE	Army Corps of Engineers
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
cfs	Cubic feet per second
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
LPNF	Los Padres National Forest
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
pers. comm.	personal communication
RBT	Rainbow Trout
UCSB	University of California at Santa Barbara
USDA	United States Department of Agriculture
UWCD	United Water Conservation District
VFD	Vern Freeman Diversion

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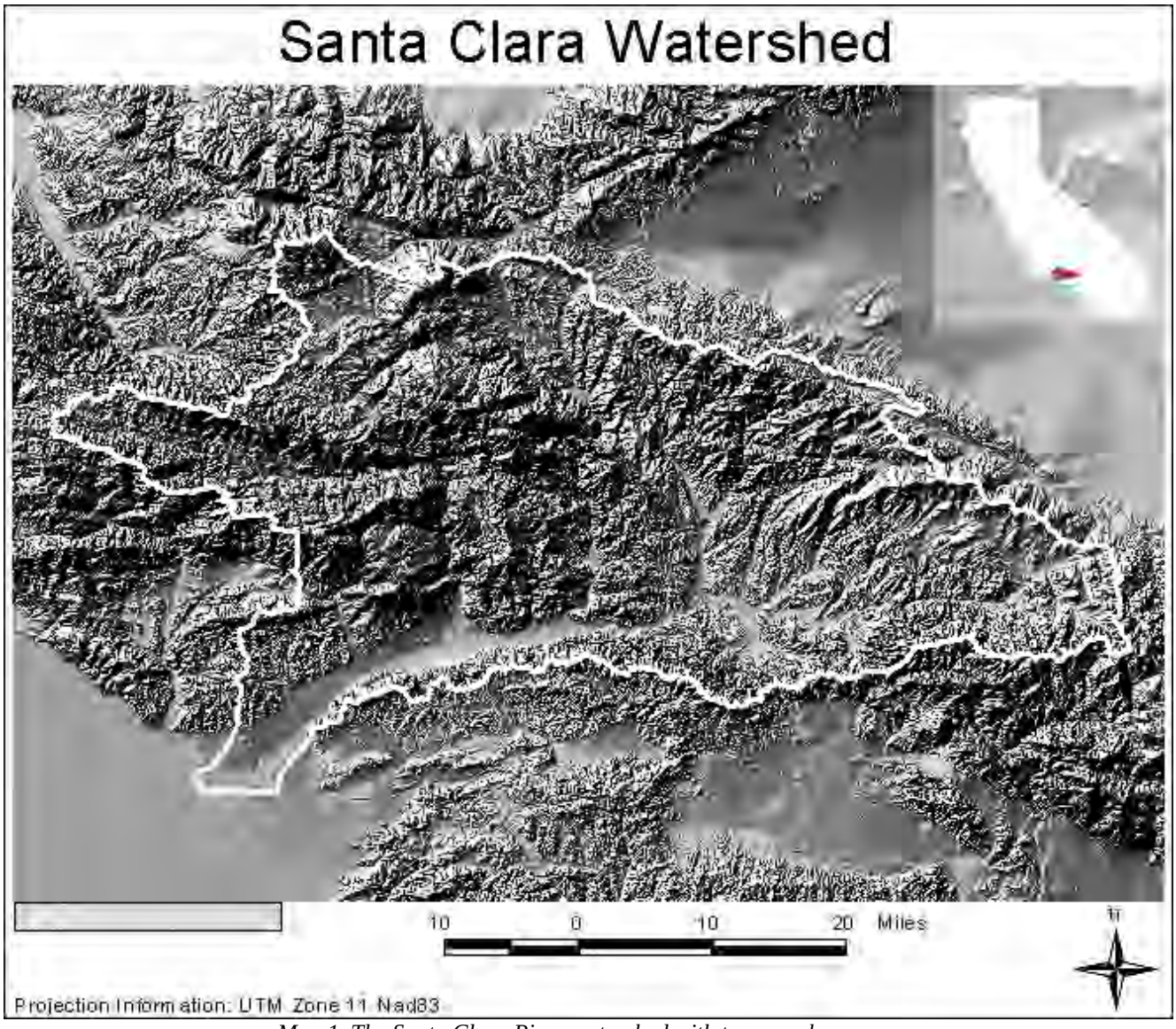
Executive Summary

The Santa Clara River watershed is located primarily in Los Angeles and Ventura Counties in California (Map 1). The watershed is large for southern California, at 1600 square miles. The purpose of this project was to analyze the habitat conditions, population status and barriers to migration for *Oncorhynchus mykiss* (steelhead trout) in the lower Santa Clara River watershed from the Piru Creek tributary downstream including significant drainages.



Map 1. The Santa Clara River watershed with topography.

Historic documentation of an important recreational steelhead fishery occurs for the Santa Clara River into the mid 1900's. Construction of dams and other migration barriers on the mainstem, Santa Paula Creek, Sespe Creek, Piru Creek, and other tributaries during the mid 1900's appear to be correlated with the demise of the steelhead run as habitat availability decreased and surface flows became highly manipulated (Capelli 1983, Moore 1980a, Outland 1971). Adult steelhead have continued to attempt to migrate up the Santa Clara River into recent times with an adult trapped at the Vern Freeman Dam in 2001. A wild, self-sustainable rainbow

trout population still exists in the headwaters of the Santa Paula, Sespe, Hopper, and Piru Creek tributaries and is producing out-migrating steelhead smolts bound for the Pacific.

Surface water diversions and groundwater pumping on the Santa Clara River reduce the river's flows, and cause barriers to migration in the forms of diversion dams, grade control structures, road crossings, and channelization projects impacting access to the river's critical spawning and rearing habitat in the tributaries. Exotic predator fish such as green sunfish and bullhead catfish observed in Sespe Creek, and other exotic gamefish in Piru Creek and other watershed reservoirs, compete with and prey upon the native steelhead and rainbow trout population.

This study commenced with a compilation and synthesis of all prior surveys for steelhead that were conducted on the Santa Clara River, and were available in either the Mark H. Capelli Southern California Steelhead Watershed Archive at the University of California, Santa Barbara (UCSB), or the U. S. Forest Service office in Santa Maria. The findings from this synthesis are located in Table C.

The tributaries that occur within the geographic boundaries of this study include: Santa Paula Creek, Sespe Creek, Pole Creek, Hopper Creek, and Piru Creek. The largest of these tributaries are Sespe and Piru Creeks. There were 702 habitat units surveyed in the Santa Clara River watershed for this study, and 129 natural and anthropogenic fish migration barriers identified. Some of the projects key findings were:

1. **Santa Paula Creek**
   a. Santa Paula Creek contained the most productive habitat in the study area for salmonids. However, the quantity of habitat is limited when compared to the amount of habitat in the Sespe Creek drainage.
   b. Santa Paula Creek appears to have greater potential to contribute to the recovery of the Southern California ESU (Evolutionarily Significant Unit) than the Hopper Creek and lesser Pole Creek tributaries.
   c. Sisar Creek accounts for 84% of the trout observed in the Santa Paula Creek drainage.
   d. Severe barriers to steelhead passage are located on Santa Paula and Sisar Creeks.
2. **Sespe Creek**
   a. Sespe Creek supports a much higher abundance of trout than Santa Paula Creek, despite the occurrence of an exotic predatory fish population. Sespe Creek also had higher numbers of larger fish than Santa Paula Creek.
   b. No individual reaches in Sespe Creek tributaries that had habitat quality scores below 5.5 had trout observed in them, and trout did not start occurring in larger numbers and with regularity until scores reached 7.0.
   c. Severe barriers to steelhead passage exist on tributaries to Sespe Creek.
3. **Pole Creek**
   a. Pole Creek had both the lowest quality estimated habitat scores and the least habitat available of all Santa Clara River mainstem tributaries measured, but could likely support a small population of *O. mykiss* with adequate fish passage in the lower reaches.
4. **Hopper Creek**
   a. Hopper Creek contains a limited amount of high quality salmonid habitat and an existing *O. mykiss* population that may contribute to the anadromous steelhead population.
   b. Severe barriers to steelhead passage occur on Hopper Creek.
5. **Piru Creek**
   a. Barriers on Piru Creek rated very highly but access would need to be developed around Santa Felicia Dam for the barriers on Piru's mainstem upstream of Santa Felicia Dam to warrant fish passage improvements.

6. **Mainstem Santa Clara**
    a. The most significant barrier to steelhead passage within the lower watershed is the Vern Freeman Diversion Dam on the mainstem of the Santa Clara River.
7. No tributaries rated low in habitat quality and high in trout abundance.
8. The average habitat quality scores and rankings for each major tributary are in Table A1. The total amount of habitat by tributary and habitat type is in Table A2.

Table A1. Average Habitat Quality Scores, in order of highest to lowest

	Habitat Quality
Santa Paula	6.45
Sespe	5.59
Piru	5.47
Hopper	5.21
Santa Clara Mainstem	4.75
Pole	3.75

The higher overall habitat quality on Santa Paula Creek may be due to almost all of the available habitat observed in the Santa Paula Creek drainage being of relatively high quality compared to Sespe Creek which contained a high amount of high quality habitat in its tributaries and portions of its mainstem, but also many dry tributaries and dry reaches in the middle and upper mainstem that reduced the overall habitat score for the drainage.

The overall high trout productivity of Sespe Creek can be accounted for by the high productivity of its tributaries, which accounted for 98% of the observed trout occurrence in the Sespe Creek drainage. Piedras Blancas Creek was observed to be the most productive followed by Howard/Rose Valley, Bear, Trout, and West Fork Sespe Creeks.

It should be noted that this study was conducted after several recent fires in the Sespe watershed, and following a five year below average rainfall period that could have differentially affected observations within watershed tributaries (e.g., the prolonged low flows in Sespe Creek created conditions favorable to the proliferation of exotic species such as bullheads which prey upon juvenile trout, a species not found in Santa Paula Creek.). There can be considerable inter-annual, decadal variability between reaches within the watershed.

Based on the findings of this study we recommend the following be priorities for revitalization of the steelhead run on the Santa Clara River.

Habitat and Population Priorities

1. Due to *O. mykiss* occurrence, abundance and habitat quality the following tributaries should receive the highest level of protection and where necessary rehabilitation:
    a. In the Sespe Creek Drainage: Piedras Blancas Creek, Howard Creek/RoseValley, W.F. Sespe Creek, Bear Creek, Lion Creek, Timber Creek.
    b. In the Santa Paula Creek drainage: Sisar Creek, and upper Santa Paula Creek.
    c. Upper Hopper Creek.
2. Protection of the highly productive mainstem reaches on Santa Paula and Sespe Creeks .

Fish Passage Priorities

1. Improved fish passage at the Vern Freeman Diversion Dam that is effective over a wider range of flows and utilizes by-pass flows more effectively to allow unimpeded upstream and downstream migration independent of water diversion operations, maintenance, debris blockage, or fish ladder damage. This dam is the most significant steelhead migration barrier within the lower Santa Clara River watershed.

2. Removal or modification of gray and red barriers in the Santa Paula, Sespe, and Hopper Creek drainages.
3. Identification and implementation of dedicated fish passage flows for the mainstem of the Santa Clara River and those reaches on Santa Paula Creek, Sespe Creek, and Piru Creek downstream of Harvey Diversion Dam, Fillmore Irrigation Diversion, and Santa Felicia Dam respectively.
4. Other high priorities are associated with many of the complex, instream migration barriers described and include; stream channel restoration, riparian restoration, removal of reservoirs harboring exotic and hatchery fish species, and elimination or reduction of erosion, pollution, and hazardous features.

Providing improved fish passage within the main tributaries of the lower Santa Clara River is a high priority to ensure that steelhead have adequate access between the critical headwater habitats and the ocean. This report outlines the specific, prioritized barriers in detail within the priority tributaries and habitat areas.

Table A2. Miles of habitat by tributary and habitat type. Approximately 17 miles of habitat were not assigned a habitat type.

	SC Mainstem	Santa Paula	Sespe	Pole	Hopper	Piru	Total
Bedrock Sheet		0.01	0.15				0.17
Cascade		0.05	0.13				0.18
Channel Confluence Pool			0.33				0.33
Corner Pool		0.02					0.02
Culvert		0.09		1.23		0.21	1.52
Dammed Pool	0.67		0.03			4.56	5.25
Dry		0.19	50.86		1.16	4.17	56.39
Glide	31.74	0.02	0.82		4.35	38.52	75.44
High Gradient Riffle			0.14				0.14
Low Gradient Riffle	0.04	0.02	0.32			0.66	1.04
Lateral Scour Pool - Bedrock Form		0.11	3.43			0.06	3.59
Lateral Scour Pool - Boulder Form		0.02	0.50				0.52
Mid Channel Pool		0.03	2.18				2.21
Plunge Pool		0.02	0.06		0.02	0.71	0.82
Pocket Water		1.24	2.88			11.66	15.77
Step Run	0.17	2.66	10.11			0.05	12.99
Step Pool		4.83	42.72	3.45	4.77	67.28	123.05
Trench Pool			0.55			0.15	0.70
Total	32.62	9.30	115.22	4.68	10.30	128.02	300.15

Introduction and Background

Background

The purpose of this project has been to analyze the habitat conditions, population status and barriers to migration for *Oncorhynchus mykiss* (steelhead trout) in the lower Santa Clara River watershed. The overall work was conducted from September 2004 through November 2005, with the field component being conducted during the summer and fall of 2004.

In 2004, Kelley concluded that significant impacts to the steelhead trout run on the Santa Clara River had taken place, but that further studies were needed before a list of restoration priorities for the run could be developed. The Santa Clara River Trustee Council Grant has provided the opportunity to address two of the three top recommendations from that study. This report communicates the results of those investigations, and provides a list of priority actions to be conducted on the Santa Clara River in order to rehabilitate the steelhead trout run.

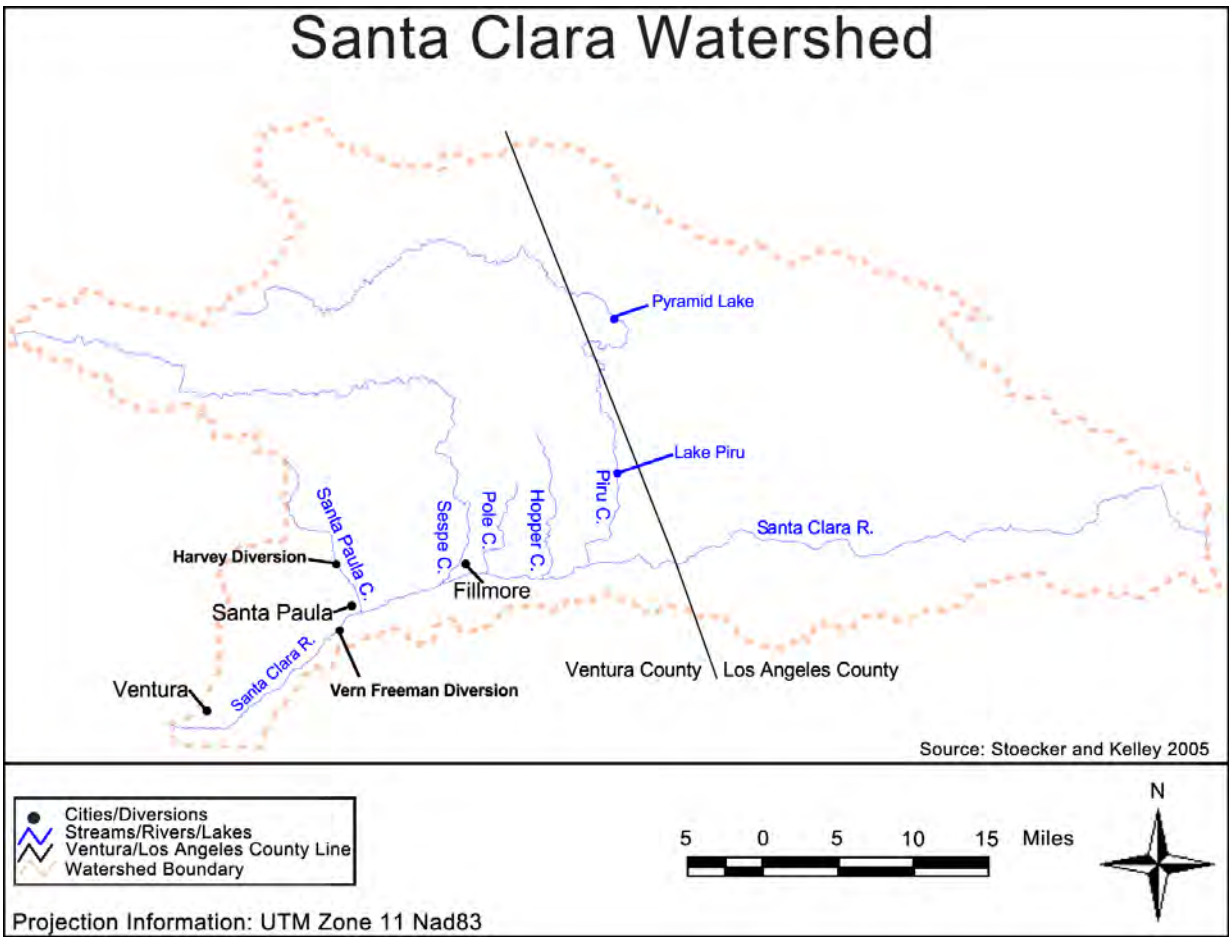
The Santa Clara River

The Santa Clara River watershed is located primarily in Los Angeles and Ventura Counties in California. The watershed is one of the largest in southern California, at 1600 square miles. The purpose of this project was to analyze the habitat conditions, population status and barriers to migration for *Oncorhynchus mykiss* (steelhead trout) in the lower Santa Clara River watershed from the Piru Creek tributary downstream including significant drainages (Map 2).

The steelhead trout run on the Santa Clara river prior to 1940 is estimated to have had thousands of fish and to have been one of the largest steelhead runs in southern California (Moore 1980a). Very few adult steelhead trout are currently observed returning to the Santa Clara River. Steelhead trapping and recording devices at the Vern Freeman Diversion Dam fish ladder have reported seven presumed adult steelhead since the construction of that dam in 1990. Surface water diversions and groundwater pumping on the Santa Clara River reduce the river's flows, and barriers to migration in the forms of diversion dams, bridge footings, culverts, and channelization projects impact access to the river's spawning and rearing habitat in the tributaries. Exotic predator fish such as green sunfish and bullhead catfish observed in Sespe Creek and other exotic gamefish in Piru Creek and other watershed reservoirs compete with and prey upon the native steelhead and rainbow trout population.

The tributaries that occur within the geographic boundaries of this study include: Santa Paula Creek, Sespe Creek, Pole Creek, Hopper Creek, and Piru Creek. The largest of these tributaries are Sespe and Piru Creeks. The Santa Felicia Dam was constructed in 1955 on Piru Creek, blocking access to significant steelhead spawning and rearing habitat.

The Santa Clara River watershed provides one of the top steelhead restoration opportunities in the entire Southern California Evolutionarily Significant Unit (ESU). Unlike many of the large rivers to the south, the Santa Clara River system remains in a relatively natural state and the mainstem has not been dramatically altered by concrete flood control channels or large impassable dams.



Map 2. Santa Clara River watershed and project tributaries.

Southern Steelhead Ecology and Habitat Requirements

The following section has been modified from Stoecker 2002.

Steelhead are rainbow trout which exhibit an anadromous lifestyle; being born in freshwater and spending a portion of their lives in the ocean before returning to freshwater to spawn. The scientific name *Oncorhynchus mykiss* is applied to both sea-run steelhead and coastal freshwater rainbow trout because they are morphologically similar and differ primarily in behavior. Healthy watershed habitat that provides the clean, cold water needed for steelhead to flourish also provides habitat for other species that utilize a variety of habitat niches within a watershed. The fact that steelhead populations have declined so dramatically in Southern California indicates that the region's watersheds have been severely modified, obstructed, and degraded. The recovery of wild, self-sustainable, steelhead populations in Southern California inevitably depends on reconnecting, restoring, and protecting the watershed components that they depend on.

Historic Distribution and Population Size

In recent history steelhead trout ascended streams from Mexico's Baja California Peninsula north to the Kuskokwim River, Alaska and across the Bering Sea to Russia's Kamchatka Peninsula and Okhostk Sea drainage's of the Western Pacific (Barnhart, 1986). The

current southern, natural limit of *O. mykiss* occurs in Northern Baja California. Historically, *O. mykiss* existed in almost every significant watershed within Southern California. Of these streams, the Santa Ynez River in Santa Barbara County is thought to have had the largest population of steelhead in Southern California with estimates of 13,000 to 25,000 adults returning in the 1943-1944 run (Titus, 1994). Moore (1980a) estimated the historical steelhead run up the Santa Clara River at around 9,000 adults. Since the beginning of the century it is estimated that steelhead populations have been reduced to less than one percent of their former population size in Southern California.

Geographic Variability

Despite the small amount of technical data, it has been widely observed that southern *O. mykiss* exhibit unique ecological requirements and behaviors, such as temperature tolerance, duration of different life stages, environmental flexibility, and polymorphic life history behavior. Coastal rainbow trout that do not become sea-run steelhead share many of the same ecological requirements with their anadromous relatives and appear to play a vital role in the sustainability of the anadromous steelhead population. The important relationship between non-anadromous rainbow trout and anadromous steelhead is well documented and should be referenced for additional information about the polymorphic life history behavior of *O. mykiss (*McEwan 2001, Thrower 2004a, Thrower 2004b, Aubin-Horth 2005). This "polymorphic perspective" is critical for resource managers to understand for successful long-term recovery planning. Remarking on the flexibility of the steelhead to environmental conditions Shapovalov and Taft (1954) noted that, "…steelhead migrate to sea at various ages and over a long period within a season, spend varying amounts of time in the ocean and return over a fairly long period within a season, are capable of spawning more than once, sometimes spawn before their first journey to sea, and may even remain in freshwater for their entire lives"(Cramer et. al 1994).

Genetic Uniqueness and Importance

Steelhead have strong homing abilities, so unique stocks or races have developed in specific drainages and in some cases tributaries of that drainage (Moyle, 1976). A 1994 study by Jennifer Nielsen found that the southern steelhead are genetically unique from northern stocks (Nielsen, 1994, 1999, 2005). Recognizing the uniqueness and importance of the devastated southern steelhead population, the National Marine Fisheries Service listed the southern steelhead as an endangered species, under the federal Endangered Species Act, in August of 1997 (Busby, 1996, National Marine Fisheries Service 1997).

Spawning

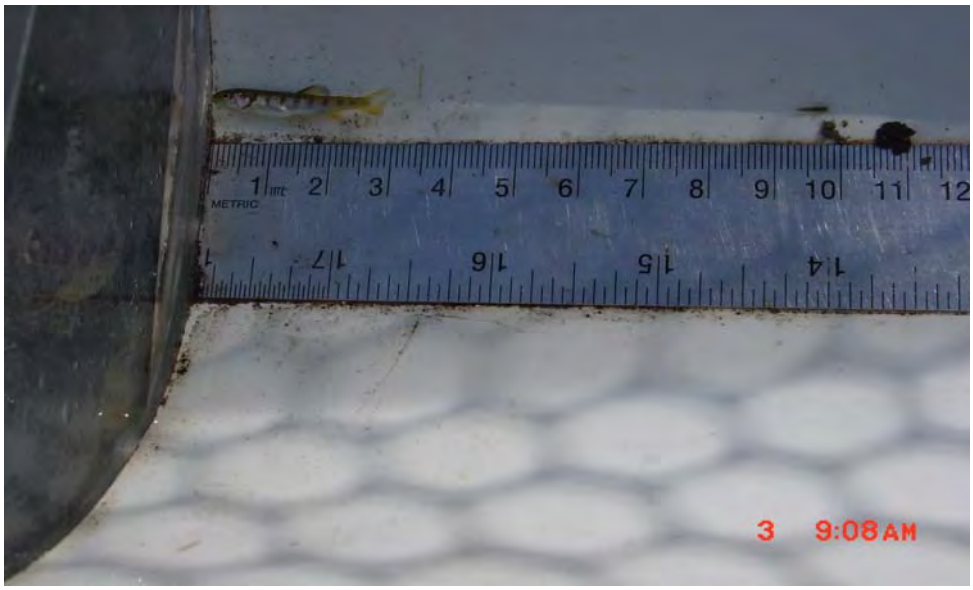
Pair of southern steelhead spawners
Photo courtesy of Scott Engblom

Steelhead spawn in cool, clear, well-oxygenated streams with suitable depth, current velocity, and gravel size (Reiser and Bjornn, 1979). This habitat type is usually associated with the upper reaches of streams and their tributaries. The optimal water depth for steelhead spawning is approximately 14 inches and ranges from about 6 to 36 inches (Bovee 1978). When a pair of adult steelhead reaches adequate habitat conditions during the spawning run, the female will clear out a depression (redd) in small to medium sized gravel substrate, where her eggs are laid. The male defends the redd from intruders and fertilizes the eggs as the female extrudes them (Shapovalov and Taft, 1954). The female then covers the eggs with a shallow layer of gravel to protect and stabilize them in their embryonic state.

Egg and Larval Development

The duration and success of egg incubation is highly variable and dependent on a number of factors including water temperature, dissolved oxygen concentration, and suspended sediment deposition. Eggs hatch into a larval stage (alevin) where they remain in the redd and feed on their attached yolk sack. Alevin are approximately 14.0 millimeters long when they are hatched and grow to 28.0 millimeter before becoming juveniles, at which point they have absorbed the yolk sac and leave the protection of the redd (Wang, 1986). The egg and larval stages of steelhead development are highly susceptible to environmental factors, and most natural mortality occurs at this time (Shapovalov and Taft, 1954).

Juvenile Development



Santa Ynez River, young of the year fry
Photo courtesy of Scott Engblom

Young juvenile steelhead (fry) often school together in shallow, protected areas along the stream margins. Fry are carnivorous and feed primarily on aquatic and terrestrial insects. As they grow, fry become territorial the school breaks up and many of the fry move into riffles that they will inhabit and defend. Fry tend to move into deeper water as they grow in size, inhabiting runs and pools (Barnhart, 1986). Juvenile steelhead are highly variable in length (2.8 cm.- 40.6 cm.) and usually stay in freshwater for one year or more (Scott and Crossman, 1973). The length of juvenile residence is determined by environmental and genetic factors. Southern steelhead tend to exhibit a high amount of flexibility in residence time due to the extreme and highly variable environmental conditions which exist throughout its range. Juvenile steelhead may remain in freshwater as coastal rainbow trout, mature, and spawn without ever migrating to sea. Similarly, rainbow trout offspring may produce young that migrate to the ocean to become steelhead (McEwan 2001).

Smoltification

Smolt, Santa Ynez River
Photo courtesy of Scott Engblom

Juvenile steelhead lose the dark oval parr marks along their sides and acquire a silver coloration when they undergo the drastic physiological change called smoltification, which allows them to migrate from freshwater to the saline ocean. Smolting steelhead, or "smolts", often display a dark tailing edge on their caudal, or tail, fin and have flaky silver scales. On the Santa Ynez River, Scott Engblom's research has found that outmigrating smolts measure between 150-200 mm in total length and are predominantly in the 160-170 mm range. Engblom found that most of the smolts are 1 year olds, but some are 2 years old (pers. comm. Engblom).

When favorable conditions exist, smolts leave their former stream habitat and may spend a period of time in an estuarine or freshwater lagoon environment before entering the ocean. Engblom found that outmigration of smolts on the Santa Ynez River typically occurs between mid-March and early May (pers. comm. Engblom). Due to the highly variable climatic conditions and flow regimes that exist in southern California, smolts may spend a considerable amount of time in the lagoon or estuary habitat found at the stream mouth. It is here where smolts acclimate themselves to saltwater and often times wait for adequate flow conditions to open the mouth of the stream allowing migration to the ocean. A study of the growth and subsequent smoltification of juvenile steelhead was conducted by Mark Moore on the adjacent Ventura River (Moore 1980b).

The Ocean Odyssey and Adulthood

Smolts gradually attain the steel-blue back coloration of sub-adults while feeding on the bounty of the northern Pacific Ocean. Some steelhead migrate extensively while feeding at sea and fish born in North American streams have been caught by commercial fisherman off the coast of Japan. Steelhead are also known to have short oceanic, or limited estuarine migrations. By utilizing abundant oceanic food sources such as juvenile greenling, squid, and amphipods, the majority of steelhead growth occurs in the ocean (LeBrasseur 1996; Manzer 1968). While at sea, southern steelhead can attain large sizes. Reports from the early 1900's related the popularity of fishing the

lower Santa Ynez River for steelhead as large as 9 kg (20 lbs.). One large steelhead documented in the Santa Clara River estuary January 1948 measured 33 inches long and 13 pounds. The range in size of returning steelhead is highly variable and dependant on many factors such as the duration of time spent in the ocean, abundance of prey, and individual hunting skill. Steelhead returning to freshwater for a second time, or more, are typically the largest returning fish. On the Santa Ynez River, Engblom has recorded adult steelhead from 14 to 28 inches in length (pers. comm. Engblom). Salmonid documentation collected and reported in Stoecker 2002 shows similar variability in the smaller coastal streams of Southern Santa Barbara County with documented steelhead up to 30 inches in length. Sexual maturity is obtained while southern steelhead are at sea and with this comes adulthood and the eventual urge to return to freshwater streams and spawn. Steelhead have excellent homing abilities and can effectively locate their stream of origin from thousands of miles away. It is believed that celestial navigation, the ability to detect the magnetic pull of the earth, and the ability to smell out individual river chemistry all contribute to guiding adult steelhead back to their natal streams.

The Spawning Run

Due to drought and/or human-related activities, southern steelhead are often impaired or blocked from accessing their natal stream due to low flow conditions. It has been observed that when faced with this prospect southern steelhead adapt, and either delay their upstream spawning migration until adequate flows exist or enter and ascend another suitable stream nearby (Kreider 1948). This action of straying from their stream of birth appears to be an important survival technique for a species whose freshwater habitat is dependant on extremely variable climatic conditions and human competition for resources, which may effectively eliminate upstream migration for a number of years. Migrating to a non-natal stream also provides the mechanism for steelhead to recolonize watersheds where they have been extirpated due to natural or human factors.

When favorable flow conditions exist, adult steelhead enter the lagoon, estuary, or stream mouth to begin their upstream migration. Steelhead can enter the stream any time flows permit, but in Southern California this generally occurs following sizable rainfall events during late fall, winter, or early spring and is dependant on the stream flow discharge of that particular season. During years with prolonged stream flows, steelhead have a larger window of opportunity to migrate upstream. During this journey upstream, steelhead utilize many components of the riverine habitat, both terrestrial and aquatic. Trees and bank side vegetation are used for shade and protective cover. Steelhead follow the path of least resistance upstream in order to minimize energy outputs. They accomplish this by utilizing submerged structures for protection from the current and by effectively reading the variable stream velocities provided by their riverine environment.

After a short while in fresh water, the silvery adult steelhead begin to take on the appearance of large rainbow trout and exhibit other morphological changes such as jaw configuration; which become more pronounced in the males. Spawning males usually have a more elongated jaw and snout that are turned inward toward the mouth. The hooked lower jaw is called a kype. Adult males usually become more colorful than the females in freshwater. As spawning nears, the males often display rusty crimson gill covers and a lateral stripe of similar color. Steelhead spawning characteristics, and the degree to which they change, are variable throughout their range. Southern steelhead typically spawn shortly after ascending the stream to suitable spawning habitat. Unlike Pacific salmon, not all steelhead die after spawning and they can return to the ocean, regain lost body weight, and enter the stream again as a larger repeat spawner during the following season(s). Steelhead may repeat this arduous life cycle several times during their life.

Adult Steelhead, Santa Clara River
Photo courtesy of Mark Capelli.

Migration Barrier Impacts on Steelhead

Steelhead and non-anadromous rainbow trout are highly mobile within their watershed; inhabiting different stream reaches as aquatic habitat conditions change over time. Steelhead utilize most accessible stream reaches within a watershed from the headwaters to the ocean, as migration corridors and for spawning, rearing, and over-summering. Barriers to migration between these reaches lead directly to the fragmentation and loss of steelhead habitat and may completely prevent adult steelhead from accessing a critical stream reach to spawn. Types of barriers include dams, road crossings, diversions, flood control channels, inadequate flow releases, water quality, and natural features such as waterfalls, cascades, and bedrock chutes.

Unnatural fragmentation of habitat reduces the amount of total available habitat and increases genetic isolation. The reduction of available habitat correlates directly to the reduction in population size of the species that uses that habitat. The lower mainstem of most river systems is utilized as a migration corridor between the ocean and critical spawning and rearing habitat found in headwater streams. The vast majority of the steelhead's freshwater life is typically spent in the upper reaches of a stream or tributary where suitable flow and habitat conditions exist for spawning and rearing. Genetic isolation encourages inbreeding within a population and can reduce the genetic diversity of a population. Ecological studies have shown that high genetic diversity within a species or population correlates to the ability of the population to both adapt to slow changes in environmental conditions and to survive environmental catastrophes common to Southern California, such as fires, floods, and droughts. Reduced genetic diversity through inbreeding also reduces the ability of steelhead populations to recover from disease. Anthropogenic migration barriers cause fragmentation which can lead to reduced genetic diversity, increased inbreeding, elevated risk of extirpation from a stream system, and the inability of steelhead to recolonize stream reaches where steelhead have been eliminated.

Steelhead Migration Capabilities and Limitations

Steelhead have physiological limitations that impede or prevent them from being able to migrate past certain natural and anthropogenic features and hydraulic conditions. It has been reported that 7 inches is the minimum water depth required for successful migration of adult steelhead (Thompson 1972, as cited in McEwan 2001). The distance fish must travel through shallow water areas is also critical. Water depth can be a significant barrier in streams that have been altered for flood control purposes (McEwan 2001). Inadequate downstream water releases from diversion dams can also present a severe migration barrier to steelhead. The California Department of Fish and Game (CDFG) Habitat Restoration Manual reports that an adult steelhead can maintain a maximum swim speed of 6.0 ft/sec. for 30 minutes until exhaustion and a maximum burst speed of 10.0 ft/sec. for 5 seconds until exhaustion. The maximum leap, or jump, speed is listed as 12 ft/sec. Jumping upstream of a structure becomes difficult or impossible when the jump pool depth becomes less than 1.25 times the jump height of the structure (measured from the pool surface to the top of the feature). For example, a barrier that has a vertical jump height of 4 feet above the surface of the downstream pool and has a jump pool depth of 5 feet, will be near the maximum jumping capability of an adult steelhead. Should the pool become shallower, the jump pool depth would decrease and the jump height would increase, likely resulting in an impassable structure.

Natural channels often exhibit a high degree of physical channel complexity, which can present natural impediments to fish movement, particularly upstream migration. These physical impediments can be temporarily reduced as a result of the rise from natural rainfall and run-off, which generally coincides with the timing of upstream migration of anadromous salmonids. Similarly some artificial barriers such as low-head weirs or near at-grade crossings, which present a partial complete impairment of instream fish movement under base flow conditions, can be temporarily rendered passable, under high flow conditions. However, such impediments complicate the movement of fish through a watercourse, and collectively have the effect of narrowing the window of opportunity for successful migration.

Methods

Population and Habitat Methodology and Data Gathering

While most of the Santa Clara River's mainstem occurs on private land a large portion of the main tributaries occurs within the Los Padres and Angeles National Forests. Access to survey stream reaches within the National Forests was limited only in the remoteness and relative inaccessibility. Extended backpacking survey expeditions into the Forests were conducted during late summer, fall, and early winter of 2004. An administration pass was provided by the Los Padres National Forest for extended parking and access within the Forest.

A schedule of priority stream reaches to be surveyed was created. Following review of available literature and discussions with local fisheries experts, project leaders decided that initial ground surveying efforts would be directed towards the Sespe Creek drainage on accessible public lands. Following surveys within the Sespe Creek drainage, efforts were focused on accessible public reaches within the Santa Paula Creek drainage. Selected example reaches on the mainstem of the Santa Clara River and the Piru Creek drainage were surveyed following coordination with project collaborators, receipt of a Ventura County access permit, and landowner permission. Stream reaches that could not be accessed due to time constraints and/or access limitations were surveyed from adjacent public lands, roads, or by air.

While field surveying was being conducted detailed parcel maps and a comprehensive list of landowners, both private and public, were developed for the Santa Clara River, Santa Paula Creek, lower Piru Creek, Sespe Creek, and Hopper Creek. After reviewing the parcel information acquired from the county, it was determined that the Ventura County Watershed Protection District permit, in addition to contacts already established with representatives from other agencies and several key landowners, would provide sufficient access to the Santa Clara River main channel and other tributary reaches to conduct example reach surveys without contacting several hundred private landowners. Liz Chattin assisted with obtaining County access and landowner parcel identification. Gretchen Coffman was helpful in providing knowledge and maps of habitat conditions on the main channel, identifying access points, and providing established landowner contacts for several property owners on the mainstem of the Santa Clara River.

A landowner access agreement letter was produced and sent to selected private landowners with parcels adjacent to lower Sespe, Santa Paula, Hopper, and lower Piru Creeks. This letter stated the nature of the survey and requested permission to access private property within the stream channel. A stamped postcard for willing landowners to return was included in this letter. Meetings with several landowners along the Santa Clara River, Sespe Creek, and Santa Paula Creek were conducted and access was obtained to conduct stream surveys on several dozen properties.

An encroachment permit was obtained from the Ventura County Watershed District to allow access to all Ventura County Flood Control property and/or easements for the Santa Clara River, Sespe Creek, Santa Paula Creek, and several sections on Hopper Creek. While this permit allowed entry to certain access points on the river, access was limited to Ventura County Flood Control property or easements within the river channel and did not ensure access across adjacent private lands.

The mainstem of Sespe Creek was ground surveyed from the downstream Los Padres National Forest boundary to upstream of Cherry Creek, near the Sespe Creek headwaters. The most significant tributaries to Sespe Creek from the West Fork Sespe Creek upstream to Cherry Creek were also surveyed. Sespe Creek tributaries that were surveyed include: Stone Corral,

Alder, Hot Springs, Park, Red Reef, Sycamore, Timber, Bear, Trout, Piedras Blancas, Lion, Howard, Rose Valley, Rock, Tule, Derydale, Potrero John, Munson, Burro, Chorro Grande, Ladybug, Godwin, and Cherry Creeks. Lower Sespe Creek was surveyed along private lands where permission was obtained downstream of the National Forest boundary. Higher stream flow habitat conditions following November 2004 rains were observed and surveyed on several reaches of Sespe Creek. Several private stream reaches on upper Sespe Creek were observed from adjacent public roads and from the air.

Public road crossings were assessed within the Santa Paula Creek sub-basin, Hopper Creek, Santa Clara River downstream of Piru Creek, lower Piru Creek, and other tributaries that enter the mainstem of the Santa Clara River from the north, and cross Highway 126. In some cases where inaccessible private lands bordered public crossings, observations of barriers and adjacent habitat was limited from the surface of the crossing. Santa Paula and Sisar Creek, and significant tributaries were surveyed on accessible private lands and within the National Forest. Several sample reaches on Piru Creek upstream of Pyramid Lake were surveyed as well as public road crossings on lower Piru Creek and tributaries downstream of Santa Felicia Dam.

Orbic Helicopters Inc. located at Van Nuys Airport was hired for two separate aerial surveying flights. The first aerial survey included the mainstem Santa Clara River from the ocean to Piru Creek, Sespe, Hopper, and Santa Paula Creeks, and Piru Creek below Santa Felicia Dam. Several small mainstem Santa Clara River tributaries were also surveyed. A second aerial survey was conducted along Piru Creek and it's tributaries upstream of Santa Felicia Dam.

Obtaining information about the historic and contemporary status and distribution of salmonids within the Santa Clara River watershed is an important factor in protecting known salmonid populations and prioritizing restoration projects. Project objectives were to identify existing salmonid populations in the field as well as compile historical documentation through data collection and personal communication with local experts. Existing salmonid documentation collected during this study was compiled in order to document historic salmonid presence along with current population presence and distribution identified in the field during this project. Relevant Santa Clara River steelhead data stored in the Capelli Steelhead Archives at UCSB and files in the U.S. Forest Service office in Santa Maria were reviewed and compiled. Historic salmonid population data were entered into an Excel spreadsheet.

Non-capture salmonid sampling techniques were utilized while conducting field surveys in order to assess current salmonid presence, distribution, and population status within the study area. Electroshocking and trapping methods that cause stress and mortality to salmonids were not used. Observations were made from the streambank and underwater. Streambank observation techniques included surveying streams in an upstream manner, wearing polarized glasses, using binoculars, and thoroughly observing habitats where salmonids are likely to occur. Underwater snorkeling methods were also used to identify salmonids with greater accuracy in deeper runs and pools. These techniques are an effective and safe way to identify the relative abundance and distribution of salmonids.

The upper tributaries of Sespe Creek, particularly those entering the mainstem from the north were heavily impacted by the Wolf Fire in 2002, which denuded much of their watersheds prior to the initiation of the present study. Additionally, the study was preceded by five years of average or below average rainfall, which also adversely affected the salmonid populations and significantly altered the habitat conditions within the upper reaches of Sespe Creek and its tributaries. Lastly, one of the wettest winters in recent history occurred during the 2004/2005 season following the survey efforts. These factors have profound effects on the habitat conditions encountered in a given year. For example, the amount of surface flow in the mainstem of Sespe Creek during the surveys was likely minimal relative to years in recent history. As a result fish distribution and relative abundance may be comparatively low. Recent fire and rainfall history in the watershed must be considered in putting the habitat and fish data collected as part of this

study in appropriate perspective. Future studies of the Santa Clara River watershed conducted under differing environmental conditions should take these considerations into account.

Population and Habitat Analytical Methods

Habitat

Determining stream reach habitat scores within the watershed was essential for analyzing and prioritizing different tributaries, habitat reaches, and steelhead migration barriers for fish passage improvement projects. Unique habitat reaches were determined and assigned a habitat quality score based on selected habitat parameters. The habitat score for a stream reach was determined by multiplying the stream reach habitat length, or quantity, by the determined habitat quality. This method of multiplying habitat quantity by habitat quality to obtain a habitat score is consistent with the habitat scoring method developed by Ross Taylor for the California Department of Fish and Game's "Priority Ranking of Culverts for Treatment" (2003). Habitat parameters were developed and modified from the CDFG Habitat Manual's "Habitat Inventory Data Form" (California Department of Fish and Game 2003). After all field data were collected, the field data sheets were compiled and verified.

Habitat Quantity Criteria

For most identified habitat reaches the linear quantity of stream was measured in the field using a laser yardage meter and following the streams thalweg. The stream reaches that could not be ground surveyed were determined by using a Global Positioning System (GPS) to identify the upstream and downstream survey locations for a reach and measuring the distance within a Geographic Information System (GIS). The measurements followed the thalweg as delineated by the U.S. Geologic Survey (USGS) blue-line streams.

Habitat Quality Criteria

For each habitat reach, a habitat quality value was determined by adding the identified habitat parameters that directly influence the quality of steelhead spawning and rearing habitat. Table B. shows the habitat parameters and values that were used to determine the habitat quality score, and a description of the parameters follows.

Table B. Habitat Parameters used in Habitat Scores

Habitat Parameters	Values and Categories			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
	1	**0.75**	**.05**	**0.25**
Percent Substrate Embeddedness	0 –25%	26 –50%	51 –75%	76 – 100%
Spawning Substrate, Relative Abundance	High	Moderate	Low	Absent
Instream Shelter %	76 – 100%	51 –75%	26 –50%	0 –25%
% Riparian Canopy Cover	76 – 100%	51 –75%	26 –50%	0 –25%
Maximum Water Depth, inches	> 72"	49" - 72"	12" - 48"	< 12"
Surface Flow	Perennial	-	Variable	Dry
Channel Alteration	Absent	< 40% of reach	40 - 80% of reach	>80% of reach
Presence of Exotic Fish	N	-	-	Y
Number of *O. mykiss* Age Classes	4	3	2	1
Relative Abundance of *O. mykiss*	0.064-0.730	0.015-0.062	0.005-0.014	0.001-0.004

Each of the above parameters was selected to be included in the scoring because it represents a key habitat characteristic necessary to a steelhead lifestage. The significance of each parameter is explained below along with the scoring guidelines.

Percent Substrate Embeddedness

Embeddedness indicates the level of fine sediment that has settled out on or around adequately-sized spawning gravel and is directly correlated to how freely gravel can be moved in the stream and how much space there is in the gravel for dissolved oxygen and water flow. This is important during the egg and larval stages of development for steelhead. CDFG Habitat Restoration Manual identifies “Pool Tail Embeddedness” as an important Habitat Inventory Method component and states that: “Percent cobble embeddedness is determined at pool tail-outs where spawning is likely to occur. Sample at least five small cobbles (2.5” to 5”) in diameter and estimate the amount of the stone buried in the sediment. This is done by removing the cobble from the streambed and observing the line between the “shiny” buried portion and the duller exposed portion. Estimate the percent of the lower shiny portion using the corresponding number for the 25% ranges. Average the samples for a mean cobble embeddedness rating.”

0.25 = Greater than 75% substrate embeddedness
0.50 = 75%-51% substrate embeddedness
0.75 = 50%-26% substrate embeddedness
1.00 = Equal to, or less than, 25% substrate embeddedness

Spawning Substrate, Relative Abundance

This parameter indicates how much spawning gravel of adequate size for building spawning redds is available within ideal tailout reaches or other potential spawning areas in a habitat reach.
0.25 = Adequately sized spawning substrate scarce or absent
0.50 = Low abundance of adequately sized spawning substrate present
0.75 = Moderate abundance of adequately sized spawning substrate present

1.00 = High abundance of adequately sized spawning substrate present

Percent Instream Shelter

Instream shelter is used by juvenile and adult steelhead to hide from predators. CDFG Habitat Restoration Manual identifies Instream Shelter as an important Habitat Inventory Method component and states that: "Instream shelter percent cover is a measure of the area of a habitat unit occupied by instream shelter. The area is estimated from an overhead view."

0.25 = 0%-25%
0.50 = 26%-50%
0.75 = 51%-75%
1.00 = 76%-100%

Percent Riparian Canopy Cover

Riparian canopy cover provides shading and cooling of stream water, an important function in southern California. Riparian vegetation also provides essential vegetative material and woody debris that provide cover and a food source for aquatic insects that trout feed on. CDFG Habitat Restoration Manual identifies "Total Canopy" as an important Habitat Inventory Method component and describes the "percentage of the stream area that is influenced by the tree canopy".

0.25 = 0%-25%
0.50 = 26%-50%
0.75 = 51%-75%
1.00 = 76%-100%

Maximum Water Depth

Water depth is highly important for providing cool water temperatures and refugia for all life stages, especially during the low water summer and fall months when this survey was conducted. CDFG Habitat Restoration Manual identifies "Maximum Depth" as an important Habitat Inventory Method component and describes to "enter the measured maximum depth for each habitat unit".

0.25 = Maximum depth less than 12 inches
0.50 = Maximum depth between 12-48 inches
0.75 = Maximum depth between 49-72 inches
1.00 = Maximum depth greater than 72 inches

Surface Flow

CDFG Habitat Restoration Manual identifies "Flow" as an important Habitat Inventory Method component on the Data Form. For this study, due to the occurrence of dry stream reaches encountered during the summer and fall survey period, surface flow characteristics in a reach were identified in one of the three categories below. These categories were modified from a habitat methodology developed by Stoecker for a CDFG funded habitat and barrier assessment of Southern Santa Barbara County streams (Stoecker *et. al.* 2002).

0.25 = Dry

Dry streambed conditions were observed and are thought to generally occur in this reach during drier months of a typical rainfall year or throughout the year during years

with low rainfall. (Some reaches that are dry for extended periods may provide spawning and temporary rearing habitat when flows are present and will receive points elsewhere for other characteristics such as riparian canopy cover and substrate embeddedness and abundance.)

0.50 = Variable

Variable surface flow conditions observed in this reach. Areas of dry streambed may occur, along with isolated pools, and/or portions of trickling surface flows during drier periods. The availability of summer and fall surface flows in this reach is dependent on constantly changing climatic, geologic, and potentially human-influenced factors. During wetter years, this reach may retain continuous surface flow conditions. During extended drought years the entire reach may dry up.

1.0 = Perennial

Surface flows were observed during late summer/fall 2004 surveys and are believed to exist continuously throughout the year in this reach. Factors mentioned above in the "Variable" description may alter the perennial designation of the stream reach or sections of it in the future.

Channel Alteration

This habitat parameter was identified in the California Department of Fish and Game Aquatic Bioassessment Laboratory's Physical Habitat Quality methodology dated May 1999. The value describes the percentage of area that structures such as channelization, bridge abutments, road crossings, levee construction, bank revetment, or other anthropogenic features within the stream channel cover within a given stream reach.

0.25 = Greater than 80% of the reach altered
0.50 = 40%-80% of the reach altered
0.75 = Less than 40% of the reach altered
1.00 = No channel alteration observed

Number of *O. mykiss* Age Classes

This provides an estimate of population structure, the more age classes that are present within a reach the healthier that population may be due to the quality of habitat and this diversity is indicative of adequate year round habitat conditions. CDFG Habitat Restoration Manual identifies age categories within the Fish Sampling Methods and states that: "Juvenile salmonids should be placed in general age categories according to length: 0+ = 3 inches or less, 1+ = 3 to 6 inches, 2+ = 6 inches or greater" For this study, a fourth (3+) age class of fish greater than 9 inches was created.

0.25 = One age class observed
0.50 = Two age classes observed
0.75 = Three age classes observed
1.00 = Four age classes observed

Relative Abundance of *O. mykiss*

The relative abundance of *O. mykiss* was determined based on non-capture observations from the streambank and snorkeling selected pools and is a conservative density value used to compare observed stream reaches. Streambank observations were made simultaneously by Stoecker and Allen while surveying slowly upstream and using

polarized glasses. One pass was made at each pool or run and the higher observed number of total *O. mykiss* was recorded and age classes sorted. Snorkel surveys were conducted sporadically at selected deeper pools and runs where bank observations were not possible. Reaches with a wetted width of less than 8 feet were surveyed with one pass by one surveyor. Reaches greater than 8 feet in width were surveyed with one pass by two surveyors. All passes were conducted in an upstream manner from the downstream thalweg of the pool or run. Estimating relative abundance was not part of the original scope of this project, but was later computed based on data collected from the established data sheet protocol. Established NOAA survey protocols were not utilized during survey efforts due to time and budget limitations. This relative abundance value should not be considered the actual density of *O. mykiss*, which would be higher in many reaches if snorkeling surveys or intrusive capture techniques were utilized throughout the study area. Relative abundance categories for *O. mykiss* were calculated based on the 122 stream reaches in which *O. mykiss* were observed. Relative abundance was calculated as the number of fish observed divided by the length of habitat for each of the 122 reaches. These abundances were then divided into four equal groups. Reaches that were not ground surveyed did not receive any score for *O. mykiss* relative abundance. Many of these unsurveyed reaches may contain *O. mykiss* during some years or parts of a given year.

0.00 = No *O. mykiss* observed.
0.25 = 0.001 - 0.004 *O. mykiss* per linear foot of stream.
0.50 = 0.005 - 0.014 *O. mykiss* per linear foot of stream.
0.75 = 0.015 - 0.062 *O. mykiss* per linear foot of stream.
1.00 = 0.064 - 0.730 *O. mykiss* per linear foot of stream.

Habitat Quality Scoring Limitations and Discussion

Habitat quality values on stream reaches that were not ground surveyed due to access restrictions were estimated from adjacent public road or land or aerial surveying. In cases where no stream observations could be made, the physical habitat values from the adjacent stream reach with the lesser (conservative) habitat values were assigned to the unsurveyed reach. Habitat quality values and habitat reach scoring methods used are not intended to assess the complex habitat conditions of the Santa Clara River estuary.

The Santa Clara Estuary historically encompassed approximately 300 acres of open water habitat, but is currently limited to approximately 30 acres, a reduction of 90% since the turn of the century (City of San Buenaventura 2005). Assessing the current use of the Santa Clara River Estuary by rearing or acclimating juvenile steelhead (or acclimating adults) requires a level of effort that was beyond the scope of the present study. However estuarine habitats, which have been studied in other California coastal watersheds, have been shown to provide highly productive rearing habitat, disproportionate to the total amount of freshwater rearing habitat available in the river system (Smith 1982, 1990). The historic or current role of estuarine systems in the maintenance of steelhead populations in watersheds south of Point Conception has not been systematically investigated, but warrant investigation as part of a larger recovery planning effort.

Habitat quality values apply to the quality of that reach for salmonids only and should not be interpreted as the ecological health of that reach or the quality of that reach to other fish or aquatic species. Stream conditions were surveyed during a snapshot in time and values will fluctuate within and between seasons. For example, the record rainfall and stream flows of early 2005 occurred following this project's stream survey efforts and dramatically changed the stream

conditions within many of reaches of the watershed. Santa Paula Creek experienced major stream channel alterations and several fish migration barriers were destroyed or significantly damaged.

Barrier Methodology and Data Gathering

Migration Barrier Identification and Locations

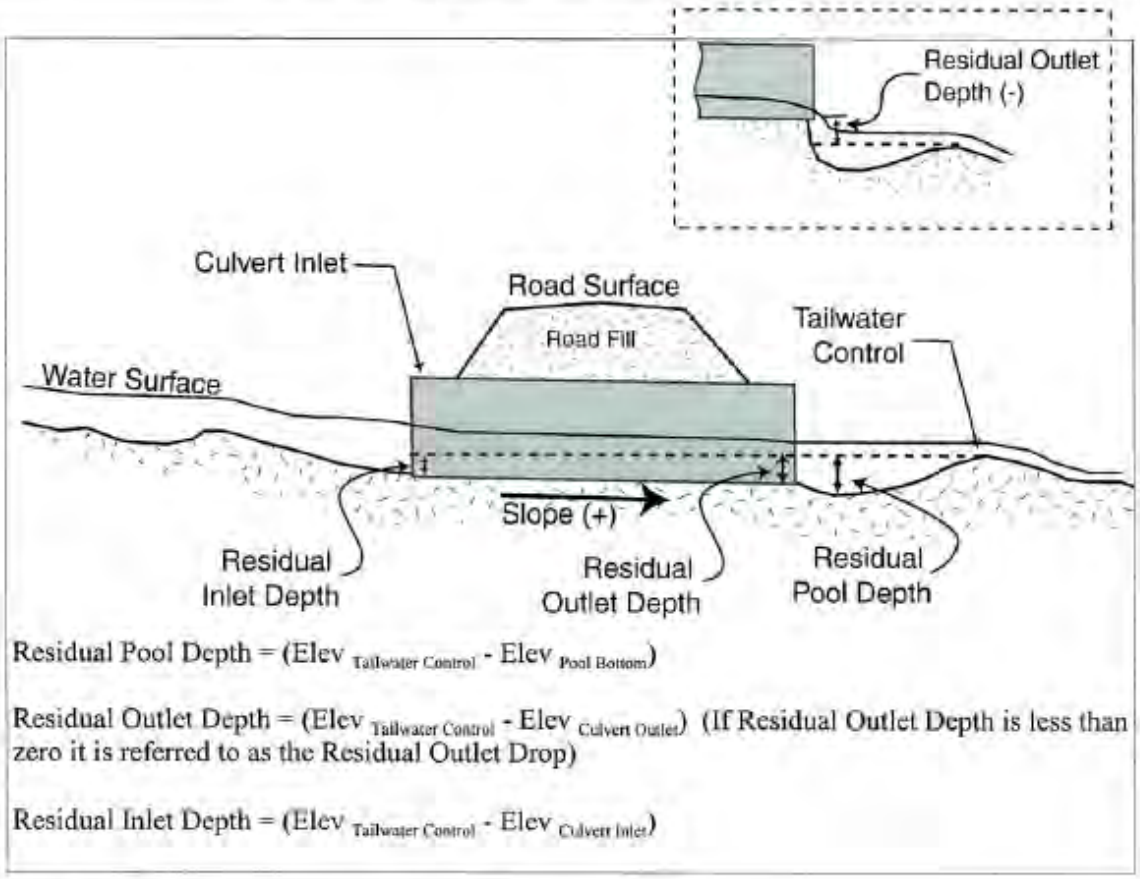
One of the principle objectives of this project was to identify steelhead migration barriers within the Santa Clara River in order to prioritize fish passage improvement projects. In addition to anthropogenic barriers, natural upstream barriers and limits to migration were identified in order to determine the amount of habitat available to steelhead. The term "barrier" in this report refers to any structure in the stream channel that impedes, with varying degrees of difficulty, or completely blocks upstream adult steelhead migration. All barriers identified were assigned a unique Barrier ID. This unique Barrier ID describes, in code, the stream and order in which the barrier is encountered moving upstream from the Santa Clara River mouth. For example, SC_1 is the first migration barrier identified on the Santa Clara River (SC). Barrier SC_SE_LN_4 is the fourth upstream barrier identified on Lion Creek (LN), a tributary to Sespe Creek (SE).

The locations for many of the identified barriers were recorded in the field using a GPS unit. A GPS signal could not be acquired at certain locations due to signal interference with dense riparian canopy cover, confined canyon walls, or overcast conditions. Where private land was not accessible, barriers were identified through document research, interviews, aerial photographs, and/or aerial surveying techniques. Upstream natural limits were also estimated on some stream reaches, by locating where the stream sustains a slope of 10-15% using CDFG barrier estimation methods and based on stream slope assessment on USGS topographical maps.

Barrier Severity

The barrier ranking method utilized for this project was developed to focus on biological considerations for restoring fish passage to the highest priority habitat reaches in the watershed. This ranking does not include complex social and economic factors. These important factors need to be further assessed in the site-specific restoration planning phase for each structure.

Fish Passage Inventory Data Sheets were developed to collect essential information about each barrier. The data sheets were modified from the template provided in the CDFG Habitat Restoration Manual. All collected barrier data were entered into a database. The CDFG "Green-Gray-Red Passage Evaluation Filter" was then utilized to identify sites that provide, or fail to provide, fish passage for all fish species and their life stages. The following road crossing barrier diagram (Figure (IX-16) and GREEN-GRAY-RED first-phase passage evaluation filter diagram (Figure IX–17) from the CDFG Manual shows how the filter works and the description of the three categories is below (image quality could not be improved).



Residual Pool Depth = (Elev $_{\text{Tailwater Control}}$ - Elev $_{\text{Pool Bottom}}$)

Residual Outlet Depth = (Elev $_{\text{Tailwater Control}}$ - Elev $_{\text{Culvert Outlet}}$) (If Residual Outlet Depth is less than zero it is referred to as the Residual Outlet Drop)

Residual Inlet Depth = (Elev $_{\text{Tailwater Control}}$ - Elev $_{\text{Culvert Inlet}}$)

Figure IX-16. Measurements used in filtering criteria.

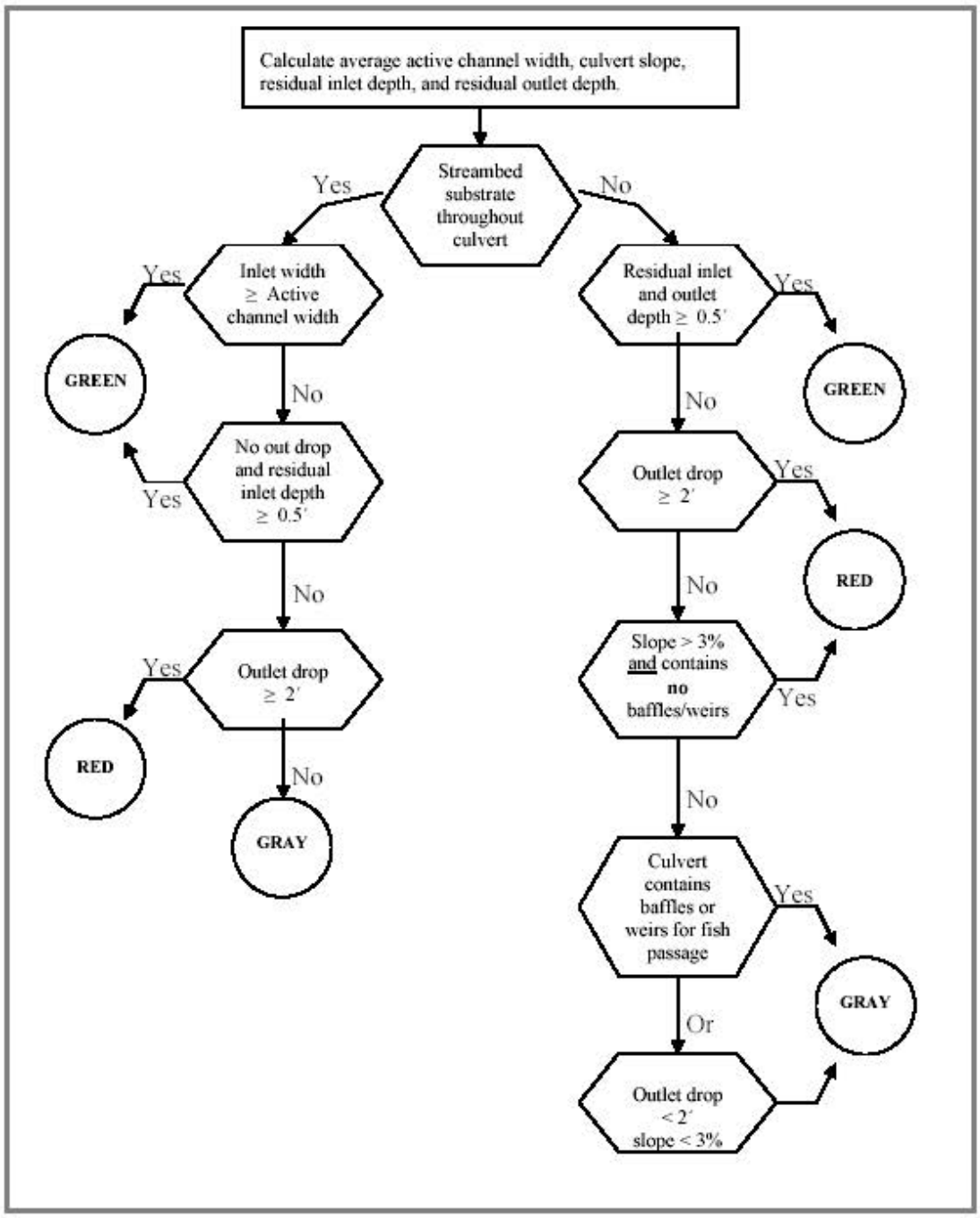


Figure IX-17. GREEN-GRAY-RED first-phase passage evaluation filter.

Green: Conditions assumed adequate for passage of all salmonid life stages during low flow conditions observed throughout this survey. Higher flows would generally submerge these structures allowing unimpeded upstream access for fish. Some in channel structures occur that were identified, but do not represent an immediate migration barrier problem for fish passage. For example, an old broken down dam on Sespe Creek used to be a significant barrier before the 1969 flood destroyed most of it. Currently, fish passage over natural substrate occurs with remnants of the dam adjacent to the channel. These green structures should be monitored to ensure that conditions do not change and cause a barrier in the future.

Gray: Conditions may not be adequate for all salmonid species at all their life stages. There may be a variety of problems/issues that cause a barrier to be rated gray, so the software FishXing (pronounced "fish crossing") can be used to determine the extent of difficulty that a barrier presents to each salmonid stage. FishXing was applied where appropriate for this project, however very few barriers that rated gray were accessible to be ground surveyed. Additionally, FishXing is generally developed for evaluation of culvert road crossings and there are few of those type of barriers on the Santa Clara River. As a result there was only one gray barrier with sufficient data that met all conditions that could be evaluated using FishXing and that is discussed in that individual barrier's evaluation. Determination of gray barrier value was made during low flow conditions observed throughout this survey. Potential barriers on private land where access was not permitted were given a gray severity and will need to be ground surveyed and analyzed further.

Red: Condition fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present. Analysis of habitat quantity and quality upstream of the barrier is necessary to assess the priority off this crossing for treatment.

Migration Barrier Priority Ranking Method

The objective of the ranking method is to prioritize the anthropogenic migration barriers within the study area for restoration or improvement of upstream adult steelhead passage. The highest priority barriers are those that partially (gray) or completely (red) impede upstream migration and have high total habitat scores upstream of the barrier to the natural upstream limit(s). This method ensures that migration barriers in a watershed are prioritized from the furthest downstream structure directly impacting anadromous steelhead to structures upstream that may impact steelhead in the future when adequate downstream access is provided. This method allows migration barriers within the accessible "anadromous reach" of a watershed and the inaccessible "non-anadromous reach" to be ranked and prioritized.

Procedure

1) All anthropogenic barriers that were assigned a red or gray value within the DFG Passage Evaluation Filter were ranked in order of descending score.
2) All anthropogenic green barriers were ranked, after the red and gray grouping, in order of descending score.

Study Findings

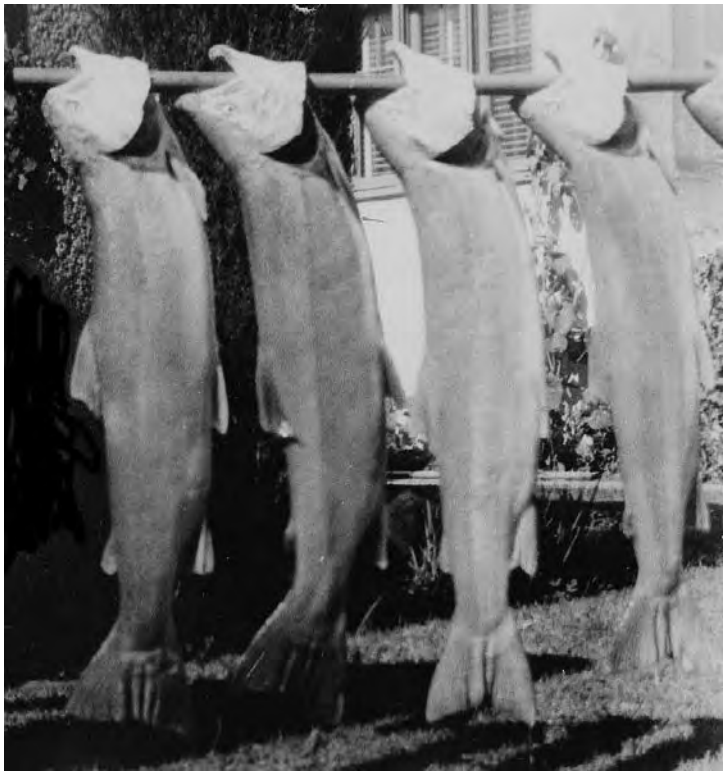
Historic Salmonid Photograph Gallery

The following photographs were obtained from Mark Capelli at NOAA Fisheries and provide excellent visual documentation of Santa Clara River steelhead from years past.

Sespe Creek Steelhead: 5-6 lbs, 25-27 inches. Captured near lower Sespe Creek by William A. Brown, Winter 1911.

Sespe Creek Steelhead: c. 5-7 lbs,, 18-27 inches. Captured by local fishers in lower Sespe Creek, Winter 1917.

Santa Clara River Steelhead: 9.75 lbs, 31 inches. Captured in the lagoon at the mouth of the Santa Clara River by John B. Colla, Winter 1942.



Santa Clara River Steelhead: 4-6 lbs, 24-26 inches. Captured at the mouth of the Santa Clara River by Ben Smith, Winter 1947.

Santa Clara River Steelhead: c. 6.5 lbs, 26 inches. Captured at the mouth of the Santa Clara River by Ben Smith, Winter 1947.

Santa Clara River Steelhead: 13 lbs, 31 inches. Captured at the mouth of the Santa Clara River by Charles D. Price, Winter 1948.

(Star-Free Press Photo)

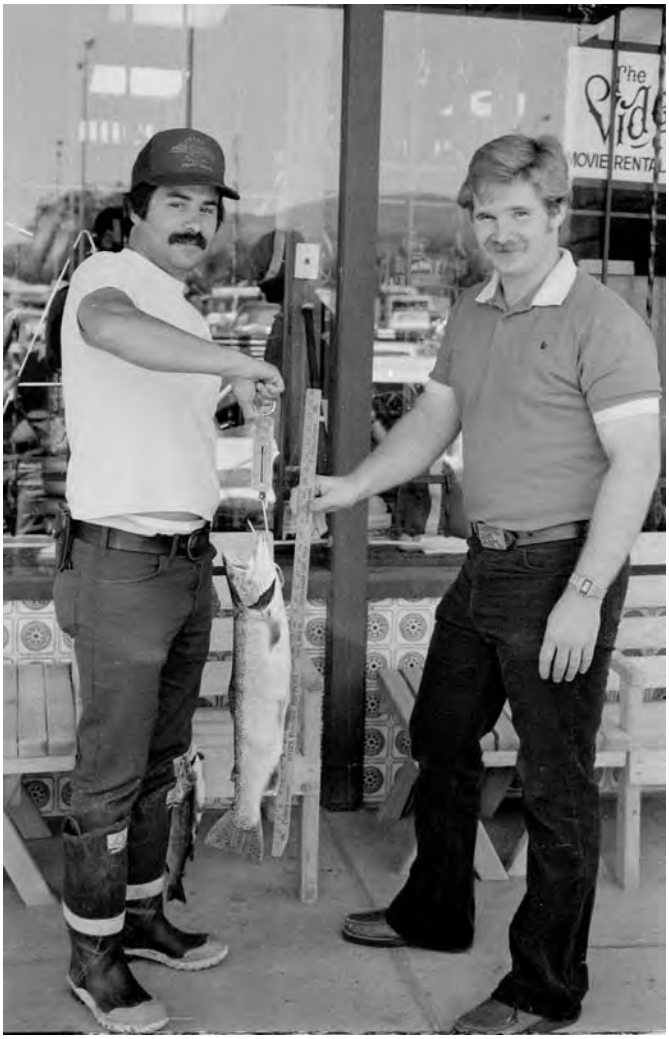
PISCATORIAL PRIZE—Ronald Dovin displays the 33-inch, 13-pound steelhead which he caught Tuesday near the mouth of the Santa Clara river. Dovin is conceded a good chance of winning the second annual steelhead derby trophy offered by Ross Corey of Arnett's sporting goods store. The piscatorial beauty was placed on display yesterday at Shaffer's sporting goods.

Santa Clara River Steelhead: 13 lbs, 33 inches. Captured at the mouth of the Santa Clara River by Ronald Dovin, Winter 1948.

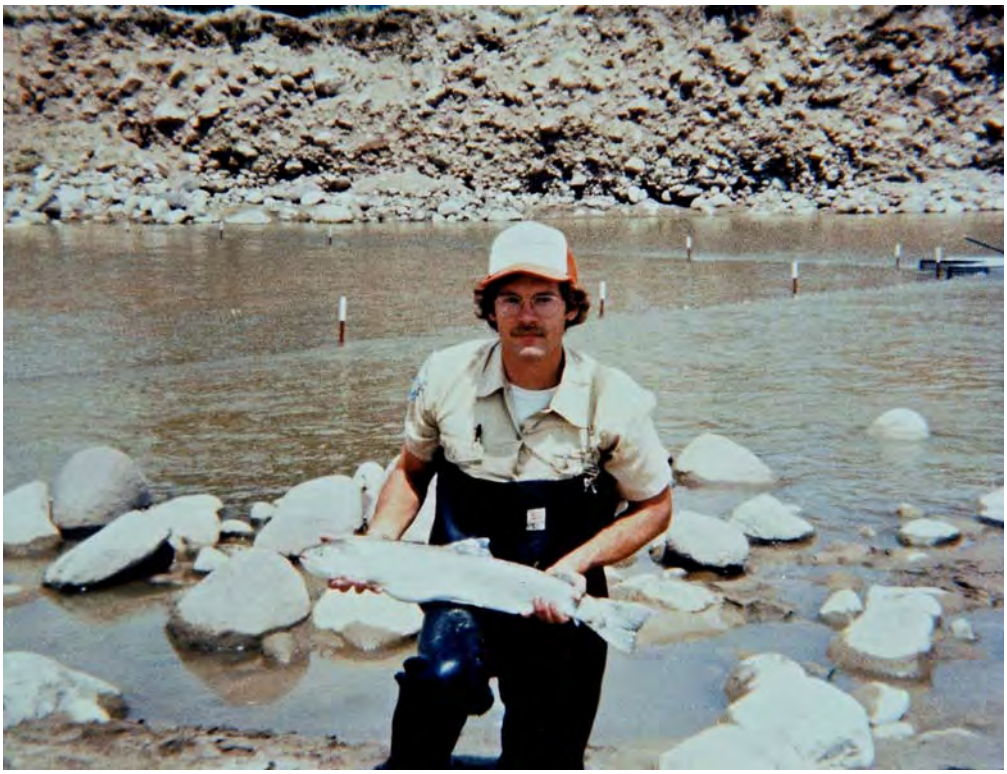
Santa Clara River Steelhead: 8 lbs, 27 inches. Captured at the mouth of the Santa Clara River by J. R. Miller, January 31, 1971.

Santa Clara River Steelhead: 8 lbs, 27 inches. Captured at the mouth of the Santa Clara River by J. R. Miller, January 31, 1971.

Santa Clara River Steelhead: c.1 lbs, 15 inches. Captured below sand and gravel quarry in the Santa Clara River by Ernest Mitchell, December 15, 1972.



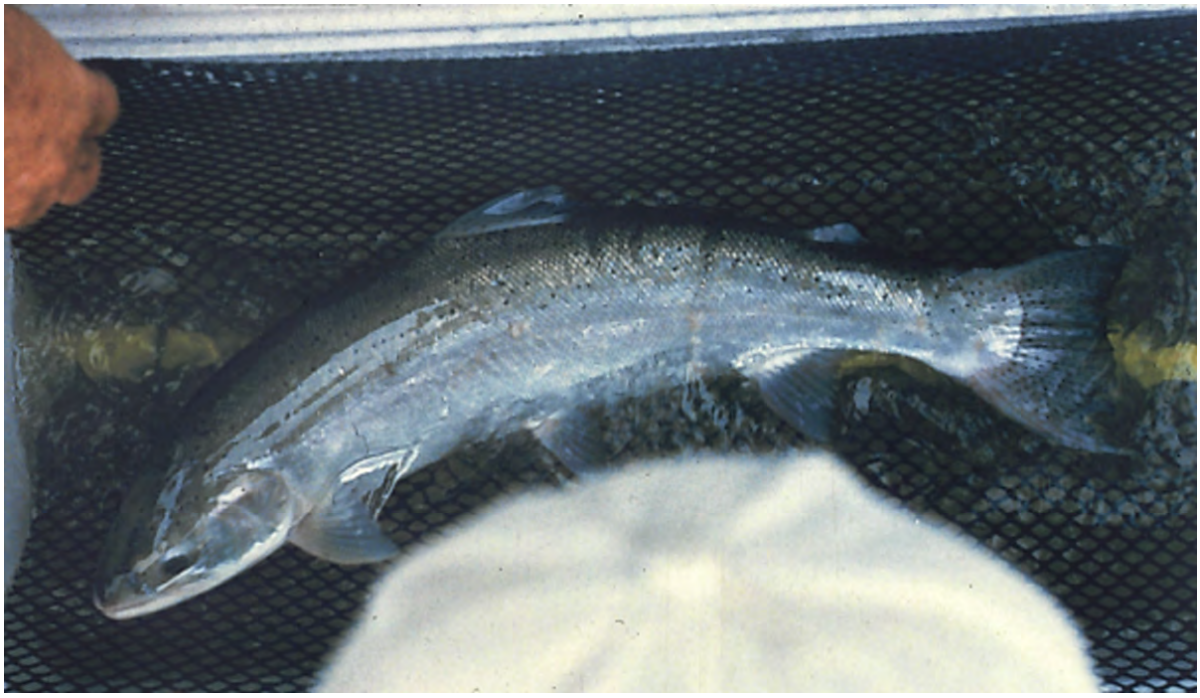
Sespe Creek Steelhead: 4.5 lbs, 24 inches. Captured by William Cardona in lower Sespe Creek, April 24, 1983.



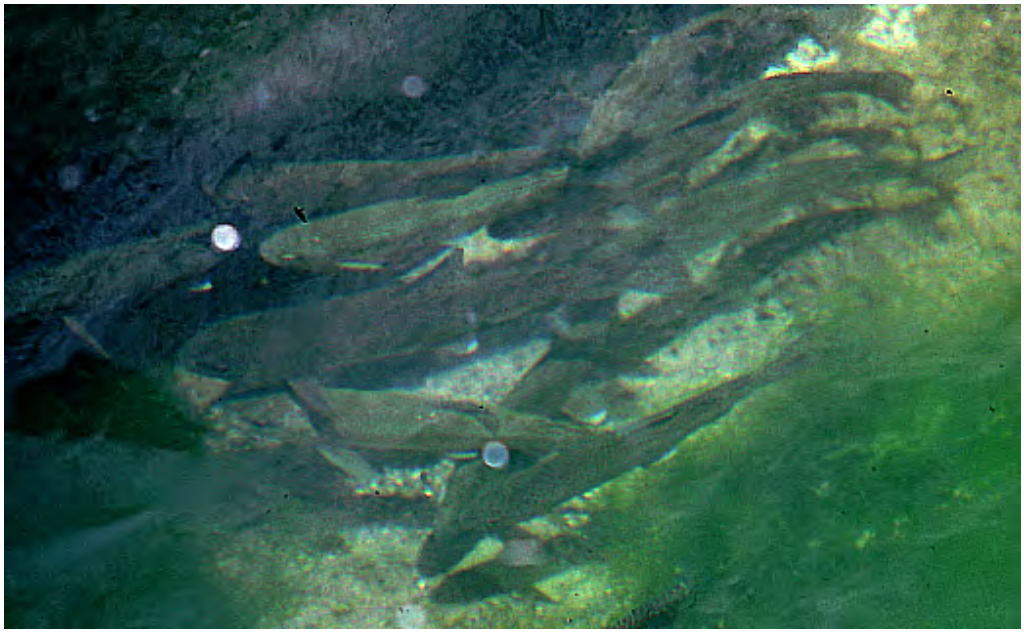
Sespe Creek Steelhead: 6.5 lbs, 27 inches. Captured near Goodenough Road by California Department of Fish and Game personnel, April 26, 1983.

Sespe Creek Steelhead: 6.5 lbs, 27 inches. Captured near Goodenough Road by California Department of Fish and Game personnel, April 26, 1983.

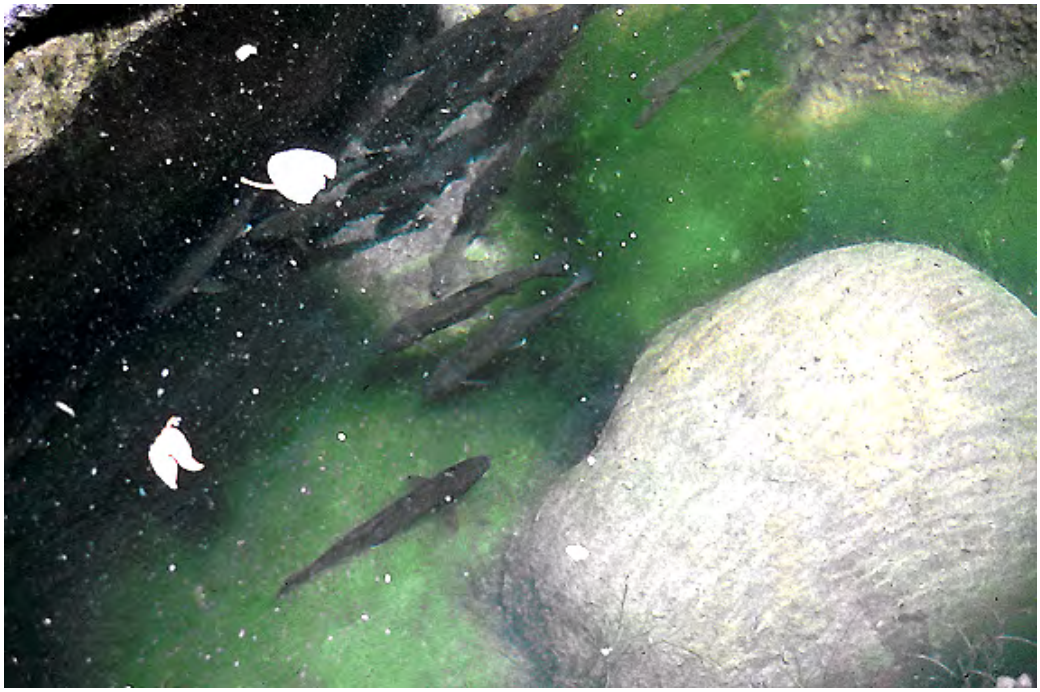
Sespe Creek Steelhead: c. 4.5, 18.75 inches. Captured in upper Sespe Gorge by Mark R. Moore, April 1983.



Santa Clara River Steelhead: c. 5 lbs, c. 25 inches. Captured at the Vern Freeman Diversion on the Santa Clara River by United Water Conservation District, March 2, 1995.



Sespe Creek juvenile Steelhead: 10-15 inches. Photographed by Mark H. Capelli in Sespe Gorge, June 1996.



Sespe Creek juvenile Steelhead: 9-13 inches. Photographed by Mark H. Capelli in Sespe Gorge, June 1996.

Sespe Creek juvenile Steelhead: 1-2 lbs, 15-17 inches. Captured by Mark H. Capelli in Sespe Gorge, June 1996.

Historic Salmonid Survey Database

The information in the following table was obtained from the two locations mentioned in the Methods section and entered into a database. The entries are organized as follows:

1. Santa Clara Mainstem
2. Santa Paula Creek and Tributaries
3. Sespe Creek
4. Sespe Creek Tributaries
5. Hopper Creek
6. Piru Creek and Tributaries

Within these sections, the information is organized alphabetically if necessary, and then chronologically. The sources for the database include interviews, anecdotal documentation, fish surveys, biological reports, and newspaper accounts.

Table C. Historical Salmonid Observations

The Santa Clara River Mainstem								
Stream(s)	**Location**	**# of Salmonids Observed or Documented**	**Fish Size-Total Length in Inches (Weight in Pounds)**	**Date of Observation (YEAR-MO-DY)**	**Observer(s)**	**Affiliation**	**Source of Information**	**Observation / Documentation Notes**
Santa Clara River	Santa Clara River	General Population Account	See notes	1900's Early to Mid	see notes	see notes	Moore, Mark. 1980. An Assessment of the Impacts of the Proposed Improvements to the Vern Freeman Diversion on Anadromous Fishes of the Santa Clara River System, Ventura County, California.	"The Santa Clara River system historically supported larger numbers of adult steelhead than today… Hubbs, citing the California Department of Fish and Game reported 'large and consistent runs into the Santa Clara River. Kreider included the Santa Clara River in a list of Pacific coast steelhead fishing streams having a regular annual migration when water conditions were normal."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Santa Clara River	General Population Account	See notes	1900's Early to Mid	see notes	see notes	Moore, Mark. 1980. An Assessment of the Impacts of the Proposed Improvements to the Vern Freeman Diversion on Anadromous Fishes of the Santa Clara River System, Ventura County, California.	"...it is reasonable to project that the average annual run in the Santa Clara River before access to these tributaries was blocked or impeded was approximately 9000 adult steelhead." – Projections made from his comparison to Ventura River to the north and respective habitat and conditions .

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Downstream of Sespe Creek	Numerous	Adult Steelhead	1900's Early to Mid	Charles Outland	Angler	Excerpt from: "Flyfishing the West", Article: Of Steelhead and Condors, by Mark Moore. Volume 4, No. 5, November - December 1981	"Charles Outland, a noted historian and author now in his eighties, remembers fishing for the runback (steelhead returning to the ocean after spawning: 'During low water periods in the late spring and summer, they would congregate in deep, willow-lined pools below the confluence of Sespe Creek and the Santa Clara, where farmer's seasonal diversion ponds existed." It seems likely that some of these adult steelhead were not going to make it back to the ocean this late in the year and would over-summer within the mainstem Santa Clara River (Stoecker).

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Lower Santa Clara River	Numerous	Adult Steelhead	1900's Early to Mid	Charlie Price	Angler	Excerpt from: "Flyfishing the West", Article: Of Steelhead and Condors, by Mark Moore. Volume 4, No. 5, November - December 1981	"Locals also knew that the steelhead fishing was good, especially in the lower Santa Clara, in the lagoon, and even surf fishing off the mouth. Says Charlie Price, an investment broker who fished the Santa Clara in his youth, 'The adults were always in the surf off the mouth by late November, waiting for the first rains to break the sandbar. You would often see a group of fisherman with shovels instead of fly rods, opening the bar...The fish would storm in and all hell would break loose..."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Estuary	Numerous	To (14 lbs.)	1940's Early	Ed Henke	Local angler	UCSB Capelli Steelhead Files: Letter from Mr. Henke to James Roads, April 20th, 1970	"One wintry day in the early '40's, there were hundreds of the locals fishing at it's mouth... There were so many steelhead migrating in that my group of friends and myself were getting fish scales on hooks by just retrieving our bait and lures on each cast. Big fish too! That year Ron Dovin took a fourteen-pounder out of the surf near the mouth."
Santa Clara River	Mouth of river	1	31" (9.75 lbs.)	1942	John B. Colla	Local angler	Photo: Capelli Archives, UCSB	Notes on the back of photo: "Steelhead taken from the lagoon at the mouth of Santa Clara River by John B. Colla"

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Santa Clara River	Numerous	12"-16"	1945 and Prior	Charles Outland	Local Author	Letter to Mark Capelli regarding personal steelhead observations when he was young	"I had the best trout fishing anyone could ask for in my own back yard in the Santa Clara River, and they were all native, ocean-run trout. It was nothing to drive within one hundred yards of a good fishing hole and catch a limit of 12-16 inches long in 45 minutes."
Santa Clara River	Mouth of river	3	Approximately 26-28"	1946	Ben and Bennie Smith	Local anglers	Photo: Capelli Archives, UCSB	Notes on back of photo: "Steelhead taken from the lagoon at the mouth of the Santa Clara River by Ben Smith, 1946."
Santa Clara River	Mouth of river	5	26" - 31"	1948	Ben and Bennie Smith	Local anglers	Photo: Capelli Archives, UCSB	Notes on top of picture: "These fish were caught legally at the mouth of the Santa Clara River by Ben and Bennie Smith. 31 inch., two 30", one 28 inches and the other 26."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Lagoon	Numerous	Up to 32"	1948	Claude Kreider	Author	Kreider, C.M. 1948. Steelhead. G. Putnam and Sons. 182 pp.	In talking of the Santa Clara river: "The bar opens only after good rains when there is sometimes splendid fishing in the long, clean lagoon through which the river sweeps. Steelhead up to 32 inches long are not uncommon here when the run starts in."
Santa Clara River	Mouth of river	1	33" (13 lbs.)	1948 January	Ronald Dovin	Local angler	Photo: Capelli Archives, UCSB: Star Free Press, January 29, 1948	Photo with no notes.
Santa Clara River	Mouth of river	1	(13 lbs.)	1948 February	Charlie Price	Local angler	Photo: Capelli Archives, UCSB	Notes on back of photo: "Steelhead taken from the mouth of the Santa Clara River, Ventura County, 1948, by Charlie Price 13 lbs."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Santa Clara River	General Population Account	Adult Steelhead	1970's	see notes	see notes	Moore, Mark. 1980. An Assessment of the Impacts of the Proposed Improvements to the Vern Freeman Diversion on Anadromous Fishes of the Santa Clara River System, Ventura County, California.	"Cooper (1976) reported a stranded adult steelhead specimen approximately one mile south of the highway 118 bridge (or three miles below the Vern Freeman Diversion). In addition to these verifiable reports by qualified observers, local newspapers (Fillmore Herald, 1974) have run stories of anglers taking adult steelhead from the Santa Clara River system. These reports and accounts indicate that the Santa Clara system still supports at least a remnant run of anadromous fishes."
Santa Clara River	Downstream of the Vern Freeman Diversion Dam, near the mouth	1	Adult Steelhead	1970's	Puckett and Villa	Biologists	pers. comm. McEachron 2005	McEachron reported that these biologists set a trap upstream of the mouth for two winters in the 1970's and only when flows were less than 200 cfs They reportedly caught one adult steelhead.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Estuary	1	26.5" (8 lbs.)	1971 Jan. 31	J.R. Miller	Local Resident	Capelli Archives, UCSB	Picture of a man with a "female" steelhead taken from the estuary.
Santa Clara River	Santa Clara River	Numerous	Adult Steelhead	1976 and Prior	Mark Capelli	NOAA Fisheries	Letter to Jack Coe of California Department of Water Resources regarding Santa Clara River Steelhead Study. Response to the Departments report to the State Water Resources Control Board entitled "Alternative Water Requirements and Costs for Migration of Steelhead Smolts in Santa Clara River.	"The Department should be aware that this steelhead fishery has been documented by contemporary field reports prepared by the CDFG, and in numerous published accounts. Additionally, the presence of a remnant run of steelhead has been recorded by the DFG as recently as 1976."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	One Mile upstream from Highway 118 Bridge	1	Approximately (4 lbs.)	1976 Feb. 12	Lt. Kenneth G. Cooper	Patrol Lieutenant in Ventura County	Memo to Mark Capelli from Mr. Cooper regarding a trout he observed while on patrol. Letter on file in Santa Lucia Ranger Station in Santa Maria.	"Re our phone conversation of Steelhead Trout migration up the Santa Clara River. Checking my records for the date of a steelhead trout I observed a 4 lb. Steelhead trout trapped when the storm waters receded during our rains Feb. 4,5,6,7, and 8th. 1976. - "The date was Feb. 12th, 1976, I walked out a section of the river after complaints of rifle shooting. I noticed the storm water had receded and left a Steelhead Trout approximately 4 lbs. High and dry."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Santa Clara River	50	Juvenile Salmonids	1981 Spring	Mark Capelli	NOAA Fisheries	Letter to Jack Coe of California Department of Water Resources regarding Santa Clara River Steelhead Study. Response to the Departments report to the State Water Resources Control Board entitled "Alternative Water Requirements and Costs for Migration of Steelhead Smolts in Santa Clara River.	"The preliminary steelhead study conducted by the CDFG in the spring of 1981 involved the trapping of fishes at three locations in the Santa Clara River system…the study did result in the capture of 50 juvenile salmonids, with 30 individuals taken from the desilting basin."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Freeman Diversion Dam	81 smolts	Smolts ~ 6 inches	1994	KSWC Newsletter, June 1995		Photo and article of one of 81 smolts trapped and released below the Diversion Dam	"Smolts (young steelhead about 6" long) migrating downstream to the ocean are also trapped at the Freeman Diversion (but not at the fish ladder - that's only for upstream movers). With a peak in April 1994, a total of 81 smolts were trapped and released just downstream to continue their journey to adulthood below to the high seas."
Santa Clara River	Freeman Fish ladder	11	6"- 9"	1994 March 25	United Water Conservation District	United Water Conservation District	Ventura County Star Free Press	"Now, over the past 10 days, 11 juvenile rainbow trout apparently headed for the ocean have been caught in a downstream fish trap near the dam,..."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Freeman Diversion Dam	1	18.5" (3.5 lbs.)	1994 April	Murray McEachron	United Water Conservation District Biologist	Ventura County Star-Free Press, April 5th, 1994 and pers. comm. McEachron 2005.	The County reported that; "An ocean going steelhead trout has negotiated the fish ladder at the Freeman Diversion Project to spawn in the Santa Clara River for the first time since the ladder was built more that three years ago. The fish, approximately 3.5 pounds and 18.5 inches long was discovered swimming upstream in the fish ladder Thursday." McEachron reported that this adult was caught in a trap at the inlet of the fish ladder. A tissue sample was reportedly tested and the fish was not a local genotype and it had been in the ocean for one year.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Freeman Diversion Dam	1	25", (7 lbs.)	1995 March 2	Maurice Cardenas and Murray McEachron	CDFG and United Water Biologist	Photo and article featured in Keep the Sespe Wild, and pers. comm. McEachron 2005	The article reported; "This 25" steelhead was caught and released on 3/2/95 at the Freeman Diversion fish ladder on the Santa Clara River. She weighed about 7 lbs., and may have spawned in the Sespe. Maurice Cardenas of the CDFG is pictured. Photo courtesy of United Water." McEachron reported that this adult steelhead was caught in a trap at the inlet to the fishway and collected tissue samples indicated the fish was 4 years old and had spent two years at sea.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Vern Freeman Diversion Dam	Hundreds	Smolts	1995-2005	United Water Biologist	United Water	Entrix, Inc. 2000, Results of Fish Passage Monitoring at the Vern Freeman Diversion Facility Santa Clara River, 1994-1998. Prepared for United Water Conservation District, Santa Paula, CA. Project # 324402. Pers. comm. McEachron 2005.	Following are reported smolts caught in the downstream migrant trap; 1995 year total-111, 1996 year total-82, 1997 year total-414, only 100 smolts for 2000-2004, and no records for 2005 as the trap was not operated and all potential smolts were allowed to migrate downstream with by-pass flows (at NOAA request). See Entrix report for additional detail.
Santa Clara River	Freeman Diversion Dam	2	17"and 26"	1996 March	Murray McEachron	United Water Conservation District Biologist	pers. comm. McEachron 2005	McEachron reported that these two adult steelhead were trapped at the fish ladder inlet trap. A fin clipping was analyze from the smaller steelhead, which had reportedly spent one year in fresh and one year in saltwater.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Vern Freeman Diversion Dam	1 adult	22" long	1999 March 16	United Water Conservation District Staff Member (letter) and Murray McEachron	United Water	Letter by United Water Conservation District, "Accidental Steelhead Take on March 16, 1999." Pers. comm. McEachron 2005	The letter stated that; "On March 16, 1999, United staff found a dead rainbow trout at the Freeman diversion, in the fish screen bay, a location where adult steelhead have never been found before. The fish was about 22" long." McEachron reported that this fish was found in the trash rack at the inlet to the diversion system when they dewatered the canal. Maurice Cardenas of DFG reportedly thought this fish was a hatchery trout from upstream, possibly the Fillmore Hatchery outlet flow pool where large hatchery trout of this size were observed by Stoecker in 2004.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Freeman Diversion Dam	2	Adult Steelhead	2000 March 21	Murray McEachron	United Water Conservation District Biologist	pers. comm. McEachron 2005	McEachron reported that two adult steelhead were reportedly observed by United Water crew migrating through the fish ladder to the Santa Clara River upstream. No lengths were recorded.
Santa Clara River	Freeman Diversion Dam	1	Approximately 25"-27"	2001 March 14	Murray McEachron	United Water Conservation District Biologist	pers. comm. McEachron 2005	McEachron reported observing one adult steelhead between 25 and 27 inches at the inlet to the fish ladder. McEachron sent a photo of this fish's back and dorsal fish showing in the fish ladder to Stoecker.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Downstream of the Vern Freeman Diversion Dam	1	Approximately 18"-20"	2001 March 14	Murray McEachron	United Water Conservation District Biologist	pers. comm. McEachron 2005	McEachron reported observing one adult steelhead between 18 and 20 inches in the Santa Clara River downstream from the Vern Freeman Diversion Dam after they "ran the flows down". McEachron also reported observing 3 Pacific lamprey in the same area of shallow water.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Clara River	Vern Freeman Diversion Dam	6000 Sucker species	Various	2005 end of May and early June	Murray McEachron	United Water Conservation District Biologist	pers. comm. McEachron 2005	McEachron reported that 6000 sucker species (approximately 1/3 Owen, 1/3 Santa Ana, and 1/3 Hybrid varieties) were observed migrating upstream in the lower reach of the fish ladder. The suckers reportedly made it through the first section of the fish ladder to a small resting pool where they were unable to migrate further upstream. McEachron thought the suckers were washed downstream with the high flows of 2004/2005 and as the flows began to subside downstream of the dam these suckers were attempting to get back upstream to adequate flows and mainstem rearing habitat.

Santa Paula Creek and Tributaries								
Stream(s)	**Location**	**# Salmon.**	**Fish Size**	**Date**	**Observer(s)**	**Affiliation**	**Source**	**Notes**
Santa Paula Creek drainage	Mainstem and Sisar Creek	1+	Trout	1800's	Thomas Bard (sp?)	Early oil speculator	pers. comm Boyd 2004	Longtime Sisar Creek resident of the Santa Paula Creek area since 1930's reported that he read a biography of early oil speculator Thomas Bard that reported "catching huge limits of trout and steelhead in the Santa Paula Creek drainage. Boyd reported that the publication is out of print and he could not find his copy. Stoecker could not locate the book at any of the Ojai used book stores. Boyd thought the accounts were from the 1800's and/or early 1900's.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Paula Creek	At waterfall downstream of the East Fork Santa Paula Creek confluence	1+	Adult Steelhead	1900's- Early	Boyd Dron	Sisar Creek Property Owner	pers. comm Boyd 2004	Longtime Sisar Creek resident of the Santa Paula Creek area since 1930's reported hearing reports of adult steelhead migrating to, and attempting to jump over, a waterfall downstream of the East Fork of Santa Paula Creek. Two significant waterfalls were surveyed by Stoecker downstream of the East Fork that would pose significant barriers to adult steelhead. It is unknown what the configuration of these waterfalls was in the early 1900's and whether adult steelhead could migrating upstream to the East Fork during the past.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Paula Creek	Pool below Harvey Dam	Numerous	18" - 29"	1942-1949	Otto Reynolds	Friend of Rod Thompson	As reported by Rod Thompson, retired Ventura County Sheriff Captain (pers. comm. 2005 with Stoecker)	Thompson reported that long-time local fisherman and resident near Harvey Dam Reynolds reported observing numerous adult steelhead appearing in "clusters" in the pool below Harvey Dam during the winters and spring and jumping at the dam. These steelhead were "common" in the 18-inch range, but occurred into the high 20-inch range.
Santa Paula Creek	In pool below the large waterfall just upstream from the East Fork Santa Paula Creek and downstream.	Numerous	13"	1950's to 1960's	Rod Thompson	Retired Ventura County Sheriff Captain	pers. comm. 2005 with Stoecker	Thompson reported fishing upper Santa Paula Creek during this time period and catching many rainbow trout up to 13 inches in length. Large trout were common in the waterfall pool upstream of the East Fork.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Paula Creek	Below Bridge Road Bridge	1	24"	1969	Rod Thompson's father	Construction/ Excavation	As reported by Rod Thompson, retired Ventura County Sheriff Captain (pers. comm. 2005 with Stoecker)	Thompson reported that his father told him about operating a tractor in the creek following the 1969 floods repairing damage to the banks and channel. While driving through a riffle section his buddy jumped out and caught a 24 inch adult steelhead in the shallows. This occurred in the spring following record high flows on Santa Paula Creek.
Santa Paula Creek	From Forest Service Boundary	Good		July 26, 1979	Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Paula Creek	From Forest Service Boundary to headwaters	5 – 15 per 100 feet of stream	2” – 11”	July 26, 1979	Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	
Santa Paula Creek	From downstream of Harvey Dam	1+	Adult Steelhead	1900's- Early	Boyd Dron	Sisar Creek Property Owner	pers. comm Boyd 2004	Longtime Sisar Creek resident of the Santa Paula Creek area since 1930's reported hearing reports of adult steelhead migrating and being caught upstream of the Harvey Dam. He reported that the dam blocked steelhead from migrating upstream and that he heard the ladder was having problems and was destroyed in 2004.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Santa Paula Creek	Near confluence of Mud Creek	1+	Various	1993 and 1996	Cindy Carpanzano	Report on the Habitat Conditions of Santa Paula Creek	On file in Santa Lucia Ranger Station Office in Santa Maria.	"This report is a response to the request for information on steelhead habitat above a steelhead barrier [Harvey Dam] located on Santa Paula Creek near its confluence with Mud Creek... If the steelhead barrier on Santa Paula Creek is removed it would open up over 5 miles of steelhead habitat... The removal of this steelhead barrier is strongly recommended as it will open up approximately 10% of the total steelhead habitat available for the Santa Clara River drainage." Surveys conducted during summer of 1993 and winter of 1996

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sisar Creek	Mainstem to upstream of the East Fork and the East Fork	1+	Rainbow trout	1930's to Present	Boyd Dron	Sisar Creek Property Owner	pers. comm Boyd 2004	Longtime Sisar Creek resident of the Santa Paula Creek area since 1930's has continuously observed rainbow trout in Sisar Creek as long as he has been there since the late 1930's. He purchased his inholding on the East Fork of Sisar Creek in 1964. He has observed rainbow trout of "catchable" size on the mainstem to upstream of the East Fork past the first LPNF road switchback. He has observed rainbow trout on the East Fork from the Sisar Creek upstream to just above his house and LPNF inholding at the natural springs there.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sisar Creek	Mainstem to the East Fork	1+	"Catchable" hatchery rainbow trout	1940's to late 1990's	Boyd Dron	Sisar Creek Property Owner	pers. comm Boyd 2004	Longtime Sisar Creek resident of the Santa Paula Creek area since 1930's reported that rainbow trout of "catchable size" from the Fillmore Hatchery have been planted in Sisar Creek during about the 1940's to sometime in the later 1900's. Rainbow trout were planted in a small concrete pond at his house on the East Fork sometime after 1964 and also in the East Fork. The trout were also planted in the mainstem Sisar from the first LPNF road switchback upstream of the East Fork downstream to below the LPNF boundary.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sisar Creek	From Forest Service Boundary to the headwaters	5 to 15 per 100 feet of stream	1” – 10”	June 12, 1979	Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	“Small stable perennial stream in good condition for most of its length with a healthy population of small RBT”
Sisar Creek	Near Camp Bartlett	1	13"	1998	Joe Marino	Retired, Los Padres National Forest Service	As reported by Rod Thompson, retired Ventura County Sheriff Captain (pers. comm. 2005 with Stoecker)	Thompson reported that his friend Joe Marino informed him of observing a 13 inch trout in Sisar Creek near Camp Bartlett.

Sespe Creek								
Stream(s)	**Location**	**# Salmon.**	**Fish Size**	**Date**	**Observer(s)**	**Affiliation**	**Source**	**Notes**
Sespe Creek	Van Trees Property	1	28" (8 lbs.)	1930's	James Van Trees father	Property owner	Pers. comm. Van Trees 2004	Following surveying the Van Trees property in the Fall of 2004, James Van Trees showed Stoecker a black and white photo of a very healthy adult steelhead held by his father. The steelhead was reportedly caught in the 1930's on the family property. Stoecker estimated the steelhead to be approximately 28 inches in length and 8 pounds. The fish appeared to be fresh from the ocean, stout and pre-spawned, and wild with adipose in tact.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Sespe Creek upstream to Tule Creek and Tule, Howard, Lion, and Bear Creek Tributaries	Numerous	Adult and Juvenile Steelhead	1930's and 1940's	California Department of Fish and Game employees	California Department of Fish and Game	Sespe Watershed Analysis. 1997. Los Padres National Forest and Ojai Ranger District, January 1997.	"Historical accounts do not differentiate between steelhead trout and rainbow trout, creating difficulty in determining the extent of early anadromous runs. California Department of Fish and Game surveys and field notes from the 1930's and 1940's indicate that steelhead ran up Piru Creek to Buck and Snowy tributaries (Evans, 1946) and up the Sespe at least as far as Tule Creek (CDFG, 1949). Juvenile steelhead were identified in Tule, Howard, Lion, and Bear Creeks indicating that these tributaries were used as rearing areas not as spawning beds (CDFG, 1935)."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Adjacent to Grand Ave.	1+	Adult steelhead	1938	Moore	Fillmore Irrigation	pers. comm. Moore	Dwight Moore recalls seeing photos of adult steelhead stranded in the family orchards adjacent to Sespe Creek as high flood flows from 1938 subsided.
Sespe Creek	Downstream of Hot Springs Creek near Sweetwater	1+	18"-19"	1950's to 1960's	Rod Thompson	Retired Ventura County Sheriff Captain	pers. comm. 2005 with Stoecker	Thompson reported fishing this section of the Sespe during this time period and catching several rainbow trout "that looked like steelhead, with bigger jaws and color".

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Sespe Creek	1	18"	1974 Jan. 28	Ron Hooper	Local Resident	Fillmore Herald, Thursday, January 31, 1974	"Fishing is so good that Ron Hooper was able to bring in an 18-inch steelhead, but not without a 15 minute battle, Monday afternoon. This is the first steelhead that's been taken from the Sespe in many years, Hooper recollected, and apparently had traveled upstream from the ocean. There's lots of water in the creek Hooper noted and that he got his limit of rainbow trout during the short time he was in the area."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	From Alder Creek confluence to Sespe Gorge	20 per 100 feet of stream	4” – 15”	October 4, 1979	Don Edwards and Ken Kestner	USDA, Forest Service	Mark, Capelli, NOAA Fisheries	
Sespe Creek	From Alder Creek confluence to Devils Gate	Abundant	2” – 18”	September 25 & 26, 1979	Don Edwards, Ken Kestner, and Mark Moore	USDA, Forest Service	Mark, Capelli, NOAA Fisheries	Stocked.
Sespe Creek	Sespe Gorge to Ladybug Creek	15 per 100 feet of stream	4” – 12”	September 1979	Mark Moore, Don Edwards, and Ken Kestner	USDA, Forest Service	Mark Capelli, NOAA Fisheries	Rainbow trout seen in the upper section of the survey reach.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek and Santa Clara River	Sespe Creek and UWCD Spreading Grounds	Numerous	Lamprey adult and amocets larvae	1981 April-May	DFG Survey crews	California Department of Fish and Game	Three Month Study on the Lower Santa Clara River and Tributaries, Ventura County, California. Department of Fish and Game, Region 5. June 1981	"Lamprey amocets larvae were captured in every set on Sespe Creek and five adults were taken over the more than three week sampling period. Since lampreys are anadromous and are very much part of the Santa Clara River biota, a viable link between Sespe Creek spawning grounds and the sea is clearly demonstrated by the presence of this species."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek Santa Clara River	Sespe Creek @ State Highway 126 Bridge and Santa Clara River @ the desilting basin (Pond B) within UWCD spreading grounds at Saticoy.	51	Sespe Creek Sampling results: Sizes vary from 3.2 cm to 20.3 cm with a mean total length of 9.4 cm; UWCD's desilting pond: Sizes vary from 14.8 cm to 22.5 cm with a mean length of 18.9 cm	1981 April-May	DFG survey crews	California Department of Fish and Game	Three Month Study on the Lower Santa Clara River and Tributaries, Ventura County, California. Department of Fish and Game, Region 5. June 1981	Graph of fish captured over the course of the study (rainbow trout): Santa Clara River Station: 0; Sespe Creek Station: 21 total over 8 days in late April beginning of May: UWCD Station: 30 total over two days in May. Sampling methods: "These data are reported be species, date captured, and location. The dates given are the dates on which the nets were retrieved. Each date represents twelve to fourteen hours of fishing effort." Dates of Observation: April 20,23,24,28,30 and May 1,5,6,12,15. 1981

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Old Telegraph Bridge	1	26" (3.75 lbs.)	1983 April 2	Bill Cardona and Duke Bradbury	Fillmore Resident and Local Fillmore Shop Owner	Fillmore Herald, Thursday April 7th, 1983. Vol. 76, number 36	"Fillmore fisherman Bill Cardona proudly displays the 3.75 lb., 26" Steel Head Trout he caught April 2 at Old Telegraph Bridge on Sespe Creek."
Sespe Creek		1	Juvenile. 5.9”	1983 April 4	CDFG	California Department of Fish and Game	Mark Capelli, NOAA Fisheries	
Sespe Creek	Near Goodenough Rd.	1	27.7" (6.5 lbs.)	1983 April 26	Caught by DFG biologists Dan Miles and Rob Palmer	Department of Fish and game Study, "Lower Santa Clara River Steelhead Study"	Department of Fish and game Study, "Lower Santa Clara River Steelhead Study", March 1985	"Steelhead trout caught in weir set in Sespe Creek near Goodenough Road April 26, 1983. This fish was a spent female that measured 27.7" and weighed 6.5 lbs."
Sespe Creek	Near Good-enough Road, and Lions Camp	25 Rainbow Adults, 3 Steelhead Adults, 2 Juveniles	Adults = 8” – 27.7”. Juveniles = 6.2” and 7.0”	1983 – 1984	CDFG	California Department of Fish and Game	Mark Capelli, NOAA Fisheries	

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Near Bear Creek and Hot Springs Creek	294 trout observed over three year study	Length ranges from 4 cm - 28 cm.	1983-1985	DFG Survey crews	California Department of Fish and Game	Report: Sasaki, Shoken. Sespe Creek Wild Trout Management Plan. 1986. California Department of Fish and Game in cooperation with US Forest Service Los Padres National Forest	"A backpack electroshocking survey was initiated in 1983 to determine the status of rainbow trout in Sespe Creek. Annual surveys were conducted in 1983, 1984, and 1985 at stations near Bear Creek and Hot Springs Canyon to compare trout relative abundance, year class strength, condition, and length parameters."
Sespe Creek	Sespe Creek	1+	Adult Steelhead	1985 and Prior	Mark Moore	LPNF	Lower Santa Clara River Steelhead Survey, Final Report, March 1985, Mark Moore	"Sespe Creek is probably the most attractive , if not the only spawning and nursery area in the system. Sespe Creek has adequate habitat to support salmonids. Steelhead entering Sespe Creek, although probably few in number, stimulate a small sport fishery that is well known to local anglers."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Confluence of Little Sespe Creek upstream to upstream of Ladybug Creek	1+	Unknown	1994-1995	LPNF Survey Crew		Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	High, Medium, and Low abundance of rainbow trout noted in different reaches throughout this entire stretch of Sespe Creek. Reaches of High rainbow trout abundance occur between the West Fork Sespe Creek and Alder Creek, downstream of Park Creek, downstream of Timber Creek, downstream of Piedras Blancas Creek past Trout Creek, and upstream and downstream from Howard Creek. See Figure 2. map for recorded distribution extent.
Sespe Creek	Oak Flat	90	40 -320 mm	1999 Aug. 4-5	LPNF	LPNF	LPNF Stream Habitat and TES Surveys	87 *Oncorhynchus mykiss* counted between 40mm and 120 mm; 3 counted approximately 320 mm

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Sespe Creek	Oak Flat	90	40-320 mm	1999 Aug. 4-5	LPNF	LPNF	LPNF Stream Habitat and TES Surveys	87 Oncorhynchus mykiss counted between 40mm and 120 mm; 3 counted approximately 320 mm
Sespe Creek	Between Beaver and Tule	100+	Sizes vary: some measurements recorded between 16" - 21"	1999 June 2	Surveyors: Chris Medak, Tom Wallace, Nick Koutzman	LPNF	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria. (LPNF Stream Habitat and TES Occupancy	This documentation seems highly unlikely due to the large size reported (Stoecker). Length maybe have been significantly over-estimated (Stoecker).
Sespe Creek	Downstream of Willett Hot Springs Creek	1+	15.5"	2002	Friend of Rod Thompson	As reported by Rod Thompson, Retired Ventura County Sheriff Captain	pers. comm. 2005 with Stoecker	Thompson reported observing a 15.5 inch rainbow trout caught by his friend in this part of the Sespe.

Sespe Creek Tributaries								
Stream(s)	**Location**	**# Salmon.**	**Fish Size**	**Date**	**Observer(s)**	**Affiliation**	**Source**	**Notes**
Abadi Creek	Hartman Ranch Potrero Seco	2040	Juvenile Rainbow Trout	1942 March 29	CDFG	CDFG	Fish Planting Receipt on file in Santa Lucia Ranger Station, USFS Department	Stocking Records: 2040 Rainbow Trout fingerlings from Hot Creek
Abadi Creek	Lower Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted in Lower Abadi Creek upstream from Sespe Creek. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Alder Creek	Alder Creek	1+	3" - 6"	1979 Sept. 24	Don Edwards and Ken Kestner	USDA Forest Service Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	Few rainbow trout observed below the barrier
Alder Creek	Near Sespe Confluence	1+	Up to 12"	1995 Oct. 27	Field crew initials: JD,NR,MW	Reach Channel Typing Form	On file in Santa Lucia Ranger Station Office in Santa Maria.	Many trout observed over several reaches of the study areas. "Nice pool with trout and pond turtles at confluence with Sespe. Trout up to 12" and 2 stripped garter snakes were observed on reach"
Bear Creek	Lower and upper Creek	50 per 100 feet of river	3" – 10"	October 3, 1979	Don Edwards and Ken Kestner	USDA, Forest Service	Mark Capelli, NOAA Fisheries	Abundant trout; good habitat. Lower section, nursery for RB; upper section can support spawning and summer nursery.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Bear Creek	Mainstem and upper tributaries	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Medium abundance of rainbow trout noted immediately upstream of Sespe Creek transitioning into low abundance upstream and into upper tributaries. See Figure 2. map for recorded distribution extent.
Cherry Creek	Cherry Creek	40 trout per 100 feet of river,	2" – 6"	August 16, 1979	Ken Kestner and Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	"Cherry Creek is the uppermost nursery stream for the Sespe Creek Drainage...scenic canyon stream with steeply sloped wooded banks."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Cherry Creek	Cherry Creek	40 trout per 100 feet of river,	2"-3"	No date on Survey Sheet		USDA, Forest Service	USDA, Forest Service	"Abundant to common Rainbow trout population throughout survey area"
Cherry Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Medium abundance of rainbow trout noted upstream from Sespe Creek transitioning into low abundance upstream. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Cherry Creek	Cherry Creek	1+	see notes	2000 July 24-28	Jaime Uyehara, C. Slaughter, D. Chua, Tony Wallace	LPNF Fish Survey	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria. (LPNF Stream Habitat and TES Occupancy	Notes from survey sheet: "Pools are crowded with *O. mykiss* and size ranges indicate they are surviving and reproducing. Seeps and subterranean flow and riparian vegetation keep cooler water in pool (some isolated). Little spawning gravel, heavy silt and embeddedness decrease suitability."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Chorro Grande Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew		Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted upstream from Sespe Creek. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Coldwater Creek	Lower Portion	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Derydale Creek	Lower Reach	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted for a short reach just upstream of Sespe Creek. See Figure 2. map for recorded distribution extent.
Derydale Creek	Derydale Creek	2	6"	1995 July 6	Reach Channel Typing Survey Crew	CDFG	On file in Santa Lucia Ranger Station Office in Santa Maria.	6" Rainbow trout observed

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Howard Creek	Howard Creek	1000's	1933 - 6,000: 1934 - 5,000: 1935 - 5,000; 1940 - 5,000: 1944 - 1500; 1948 - 4,800; 1953 - 3049: 1956 - 8,000.	1933 - 1956	CDFG	CDFG Fish Stocking Record	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	Multiple fish stocking records on file for this small tributary. Stocking report for multiple years - Stock taken from Loch Leven, see next column for year and amount stocked
Howard Creek	"Road crossing downstream to mouth"	5-Apr	Between 4"-6"	1949 Sept. 3	Survey by John L. Hartnett	CDFG Stream Survey	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	"This creek arises from springs at the head of Howard Canyon and flows for a distance of 3 miles to unite with the Sespe Creek. There are no barriers along the stream. Many nice pools were observed."
Howard Creek	Howard Creek	Abundant	Length range: 1" - 11"	July 11, 1979	Mark Moore and Ken Kestner	USDA Forest Service	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	Rainbow trout abundant: 70 recorded per 100 feet

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Howard Creek Rose Valley Creek	Rose Valley Lakes	8000	Catchable Rainbow trout	1988	George Garcia	CDFG Fish Planting Record	Garcia, George. 1989 Final Rose Valley Lakes Aquatic Vegetation Abatement Plan. United States Forest Service.	"Rainbow trout are stocked on a put and take basis every two weeks, from the months of Feb. To May, by the CDFG hatchery in Fillmore. In 1988, 8,000 catchable rainbow trout was supplied to both Rose Valley Lakes (Mike Hayden, personal communication)." Stocked from hatchery in Fillmore. These lakes have been stocked with trout and exotic fish species for many years and additional records exist at the Fillmore hatchery (Stoecker).

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Howard Creek	Howard Creek	Over 100 Rainbow trout per 100 feet of river surveyed	To 255mm	1994 August	LPNF Fish Survey Crew	LPNF Fish Survey	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria. (LPNF Stream Habitat and TES Occupancy	"Though Howard Creek has a small watershed area, reliable springs and dense canopy cover make it a highly productive spawning and rearing stream for rainbow trout. During our surveys, average densities were over 100 individuals per 100 feet with over 50% being fry and fingerlings. All size classes were represented with the largest individual being 255 mm in length."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Howard Creek	Howard Creek and Rose Valley Creek including three upper tributaries	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	High abundance of rainbow trout noted for Howard Creek downstream of the Rose Valley Creek confluence and low abundance for a short reach upstream of Rose Valley Creek. Low abundance upstream noted for Rose Valley Creek and a short stretch for three upper tributaries. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Keefe Ditch	Channelized Irrigation Ditch	1+	Adult Steelhead	1980's and Prior	Dwight Moore	Fillmore Irrigation	Pers. comm. Moore (Stoecker)	This former small tributary has been channelized with concrete and releases outflow from the Fillmore Irrigations Diversion on Sespe Creek on Van Trees property and flows into Lower Sespe Creek from the west and under Grand Avenue. Moore has observed adult steelhead in the past (~pre-1980's) attempting to migrate up this ditch into the outflow, which may have been cooler than the mainstem Sespe.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Ladybug Creek	Mainstem	Low Abundance		1994-1995	LPNF Survey Crew		Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted upstream from Sespe Creek. See Figure 2. map for recorded distribution extent.
LadyBug Creek	Within the LPNF	1+	6"	1995 Nov. 1	USFS	USDA Forest Service	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	"Rainbow trout fry up to 6" observed in upper reach"

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Lion Creek	Sespe Creek tributary	1+	4"-5"	1949 March 21	CDFG	CDFG Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	"The fingerling plant in this stream last year was made by pack stock going up Lion Creek drainage. Fingerlings were planted above and below the falls. This is a nice appearing small stream. A few trout 4-5 inches in length were noted."
Lion Creek	Entire length surveyed	15 per 100 feet of stream	1" – 12"	June 26, 1979	Mark Moore	USFS Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	"Summary of lower stream section: abundant pools and riffles…excellent spawning and nursery habitat, stream loaded with 0+ trout; no problem catching lots of fish." Abundant and healthy Rainbow trout population.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Lion Creek	Mainstem, East and West Forks, and two minor downstream tributaries	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low and Medium abundance of rainbow trout noted downstream of the East and West Fork confluence. Low abundance upstream into both East and West Forks. See Figure 2. map for recorded distribution extent.
Lords Creek	Tributary to the Sespe Creek	6000	Juvenile Rainbow Trout	1945 Feb. 18	CDFG	CDFG	Fish Planting Receipt on file in Santa Lucia Ranger Station, USFS Department	Stocking Records: 6000 Rainbow Trout fingerlings from Fillmore Hatchery.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Lords Creek	Tributary to the Sespe Creek	1200	Juvenile Rainbow Trout	1947 May 23	CDFG	CDFG	Fish Planting Receipt on file in Santa Lucia Ranger Station, USFS Department	Stocking Records: 1200 Rainbow Trout fingerlings from Fillmore Hatchery
Munson Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted upstream from Sespe Creek. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Park Creek	Lower Portion	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low to medium abundance of rainbow trout noted with medium abundance from the Sespe upstream then low abundance upstream. See Figure 2. map for recorded distribution extent.
Park Creek	Park Creek	1+	To 4"	1995 Sept. 5	Initials of field crew: JD,MW,NR,BL	USFS Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	Small population of trout observed

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Piedras Blancas	From confluence with Sespe Creek to the headwaters	1 – 20 per 100 feet of stream	2” – 12”	August 1, 1979	Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	Rainbow trout abundant or common in lower and middle section of stream.
Piedras Blancas Creek	Mainstem and North Fork	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low, Medium, then High abundance of rainbow trout noted upstream from Sespe Creek to the North Fork Confluence. Medium abundance transitioning into low abundance upstream into both upper Piedras Blancas and the North Fork. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Piedras Blancas	Piedras Blancas	18	6" - 12"	1995 April	Local Angler	Sespe Creek Angler Survey conducted be Sespe Flyfishers	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	18 fish taken
Pine Creek	Lower Portion	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electroshocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Potrero John Creek	From confluence with Sespe up river to stream elevation 4750'	5	1" -10"	1979 July 6	Mark Moore	USFS Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	"Excellent nursery habitat despite significant bottom sediments. Many 0+ rainbow trout, only 5 adult trout seen up to 12" in length. Survey ends at sheer impassable waterfall 70' high at elevation 4750."
Potrero John Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Medium abundance of rainbow trout noted upstream from Sespe Creek transitioning into Low abundance. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Red Reef Creek	Mainstem and upper tributaries	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	High abundance of rainbow trout noted between Sespe Creek and upper tributaries with medium abundance noted for the tributaries. See Figure 2. map for recorded distribution extent.
Rock Creek	Rock Creek	2000	Fingerlings	1948 June 6	CDFG	CDFG Fish Planting Record	On file in Santa Lucia Ranger Station Office in Santa Maria.	2000 fingerlings stocked from Mt. Whitney

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Rock Creek	Rock Creek	1+	3 - 8 inches	1979	LPNF Survey Crew	LPNF	USDA Forest Service Stream Survey. On file in Santa Lucia Ranger Station Office in Santa Maria.	"fingerlings where water permitted"
Rock Creek	Mainstem and East Fork	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low and Medium abundance of rainbow trout noted for Rock Creek from the Sespe upstream past the East Fork. Low abundance noted for the East Fork. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Rock Creek	Rock Creek	1+	10" average	1995 Sept. 27	Brian Landau, Maryanne Wampler: Surveyors	USFS Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	A small population of rainbow trout was observed
Timber Creek	Timber Creek	50 per 100 feet	3" - 10"	1979 Oct. 1	Ken Kestner. Separate survey of same data and findings by Don Edwards is also available.	USDA Forest Service Stream Survey	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	Notes from Stream Survey: "Timber Creek offers a few trout of catchable size, but serves predominately as a summer nursery for juveniles, for which the habitat is best suited. The lower section is excellent habitat for a wide array of wildlife as well as for juvenile trout." KK. “Highly productive nursery in lower section.” DE

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Timber Creek	Timber Creek	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	High abundance of rainbow trout noted immediately upstream of Sespe Creek transitioning into medium abundance upstream. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Trout Creek	From confluence with Sespe Creek to 3500' elev.	5 – 10 per 100 feet of stream	1" – 12"	June 26, 1979	Mark Moore	USDA, Forest Service	Mark Capelli, NOAA Fisheries	Trout mostly in pools.
Trout Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low abundance of rainbow trout noted upstream of Sespe Creek. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Tule Creek	Tule Creek	6840	Fingerlings	1934 and 1942	CDFG	CDFG	CDFG Fish Planting Record. On file in Santa Lucia Ranger Station Office in Santa Maria.	1840 fingerlings from Hot Creek in 1942; 5000 fingerlings from Loch Leven in 1934
Tule Creek	Tule Creek	10-15 RBT per 100 feet	1"-12"	1979 June 25	Mark Moore	USDA Forest Service Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	"This portion of Tule Creek is an important spawning tributary to upper Sespe Creek fish". Describing the Lower Section surveyed.3 sections surveyed: 10-15 RBT per 100 feet

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Tule Creek	Mainstem	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Medium abundance of rainbow trout noted from Sespe Creek upstream transitioning into low abundance. See Figure 2. map for recorded distribution extent.

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Tule Creek	Tule Creek Slide Study Area	53	1"-6" with five over 6"	2000 Aug. 1-2	C. Slaughter, D. Chua, D. Muir, Tony Wallace	LPNF Fish Survey	Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria. (LPNF Stream Habitat and TES Occupancy	53 Rainbow Trout counted
Tule Creek	Tule Creek	40	1-10"	2000 Dec. 18-19	Jamie Uyehara	Project manager for Forest Service	LPNFS Sespe and Tule Creek Snorkeling Surveys. Survey Data sheets on file at Santa Lucia Ranger Station in Santa Maria.	32 Rainbow trout recorded between 1" and 6"; 8 Rainbow trout recorded between 6" - 10".
West Fork Sespe Creek	West Fork Sespe Creek	Abundant	3" -12"	1979 Sept. 10	Ken Kestner and Don Edwards	USDA Forest Service Stream Survey	On file in Santa Lucia Ranger Station Office in Santa Maria.	Abundance of trout was common

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
West Fork Sespe Creek	Lower Portion	1+	Unknown	1994-1995	LPNF Survey Crew	LPNF	Figure 2. Steelhead/ resident rainbow trout abundance and location of potential barriers to upstream fish movements in the Sespe Creek watershed. Trout abundance estimates from 1994-1995 electro-shocking and snorkel surveys. Sespe Watershed Analysis 1997.	Low to medium abundance of rainbow trout noted on two different tributaries within the West Fork Sespe Creek drainage. See Figure 2. map for recorded distribution extent.

Hopper Creek								
Stream(s)	**Location**	**# Salmon.**	**Fish Size**	**Date**	**Observer(s)**	**Affiliation**	**Source**	**Notes**
Hopper Creek	Pool below the large impassable upstream anadromous limit waterfall	1+	16"+	1984	Friend of Rod Thompson	Rod Thompson, Retired Ventura County Sheriff Captain	pers. comm. 2005 with Stoecker	Thompson reported that a close friend of his observed a several trout in the 16" range and some bigger in the large pool below waterfall identified in this report as the upstream natural limit to anadromy.
Hopper Creek	Upstream of the large waterfall that is the upstream limit to anadromy	Numerous	9"-11"	1985-1989	Rod Thompson	Retired Ventura County Sheriff Captain	pers. comm. 2005 with Stoecker	Thompson reported that he fished Hopper Creek several times in this time period upstream of the large impassable waterfall and limit to anadromy. He reported excellent year-round flows in Hopper Creek and abundant rainbow trout upstream of the waterfall. He did not know how they got upstream of the waterfall.
Hopper Creek	Upstream to impassable waterfall	10	12"-16"	2001 April	Brian Trautwein	Environmental Defense Center	pers. comm. 2005 with Stoecker	Trautwein reported seeing up to 10 rainbow trout approximately 12-16 inches on Hopper Creek upstream of Highway 126 to the large pool at the base of the impassable waterfall identified as the upstream limit to anadromy in this report. Trautwein also reported that Maurice Cardenas of the DFG had surveyed Hopper Creek and observed rainbow trout presence.

Piru Creek and Tributaries								
Stream(s)	**Location**	**# Salmon.**	**Fish Size**	**Date**	**Observer(s)**	**Affiliation**	**Source**	**Notes**
Aqua Blanca	Above Narrows, One mile above mouth of creek, Near Tin Camp	Numerous	Unknown	1933, 1934, 1935, 1939, 1942, and 1944	CDFG	CDFG	CDFG Fish Planting Record. On file in Santa Lucia Ranger Station Office in Santa Maria.	Many records of Rainbow trout planted in years: 1933, 1934, 1935, 1939, 1942, and 1944 Department of Fish and Game: Fish Planting Field Record: Fish planted above in numerous locations: 1. Above Narrows, 2. One mile above mouth of creek. 3. Near Tin Camp. Smolts planted from Hot Creek, Mt. Whitney
Agua Blanca	Surveyed from Borracho Springs Downstream to Piru Creek Confluence	Abundant	1"-15"	1979 Aug. 7-9	Mark Moore	LPNF Surveyor	USDA Forest Service Stream Survey: On file in Santa Lucia Ranger Station Office in Santa Maria.	Upper Section Surveyed: "Trout seen up both forks upper canyon, many 0"+ fish." Middle Section Surveyed: "Trout abundant, many up to 12"." Lower Section: "...few large trout though many 1"-3" trout seen"
Buck Creek	Buck Creek	4,080	Fingerlings	1942 March 23	CDFG	CDFG Fish Planting Record	Santa Lucia Ranger Station Office in Santa Maria.	4,080 fingerlings planted

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Buck Creek	Buck Creek	1,600	Fingerlings	1942 June 23	CDFG	CDFG Fish Planting Record	On file in Santa Lucia Ranger Station Office in Santa Maria.	1,600 fingerlings planted
Buck Creek	3 miles of Buck Creek	1+	Various	1953 June 29	Fisheries Biologist	CDFG	Department of Fish and Game Intraoffice Correspon-dence	"Buck Creek has about 3 miles of fishable water during good water years. There is sufficient water there to support trout, adequate numbers of our Piru Creek stocking work upstream and provide a small fishery."
Chorro Grande Creek	Chorro Grande Creek	4,080	Fingerlings	1942 March 27	CDFG	CDFG Fish Planting Record	On file in Santa Lucia Ranger Station Office in Santa Maria.	4,080 fingerlings stocked from Hot Creek

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Fish Creek	Fish Creek/ Piru confluence to 6 miles up river	30 - 50 rainbow trout per 100 feet of stream	1"-13"	1979 Sept. 11	LPNF	USDA Forest Service Stream Survey	USDA Forest Service Stream Survey: On file in Santa Lucia Ranger Station Office in Santa Maria.	
Lockwood Creek	From Confluence with Piru up river 4 miles	Abundant	6"-8"	1946 Sept. 18	CDFG	CDFG Field Notes	On file in Santa Lucia Ranger Station Office in Santa Maria.	"Lockwood creek only extends 4-5 miles from Sneddens to junction with Piru Creek. Green algae is abundant; adequate pools and shelter. A fine little trout stream. Trout 6-8 inches in length in nearly every pool."
Lockwood Creek	Lockwood Creek	63	Average total length was 136mm	1996-1997	Fisheries Biologist for CDFG	CDFG	Summary of CDFG Upper Piru Creek Fish Population Surveys. 1996-1997	"During electrofishing, snorkeling, angling surveys the only fish observed were rainbow trout. A total of 63 trout were recovered from Lockwood Creek."

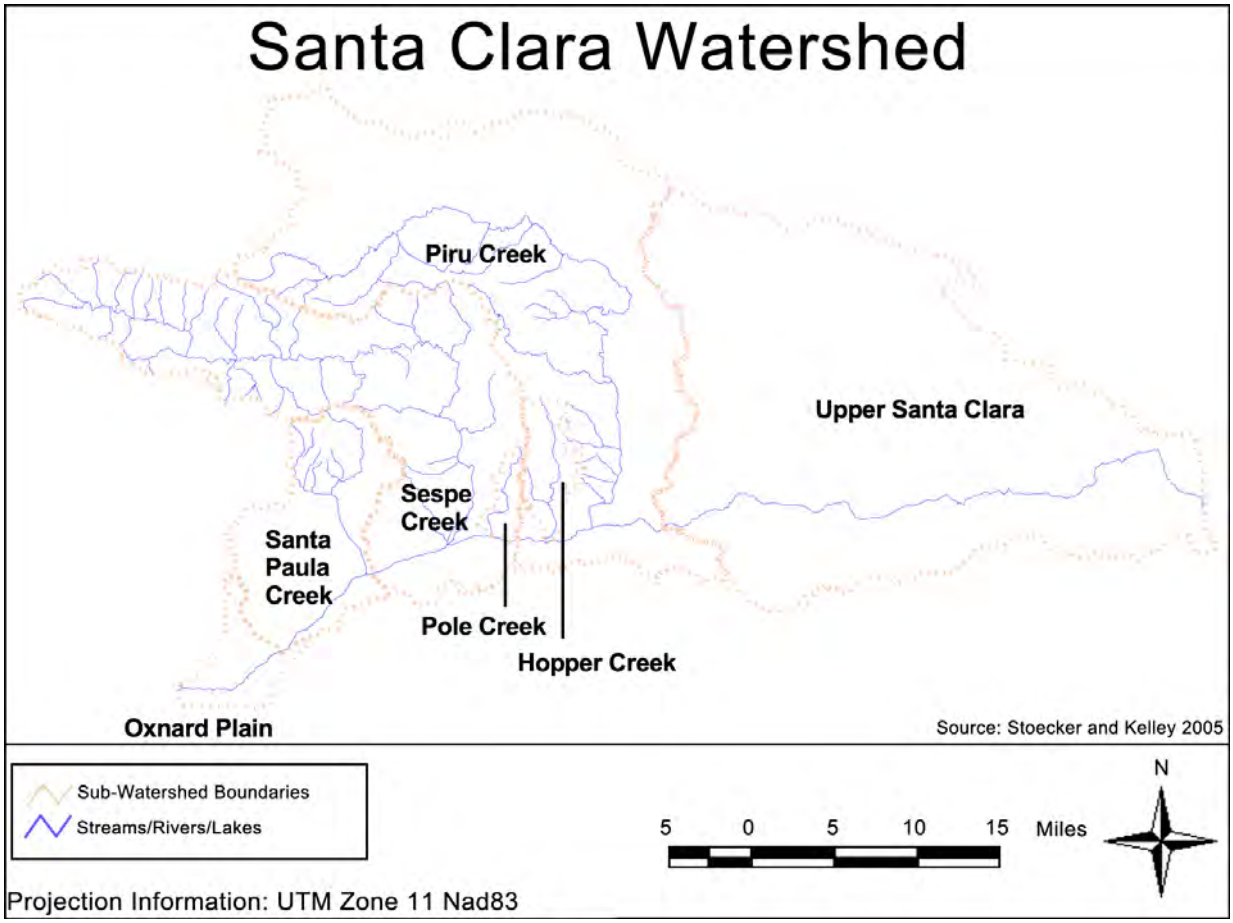
Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Piru Creek	From the Santa Clara River upstream to Snowy Creek	Numerous	Adult Steelhead	1930's and 1940's	CDFG	California Department of Fish and Game	Sespe Watershed Analysis. 1997. Los Padres National Forest and Ojai Ranger District, January 1997.	"Historical accounts do not differentiate between steelhead trout and rainbow trout, creating difficulty in determining the extent of early anadromous runs. California Department of Fish and Game surveys and field notes from the 1930's and 1940's indicate that steelhead ran up Piru Creek to Buck and Snowy tributaries (Evans, 1946)
Piru Creek	Upper Piru Creek	437 fish estimate per mile of river	Average total length was 136mm	1996-1997	Fisheries Biologist for CDFG	CDFG	Summary of CDFG Upper Piru Creek Fish Population Surveys. 1996-1997	"During electrofishing, snorkeling, angling surveys the only fish observed were rainbow trout. A total of 140 trout were recovered from the three sections sampled on Piru Creek."

Stream(s)	Location	# Salmon.	Fish Size	Date	Observer(s)	Affiliation	Source	Notes
Seymour Creek	Upstream of Lockwood Creek	Many	Fingerlings	1943-1944	CDFG	CDFG	CDFG Fish Planting Record. On file in Santa Lucia Ranger Station Office in Santa Maria.	"Many fingerlings planted"
Seymour Creek	Lower .5 miles surveyed	1+	Planted Size	1946 Sept. 18	CDFG	CDFG	CDFG Stream Survey. On file in Santa Lucia Ranger Station Office in Santa Maria.	"This creek is suitable for trout in lower .5 mile. Trout present in pools. There appeared to be a few of planted size that had run up out of Lockwood Creek."
Snowy Creek	Snowy Creek	4860	Fingerlings	1942 March 10	CDFG	CDFG	CDFG Fish Planting Record.. On file in Santa Lucia Ranger Station Office in Santa Maria.	4,860 fingerlings stocked

Also see Appendix III for additional historic salmonid documentation for the Santa Clara River watershed from Titus, CDFG.

Habitats, Populations, and Barriers

There were 702 habitat units in the five surveyed subwatersheds in the Santa Clara River watershed (Map 3).



Map 3. Drainages of the Santa Clara River Watershed

In discussing the information and data collected on each tributary of the Santa Clara River, there will be reference to habitat quality rather than habitat score. This is because the score includes the amount of habitat (in miles), which is good for understanding the overall value of a stream or watershed, but is less useful when trying to determine where optimal habitat occurs. Therefore the habitat quality and length of habitat available, when mentioned, will be discussed separately. The tributaries will be presented in the order encountered when moving from the ocean up the mainstem. All habitat scores are in Appendix I; Tables D. and E. are summaries of key parameters discussed below.

Table D. Key Stream Reach Characteristics (includes mainstem)

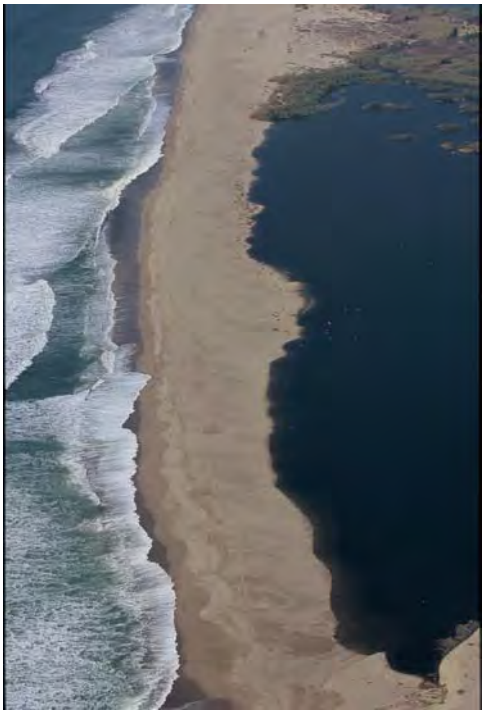
	Habitat Quality	% Embeddedness	% Canopy	No. of *O. mykiss* observed in field	Miles of habitat
Santa Clara Mainstem	4.75	69.2	9.2	0	32.6
Santa Paula Creek	6.45	28.6	53.3	233	18.4
Sespe Creek	5.59	36.4	31.0	2952	123.0
Pole Creek	3.75	62.5	42.5	No Access	4.7
Hopper Creek	5.21	63.3	26.7	No Access	10.3
Piru Creek	5.47	41.7	28.8	24	128.0
Average	5.2	50.3	31.9	--	--
Total	--	--	--	3209	317

Table E. Proportion of *O. mykiss* observed in Santa Paula, Sespe, and Piru Creeks during 2004 surveys, by size class

	Less than 3.0"	3.0 - 6.0"	6.1 - 9.0"	Larger than 9.0"
Santa Paula Creek	51.0%	35.0%	13.0%	1.0%
Sespe Creek	61.0%	32.0%	5.0%	2.0%
Piru Creek	17.0%	58.0%	25.0%	0.0%

Mainstem Santa Clara Population and Habitats

The Santa Clara Estuary historically encompassed approximately 300 acres of open water habitat, but is currently limited to approximately 30 acres, a reduction of 90% since the turn of the century. (City of San Buenaventura 2005). Estuarine habitats, which have been studied in other California coastal watersheds, have been shown to provide a highly productive rearing habitat, disproportionate to the total amount of freshwater rearing habitat available in the river system (Smith 1982, 1990).



Sandbar at the mouth of the Santa Clara River

In general, the Santa Clara River mainstem is a sandy, broad channel with adjacent flood plains and associated vegetation. Fine particles such as silt and sand can interfere with or prevent trout egg development and growth. The mainstem has few established riparian trees or large boulder substrate instream that offer shade to cool water temperatures and cover from predators. The mainstem upstream of the Vern Freeman Diversion has a tendency to run along the base of South Mountain creating more pool habitat than in the reach below the Vern Freeman Diversion Dam where the Santa Clara River delta (Oxnard Plain) fans out.

Upstream of the Vern Freeman Diversion looking toward Santa Paula

Thirteen reaches were surveyed beginning at the mouth of the river and extending upstream to the confluence with Piru Creek. Surface flow was present in the majority of the reaches surveyed. There was greater channel alteration below the Santa Paula Creek confluence, than upstream of it. Non-native vegetation, including infestations of *Arundo donax* in the lower and middle reaches, occurred in every surveyed reach. In terms of habitat characteristics important to trout, the average of the six water temperatures taken upstream and downstream of Santa Paula Creek during the fall was 57.7°F. As would be expected naturally, the mainstem of the Santa Clara River had the highest average percent substrate embeddedness of the surveyed areas, and the lowest percent riparian canopy closure. Spawning gravel was either absent or in low abundance. The average habitat quality score was a low 4.75. Surface flow abundance and duration is highly variable due to extensive water diversion, reservoir release, and groundwater pumping operations within the watershed. While conditions are poor for spawning and sub-optimal for rearing in most reaches, the mainstem is a critical migration corridor for upstream and downstream steelhead movement.

Downstream of the Santa Paula Creek confluence

Neither trout, nor exotic fish were observed in the Santa Clara River, but only limited observations were conducted at a small number of example reaches and from the air. The mainstem contains downstream migrating steelhead smolts during certain times of the year and may contain rainbow trout year round in some perennial reaches. The mainstem mainly serves as a migration corridor between headwater habitat and the ocean although historic documentation of adult steelhead downstream of Sespe Creek during summer months in the early to mid 1900's indicate that the mainstem may have served a valuable function for over-summering adult steelhead unable to migrate back to the ocean as flows subsided.

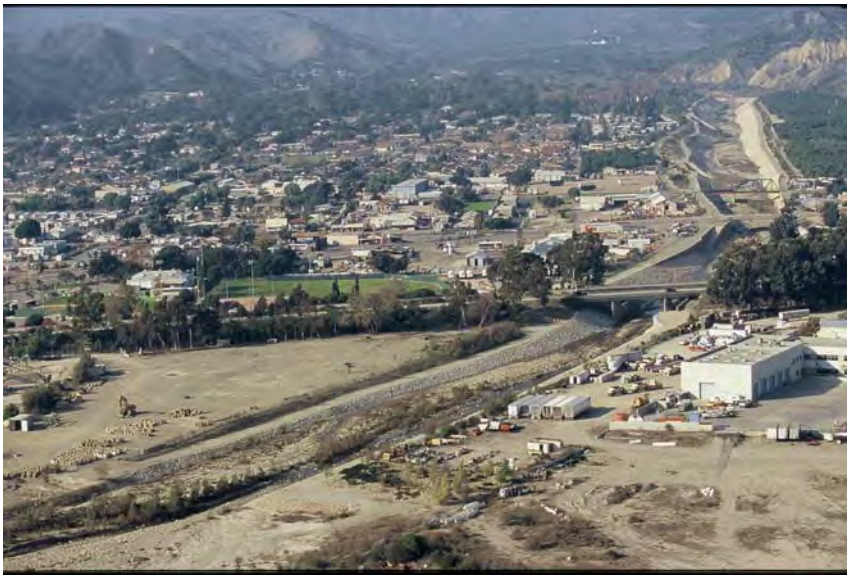
Upstream of the Santa Paula Creek confluence

Mainstem Santa Clara River Barriers

Every recommended fish passage improvement project listed in the barrier descriptions within this report are dependent upon mainstem Santa Clara River steelhead migration. The discussion of the Vern Freeman Diversion Dam also includes some discussion of upstream

surface flows and releases from upstream reservoirs that must be considered together. Mainstem migration flow studies and steelhead recovery actions must also be coordinated with all water users and facilities within the watershed. Ensuring effective steelhead migration upstream and downstream on the mainstem of the Santa Clara River is essential for recovery of the steelhead population. In fact, effective mainstem migration is necessary for the anadromous steelhead population regardless of other actions taken because without access to the principal steelhead spawning and rearing tributaries all other recovery actions would have little or no effect on the recovery of steelhead.

Santa Paula Creek Populations and Habitat

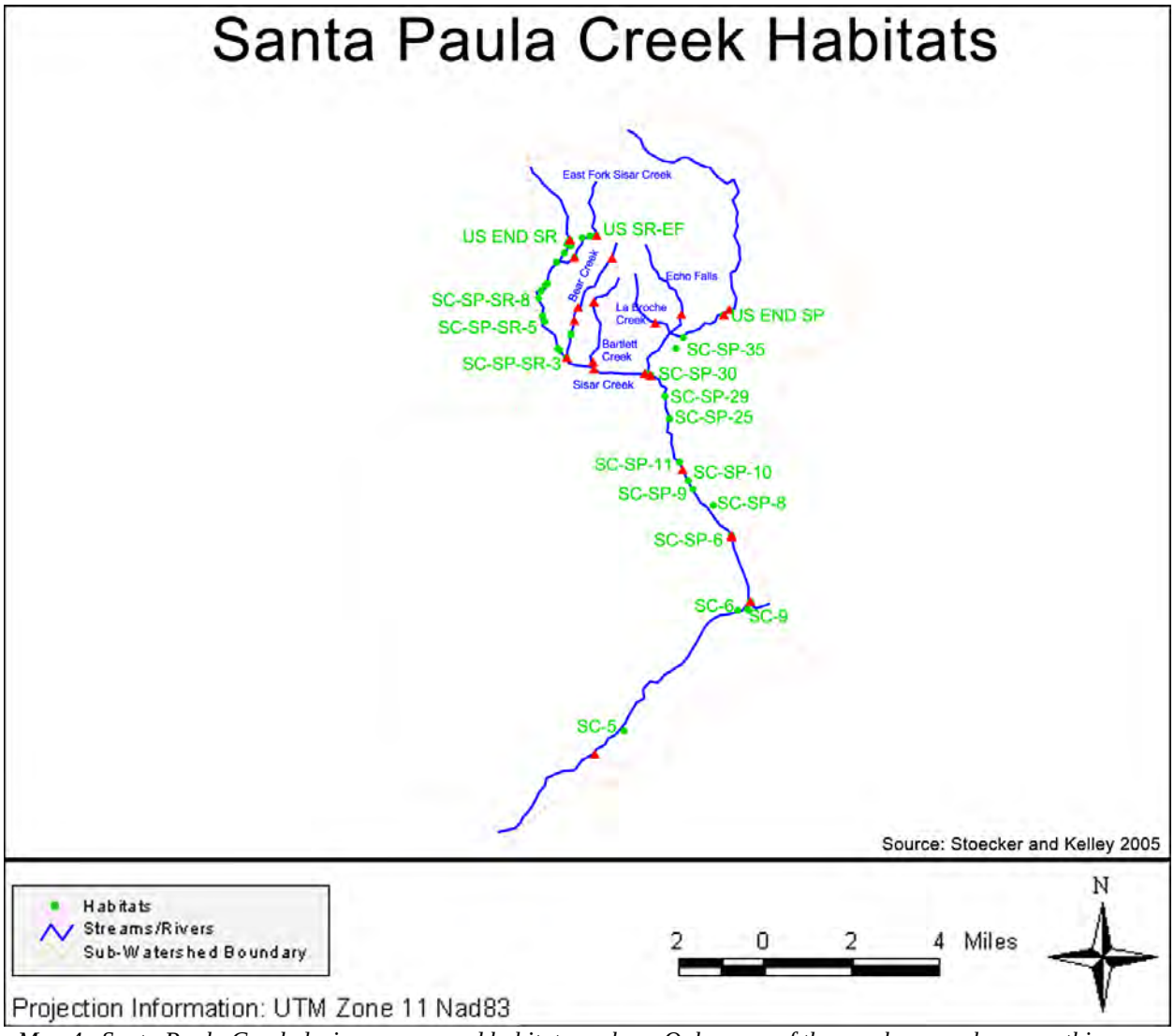


Lower Santa Paula Creek and ACE Channelization

Eighty-two reaches were surveyed within the Santa Paula Creek drainage (Map 4).

Santa Paula Creek has a significant amount of good trout habitat, and the tributary received the highest average habitat quality score at 6.45. Sisar Creek accounts for 84% of the trout observed in the Santa Paula Creek drainage. The greatest amount of channel alteration occurred lower in the creek, however there is also significant alteration downstream of the confluence of Santa Paula and Sisar Creeks adjacent to the Highway 150 crossing, as well as on portions of Bear Creek. Water temperature was taken in 71 reaches during the fall and averaged 53.9°F. Native vegetation was found throughout the subwatershed, and perennial water flow occurred in all mainstem reaches and along the mainstem of Sisar Creek. Spawning gravel varied throughout stream reaches with many reaches containing a moderate to high amount of clean spawning gravel. Santa Paula Creek had the lowest average percent substrate embeddedness in the study area, as well as the highest instream cover value, and riparian canopy closure. The Santa Paula Creek drainage contains approximately 18.5 miles of habitat historically accessible to steelhead.

A total of 233 trout were observed in the surveyed reaches with the smallest size class of fish dominating at more than 50% of the total. Relative abundance of fish on Santa Paula Creek was the second highest in the lower Santa Clara River watershed. No exotic fish were observed in the surveyed reaches. A small number of Santa Ana sucker were observed in the lowest reaches of Santa Paula Creek just upstream of the Santa Clara River and downstream of the Army Corp channel.

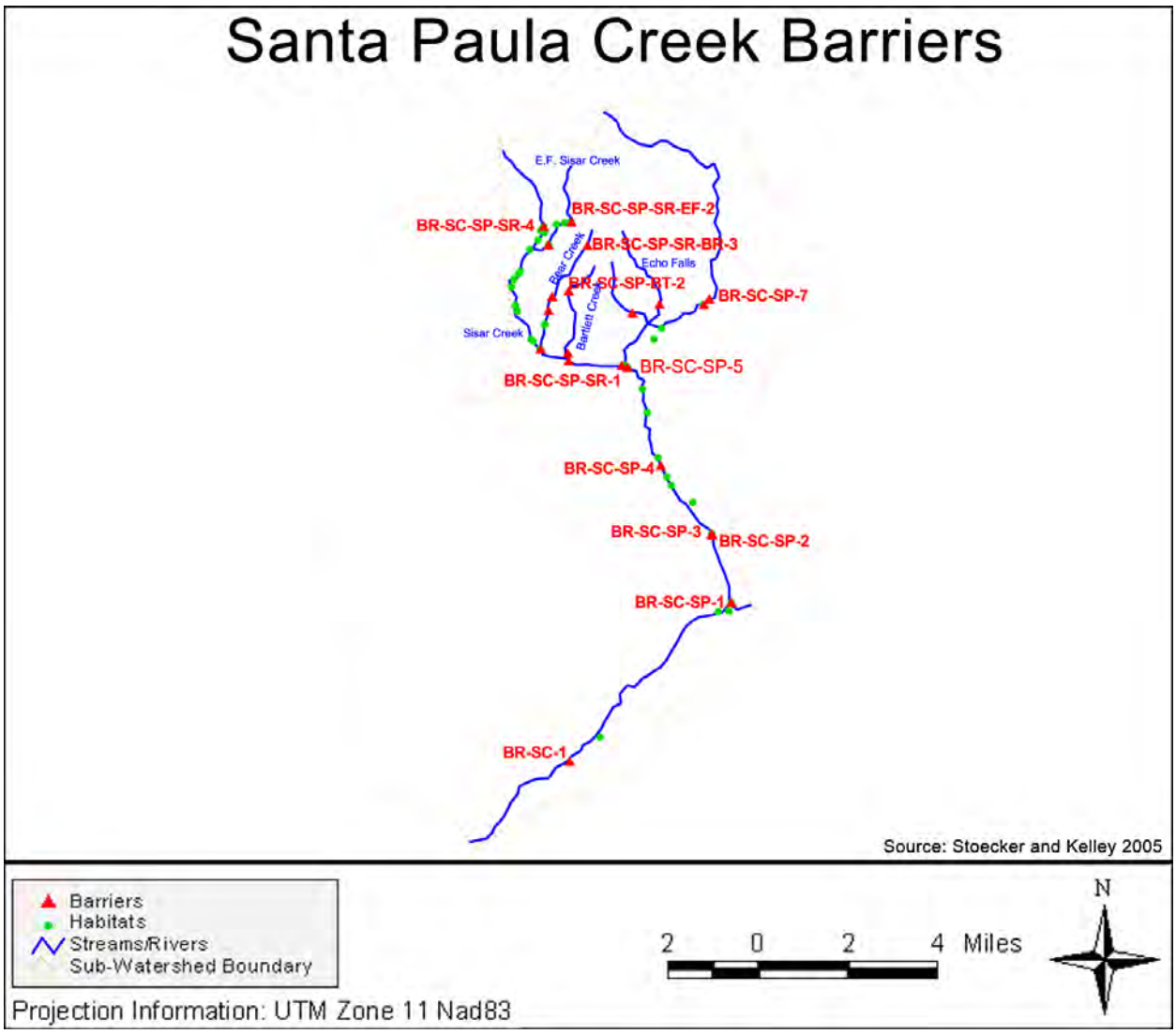


Map 4. Santa Paula Creek drainage surveyed habitat reaches. Only some of the reaches are shown on this map.

Santa Paula Creek at Steckel Park Bridge

Santa Paula Creek Barriers

With adequate mainstem Santa Clara River migration, Santa Paula Creek offers substantial high quality habitat with *O. mykiss* present. The drainage also contains some of the Santa Clara River watershed's most challenging steelhead barriers, after the Piru Creek drainage (Map 5).



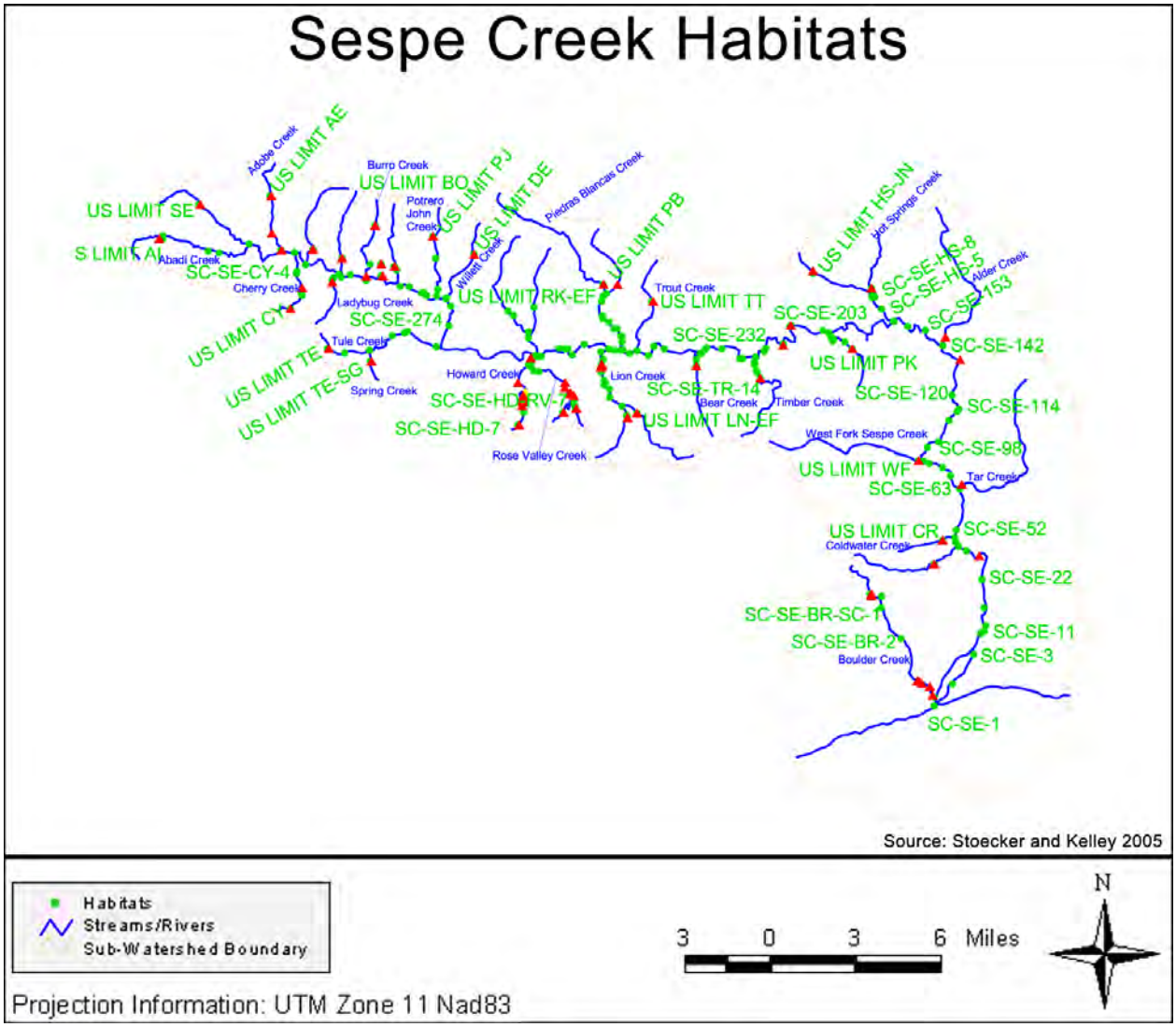
Map 5. First barrier on the mainstem Santa Clara River, and the barriers on Santa Paula Creek. Barriers depicted in this map include all recorded potential impediments to fish passage, ranging from those which present complete blockage under all flow conditions, to those that present a partial blockage only under some flow conditions. The text should be consulted for a full characterization of each of the depicted barriers on this map.

Following the high stream flows of 2004/2005 many of the barriers in Santa Paula Creek were dramatically altered. Fish ladder facilities at the Army Corp Channel near the mouth and at Harvey Dam were both damaged so severely that fish passage at those sites is no longer possible and the entire drainage is effectively inaccessible to steelhead or other upstream migrating fish. CALTRANS grade control structures under the Highway 150 bridge also failed causing another impassable fish barrier. Sisar Creek contains high quality habitat and several road-crossing barriers below the Los Padres National Forest. In general the tributaries to Sisar Creek have minimal habitat value, so the barriers on the mainstem Sisar Creek rank higher and fish passage improvement projects should focus on those barriers following effective passage on the mainstem of Santa Paula Creek.

Sespe Creek Populations and Habitat

Sespe Creek has little anthropogenic channel alteration except levee construction and bank protection in the lower creek adjacent to Fillmore and upstream bank protection adjacent to Highway 33 near Potrero John and Derydale Creeks. Much of the watershed has been highly

impacted by recent fires. Of the 485 surveyed reaches (Map 6), water temperature was measured in 240 of them, and the average summer/fall temperature was 59.8°F. Surface flow was observed to be perennial downstream of the Hot Springs Creek confluence with Sespe Creek, and was variable or dry upstream of the confluence of Hot Springs Creek to the confluence with Potrero John Creek. Perennial flow also occurs where spring flows from Howard Creek empty into Sespe Creek and extends downstream. Upstream from the Potrero John Creek confluence Sespe Creek has alternating perennial or variable water presence with dry reaches observed in the uppermost reaches of Sespe Creek.



Map 6. Sespe Creek drainage surveyed habitat reaches. Only some of the reaches are shown on this map.

In many locations, especially the lower gorges, steep bedrock walls provide extensive shade cover where a riparian canopy may be absent. The majority of riparian canopy vegetation in the Sespe Creek subwatershed is native. Out of the reaches surveyed, close to half had a medium abundance of spawning gravel.

Sespe Creek upstream of Devil's Gate

The greatest numbers of trout observed in the Santa Clara River watershed were in the Sespe Creek drainage with a total of 2954, and the Sespe had the highest relative abundance of trout. The smallest size class of trout contained 61% of fish observed. Native Arroyo chub and Three-spine stickleback also occurred in reaches of this subwatershed.

West Fork Sespe O. mykiss

Bullhead catfish and green sunfish occur in Sespe Creek. The highest occurrence of exotic fish occurred from just upstream of the confluence of Coldwater Creek to near the confluence with Bear Creek. No exotic fish were observed in any Sespe Creek tributaries, but the source of these fish may be from reservoirs within the Howard Creek/Rose Valley tributary where exotic fish have been planted in the past. The average temperature for reaches in which

exotic fish occurred was 67.14°F versus 56.32°F for reaches that did not have exotic fish. Of the 107 surveyed reaches that had exotics, bullhead catfish occurred in 78 reaches, and green sunfish occurred in 46.

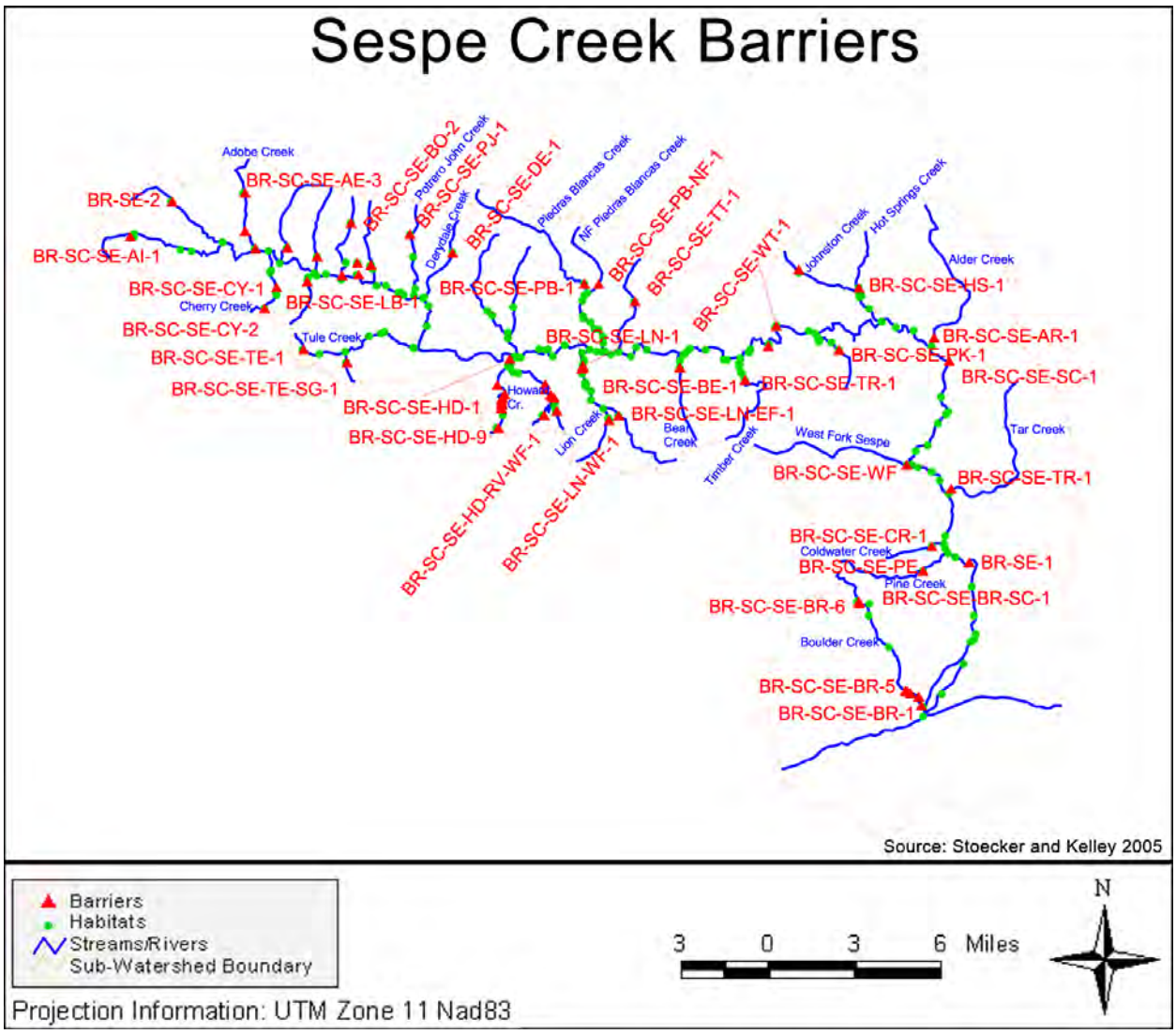
Juvenile Black Bullhead from Sespe Creek

Sespe Creek had the second lowest overall percent substrate embeddedness of surveyed Santa Clara River tributaries, medium levels of riparian canopy closure, and the second highest average habitat quality at 5.59. As noted earlier, the recent fires and low rainfall in the Santa Paula and Sespe Creek watersheds may have increased the degree of embeddedness in both creeks. Sespe Creek contains 123 miles of habitat historically accessible to anadromous steelhead, the second highest amount of tributary habitat in the lower Santa Clara River watershed. Due to the high quality salmonid habitat, large quantity of habitat, lack of mainstem migration barriers, and presence of wild, self-sustainable *O. mykiss* populations, Sespe Creek offers the greatest potential for immediate steelhead recovery in the Santa Clara River. The ability of Sespe Creek to provide Santa Clara River steelhead recovery is entirely dependant upon adequate migration flows on the mainstem Santa Clara River and effective fish passage at the Vern Freeman Diversion Dam.

Perennial habitat on Sespe Creek downstream of Howard Creek

Sespe Creek Barriers

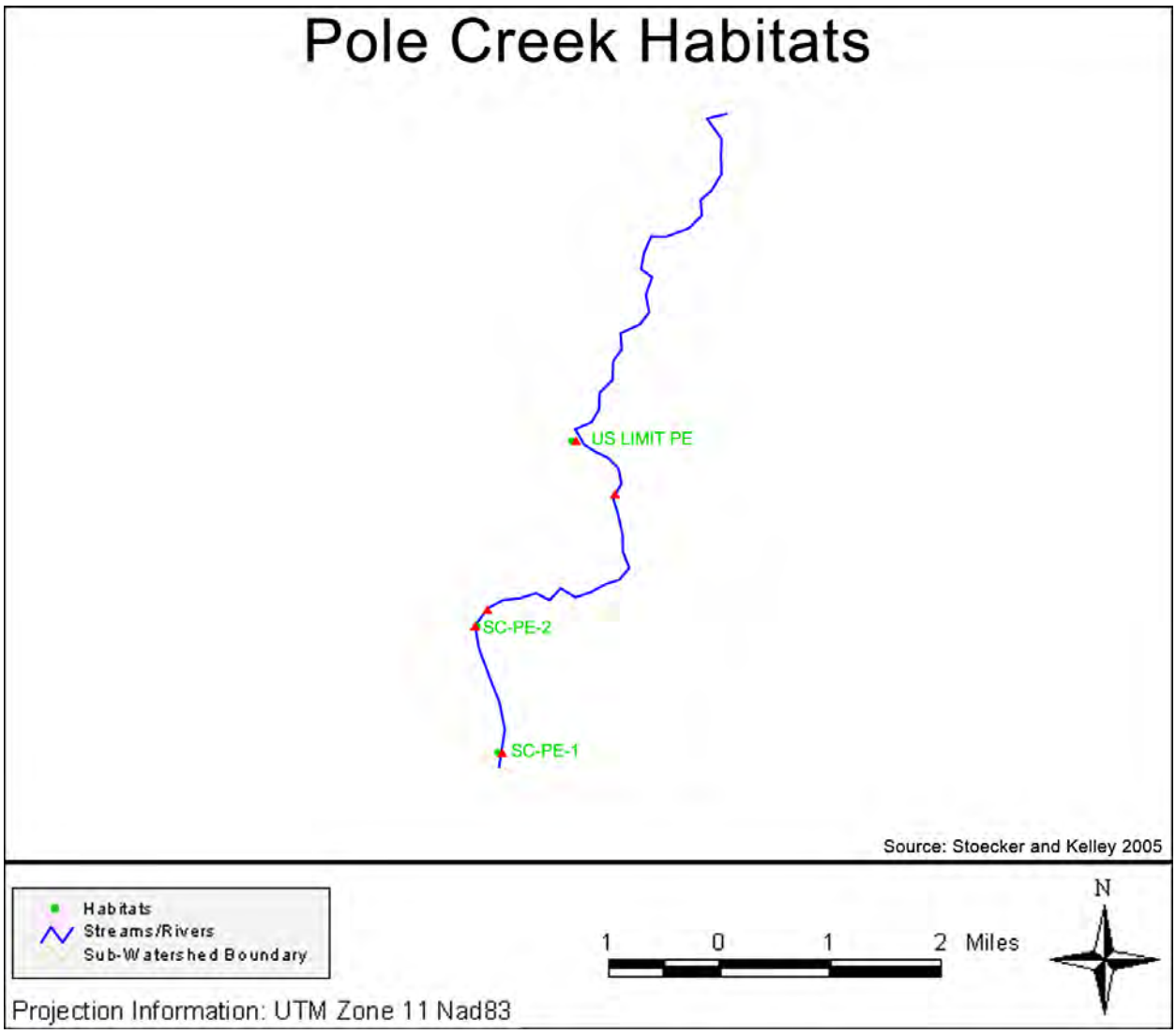
With adequate mainstem Santa Clara River migration opportunities, Sespe Creek offers the largest amount of high quality habitat with wild, reproducing *O. mykiss*. Only the partial remains of one broken down dam occur on the mainstem of Sespe Creek. Other than this relic, no other unnatural structures impede upstream steelhead passage on the mainstem (Map 7). Several anthropogenic barriers occur on important tributaries to Sespe Creek. The highest ranked tributary barriers start with Howard Creek, followed by barriers on Boulder and Lion Creek with barriers on Burro Creek 1 and 2 and Adobe Creek intermixed.



Map 7. Barriers on Sespe Creek. Not all barriers are labeled in order to increase legibility. Barriers depicted in this map include all recorded potential impediments to fish passage, ranging from those which present complete blockage under all flow conditions, to those that present a partial blockage only under some flow conditions. The text should be consulted for a full characterization of each of the depicted barriers on this map.

Pole Creek Populations and Habitat

Pole Creek is a smaller tributary to the Santa Clara River; limited observations and habitat estimations for two reaches were made from the air (Map 8).



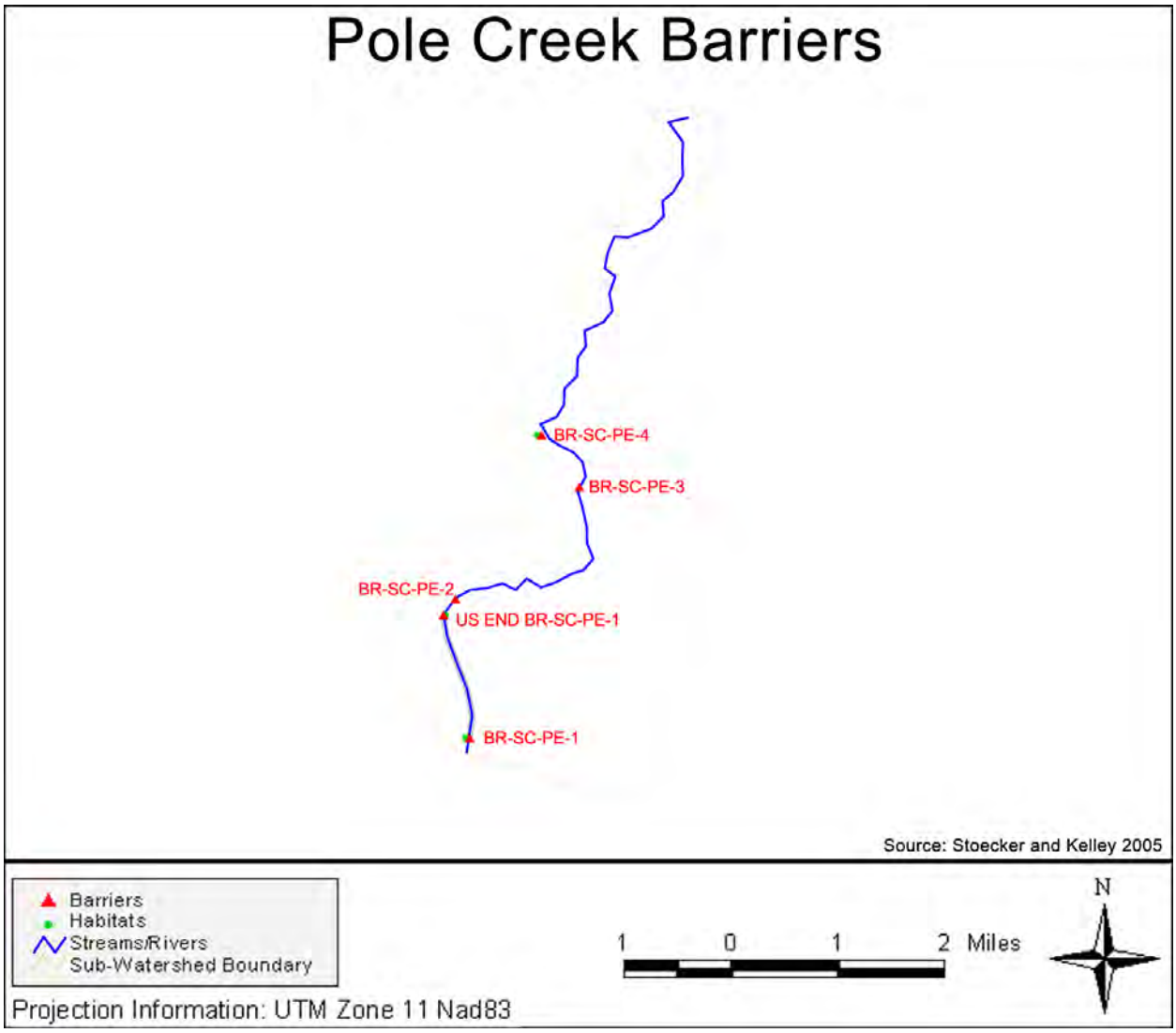
Map 8. Pole Creek drainage surveyed habitat reaches. Only some of the reaches are shown on this map.

There is a high amount of channel alteration in the lower creek due to the presence of a flood control channel. Non-native riparian vegetation occurs in the lower reach. Dense native riparian vegetation occurs in the upper reach. Spawning gravel was absent in the flood control channel and estimated to occur in medium abundance throughout the upper reach. Pole Creek had the second highest average percent canopy closure, the lowest estimated average maximum water depth, the shortest surveyed habitat at 4.7 miles, and an average habitat quality of 3.75. This currently inaccessible tributary appears to contain a limited amount of amount of adequate salmonid habitat that likely has the potential to support a small steelhead population if fish passage is provided to the upper drainage. It is unknown whether trout occur in Pole Creek. Additional habitat and snorkeling surveys are needed.

Following completion of this report a 1999 Department of Fish and Game memorandum was obtained with comments from NOAA Fisheries. This document (CDFG 1999) describes habitat conditions observed in a 1992 survey of Pole Creek along with several color photographs. The surveyors describe adequate salmonid habitat conditions in Pole Creek, but no trout presence. This memorandum is attached in Appendix IV. Please refer to this memo for additional information

Pole Creek Barriers

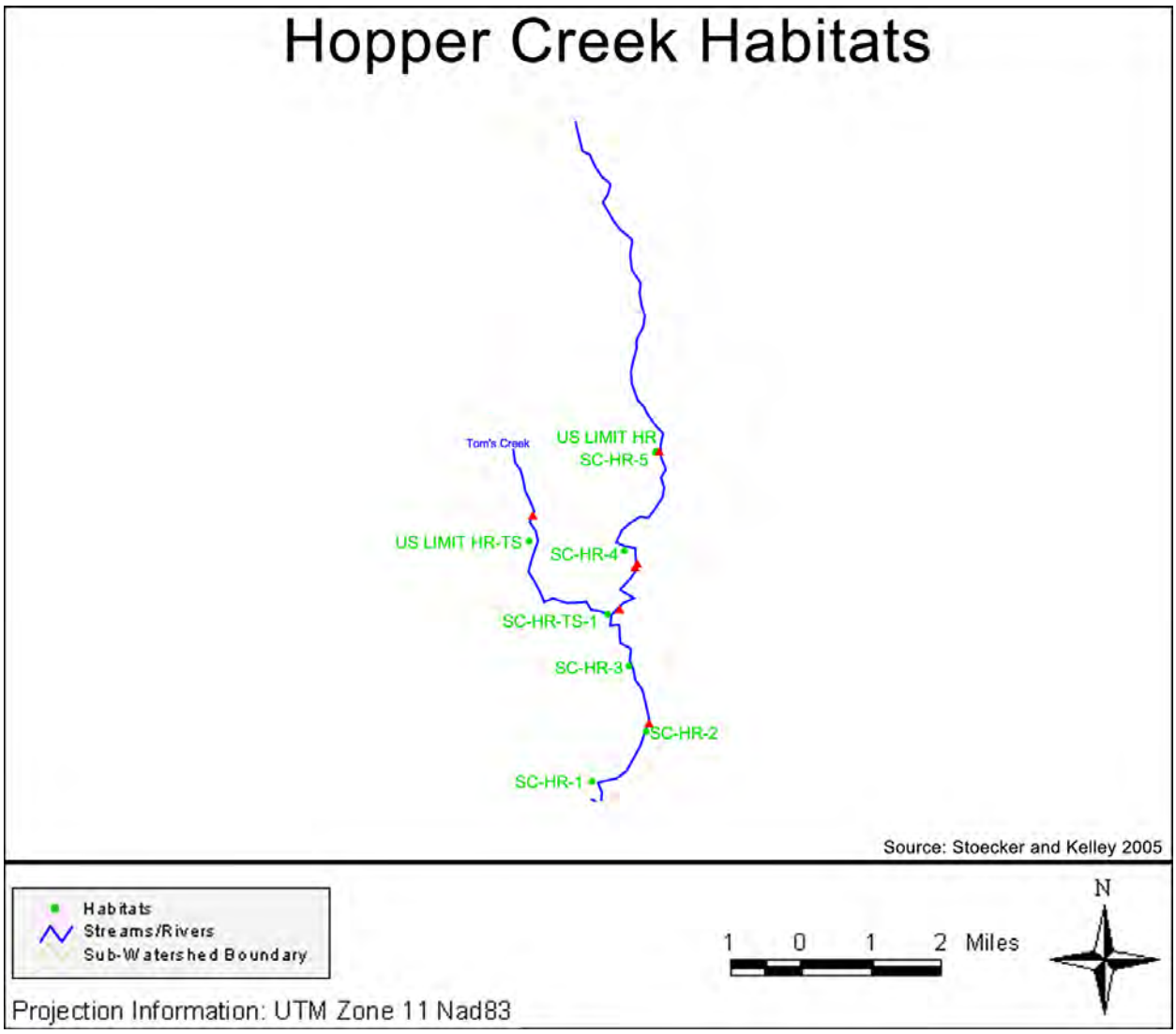
Additional assessment of habitat conditions and potential migration barriers is needed to determine if costly fish passage measures are warranted (Map 9). This tributary may not be considered a high short-term priority for Santa Clara River steelhead recovery, but rather part of a long-term recovery objective.



Map 9. Barriers on Pole Creek. Not all barriers are labeled in order to increase legibility. Barriers depicted in this map include all recorded potential impediments to fish passage, ranging from those which present complete blockage under all flow conditions, to those that present a partial blockage only under some flow conditions. The text should be consulted for a full characterization of each of the depicted barriers on this map.

Hopper Creek Populations and Habitat

Six stream reaches on Hopper Creek were assessed and only limited habitat observations were made from Highway 126, adjacent road access in the nursery facilities, and from the air due to lack of access (Map 10).



Map 10. Hopper Creek drainage surveyed habitat reaches. Only some of the reaches are shown on this map.

There was greater channel alteration lower in the creek with a constructed earthen levee, bank protection associated with Highway 126, and road crossings associated with nursery and oil facilities in the middle reaches. Spawning gravel was scarce or absent in the lower reaches, and appeared to be in high abundance in the upper reaches. The Tom's Creek tributary appeared to have low spawning gravel abundance. Excellent rearing habitat was observed in the uppermost accessible anadromous reaches immediately downstream from a large impassable waterfall.

Following completion of this report, a 1999 Department of Fish and Game memorandum was obtained with comments from NOAA Fisheries. This document (CDFG 1999) describes habitat conditions and *O. mykiss* observations from 1992 surveys within Hopper Creek. This memorandum is attached in Appendix IV. Please refer to this memo for additional information.

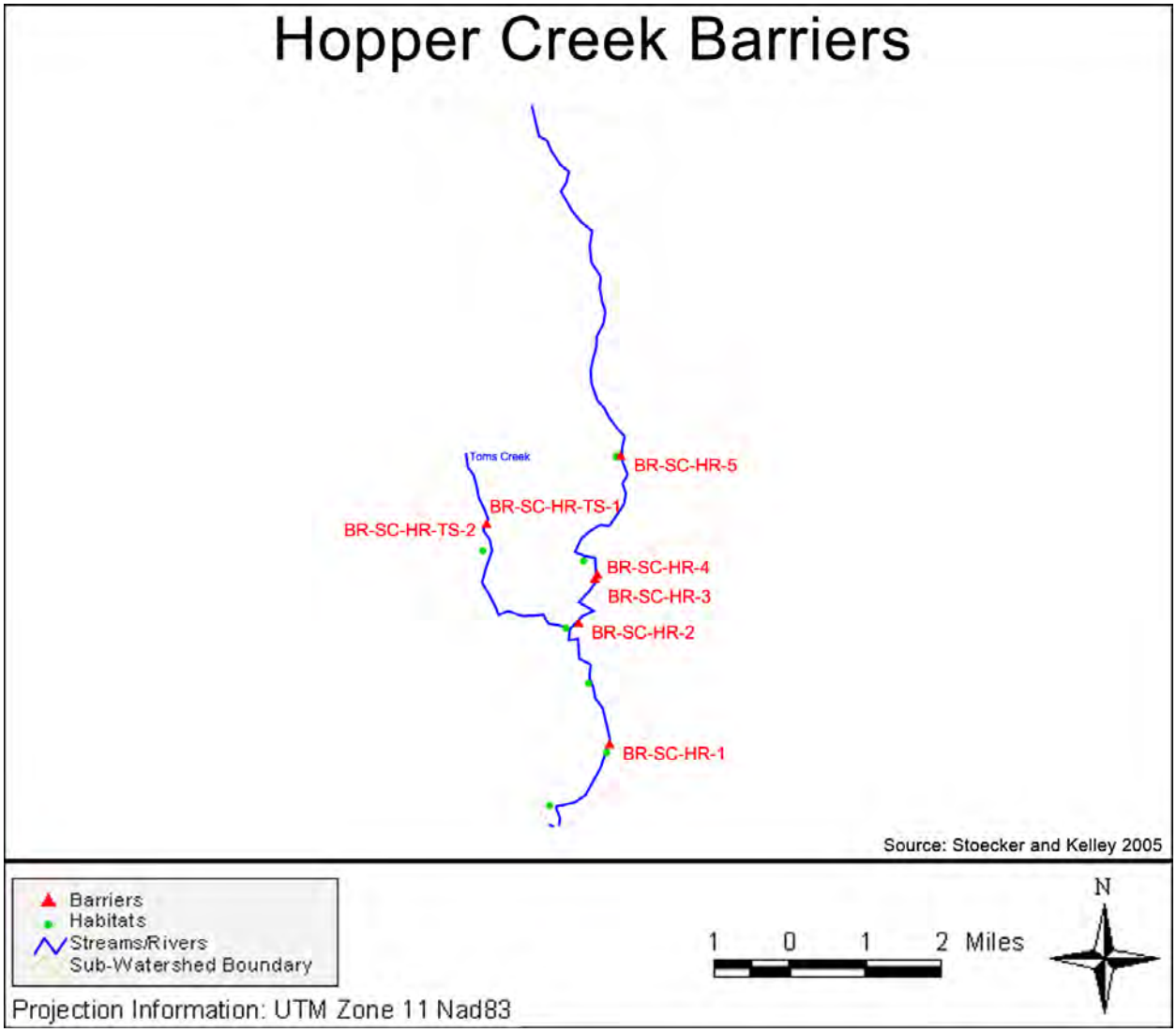
Hopper Creek upstream of nursery operations

Hopper Creek had the second highest average percent substrate embeddedness, and low average percent canopy closure, though its percent instream shelter cover was similar in value to most of the other tributaries. Hopper had an average habitat quality of 5.21. Hopper Creek has slightly more than 10 miles of habitat historically available to steelhead, at the upstream end of which a natural waterfall occurs. While relatively poor habitat conditions occur in the lower reaches and bring the average habitat value for the tributary down, excellent salmonid habitat conditions occur in the upper reaches. Large *O. mykiss* are also reported to occur in this tributary both upstream and downstream of the large waterfall barrier to anadromy (pers. comm. Thompson 2005).

Perennial habitat downstream of impassable waterfall on Hopper Creek, post-fire

Hopper Creek Barriers

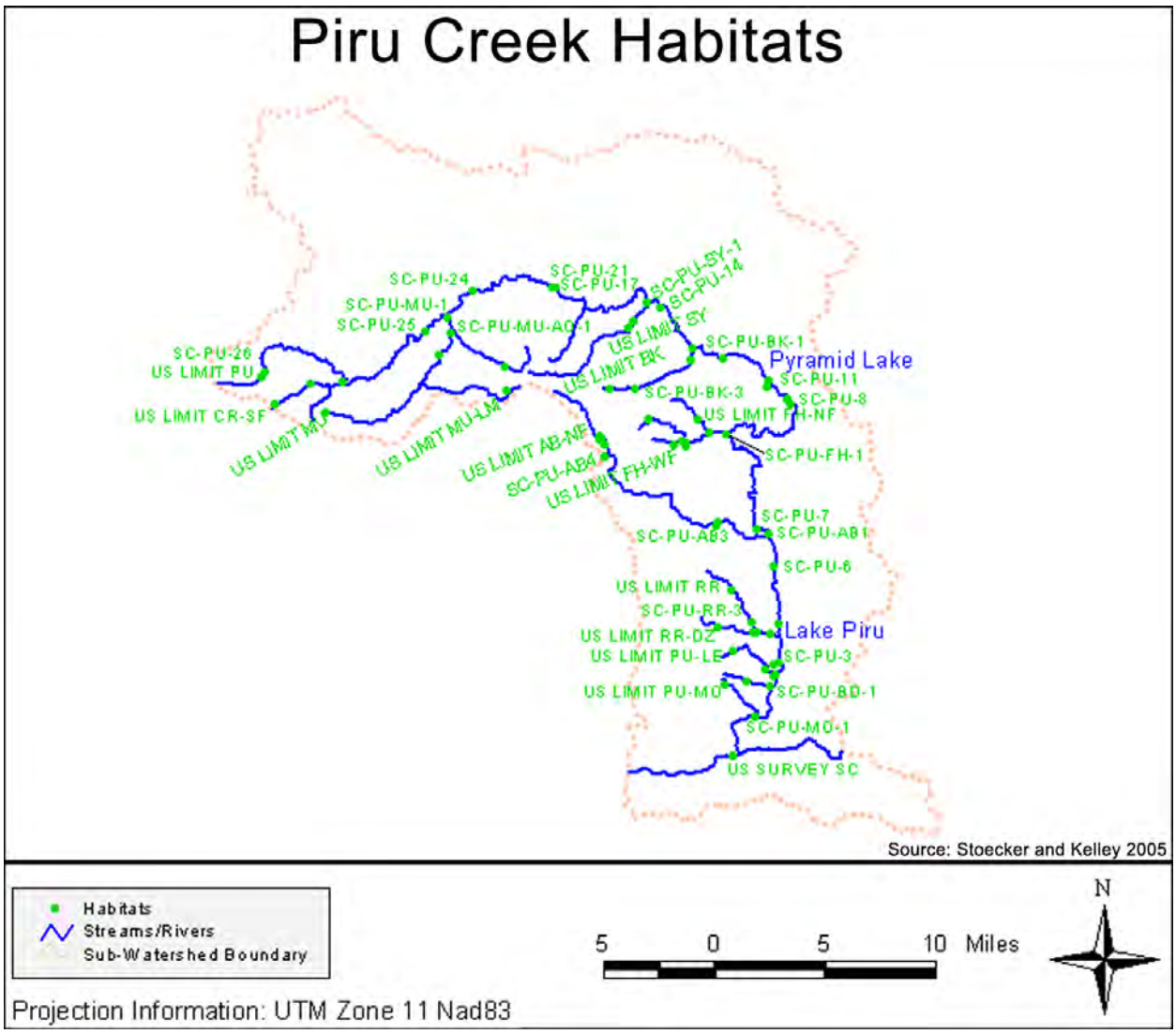
Hopper Creek's barriers ranked the highest after Santa Paula Creek barriers. This significant tributary has only four significant migration barriers with relatively inexpensive fish passage improvement recommendations to provide effective access for steelhead from the Santa Clara River (Map 11). Due to the relatively low cost of restoring steelhead access to this trout-bearing tributary, the restoration priority should be moderate to high. Successful recovery of steelhead to Hopper Creek is dependant on effective mainstem Santa Clara River surface flows from Santa Felicia Dam and upper watershed dam releases as well as effective fish passage at the Vern Freeman Diversion Dam and releases to the ocean.



Map 11. Barriers on Hopper Creek. Not all barriers are labeled in order to increase legibility. Barriers depicted in this map include all recorded potential impediments to fish passage, ranging from those which present complete blockage under all flow conditions, to those that present a partial blockage only under some flow conditions. The text should be consulted for a full characterization of each of the depicted barriers on this map.

Piru Creek Populations and Habitat

On Piru Creek, 54 reaches were identified and limited ground surveying of selected example reaches and aerial surveying was conducted (Map 12).



Map 12. Piru Creek drainage surveyed habitat reaches. Only some of the reaches are shown on this map.

There were some reaches with channel alteration observed including the two large mainstem dam and reservoir facilities and a concrete channel downstream of Pyramid Dam. One water temperature measurement of 34F was taken in the late fall with thick ice on the creek surface. Spawning gravel abundance was low downstream of Santa Felicia Dam and upstream of Lockwood Creek and medium throughout most of the subwatershed with some high abundance stream reaches between Piru Lake and Lockwood Creek. Twenty-four rainbow trout were observed in example reaches between Pyramid Lake and Lockwood Creek and trout are also known to occur between Pyramid Dam and Piru Lake and larger tributaries. Piru and Pyramid Lakes are known to support several exotic gamefish species that are planted and likely migrate into adjacent stream reaches.

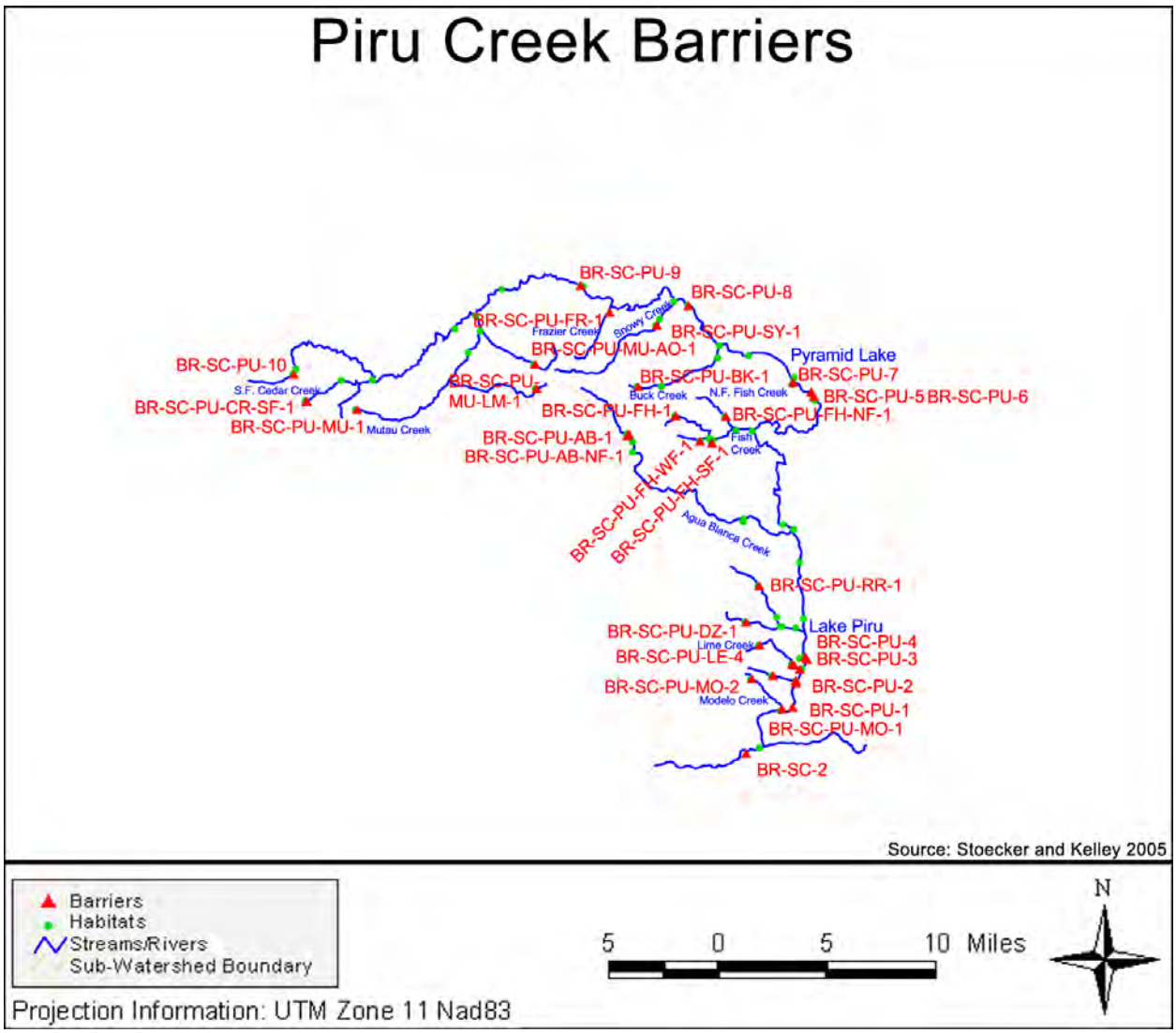
Piru Creek upstream of Agua Blanca Creek

Instream shelter cover was similar in value to other tributaries. Percent substrate embeddedness averaged 42%, and average habitat quality was 5.47. Piru had 128 miles of surveyed habitat excluding Lockwood Creek and other potentially valuable eastern tributaries downstream, which were not observed. The highest quality salmonid habitat in the Piru Creek drainage appears to occur downstream of Lockwood Creek and within the significant western tributaries. Surface flows in Piru Creek downstream of Pyramid Dam to the Santa Clara River are highly manipulated by dam releases and habitat conditions are highly dependant on these releases. Historic salmonid documentation identifies the pre-dam steelhead run migrating upstream to Buck and Snowy Creeks and within these and significant downstream western tributaries. Aqua Blanca and Fish Creek both contain suitable habitat for *O. mykiss* and support adfluvial populations of fish that have the potential to contribute to the re-establishment of anadromous runs of *O. mykiss* within the Piru Creek drainage (NOAA Fisheries 2005).

Piru Creek downstream of Gold Hill

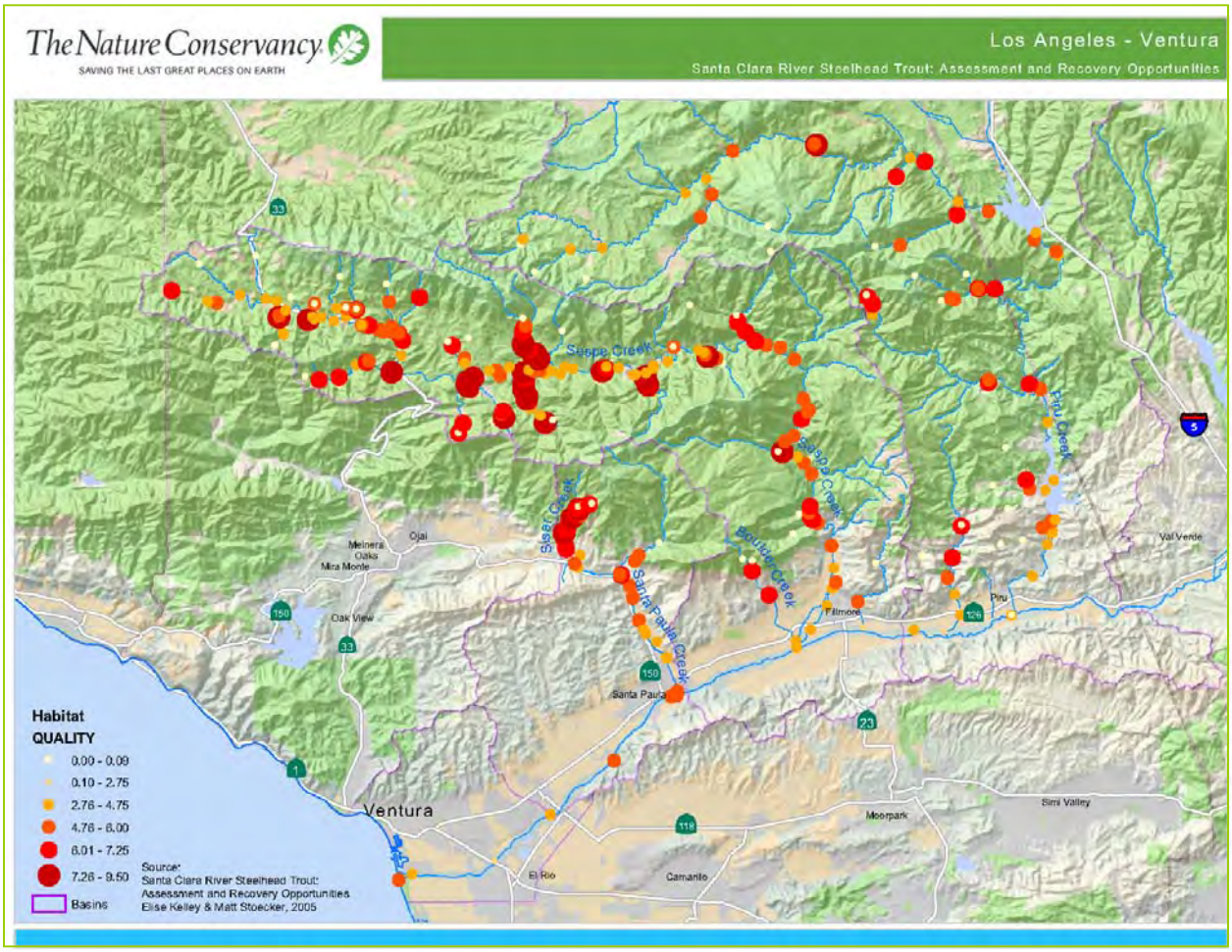
Piru Creek Barriers

Future steelhead access to upper Piru Creek would provide a significant increase in habitat and likely adult steelhead run size within the Santa Clara River, but short-term recovery of steelhead to downstream Santa Clara River tributaries is also highly dependant on adequate mainstem surface flows that are influenced by water releases from Santa Felicia Dam and Piru Creek (and to a lesser degree by periodic runoff/spillage from Castaic and Bouquet Canyons as well as the upper watershed). As noted in a NMFS letter to FERC regarding Santa Felicia Dam re-licensing dated February 5, 2001, adequate water releases from Santa Felicia Dam to ensure effective migration along the mainstem needs to be planned in conjunction with effective fish passage at the Vern Freeman Diversion Dam on the Santa Clara River). In the short-term, ensuring effective water releases from Santa Felicia Dam is the highest priority for the Piru Creek drainage. In the long-term, fish passage upstream of Santa Felicia Dam in conjunction with fish passage at mainstem barriers in Piru Creek downstream of Santa Felicia Dam should be top priorities (Map 13). Even if Pyramid Dam were to be left in place without fish passage, effective steelhead passage upstream of Santa Felicia Dam would open up over 15 miles of high quality habitat along middle Piru Creek and its large tributaries in that reach including Agua Blanca Creek and Fish Creek.



Map 13. Barriers on Piru Creek. Not all barriers are labeled in order to increase legibility. Barriers depicted in this map include all recorded potential impediments to fish passage, ranging from those which present complete blockage under all flow conditions, to those that present a partial blockage only under some flow conditions. The text should be consulted for a full characterization of each of the depicted barriers on this map.

Habitat Priorities



Map 14. Map of habitat quality, provided courtesy of Brian Cohen, The Nature Conservancy

Santa Paula Creek

Santa Paula Creek contained the most productive habitat in the study area for salmonids. However, the quantity of habitat is limited when compared to the amount of habitat in the Sespe Creek drainage. Santa Paula Creek does have a greater habitat score and higher fish productivity potential than Hopper Creek and the lesser Pole Creek tributaries. There are a number of habitat characteristics that are indicated to be of higher value on Santa Paula Creek than on Sespe Creek such as lower water temperatures, medium to high abundance of spawning gravel throughout the subwatershed, low percentage of substrate embeddedness, and a high percent of riparian canopy cover and instream cover. Despite these strong habitat indicators for Santa Paula Creek, Sespe Creek supports a much higher abundance of trout. The cause of Santa Paula Creek's lower trout numbers may be explained by habitat characteristics not measured in this study such as abundance of food, or amount of age-related habitat available, or by migration connectivity. Sespe Creek is more accessible to steelhead trout than Santa Paula Creek and reduced connectivity may be isolating the Santa Paula Creek trout population and reducing genetic

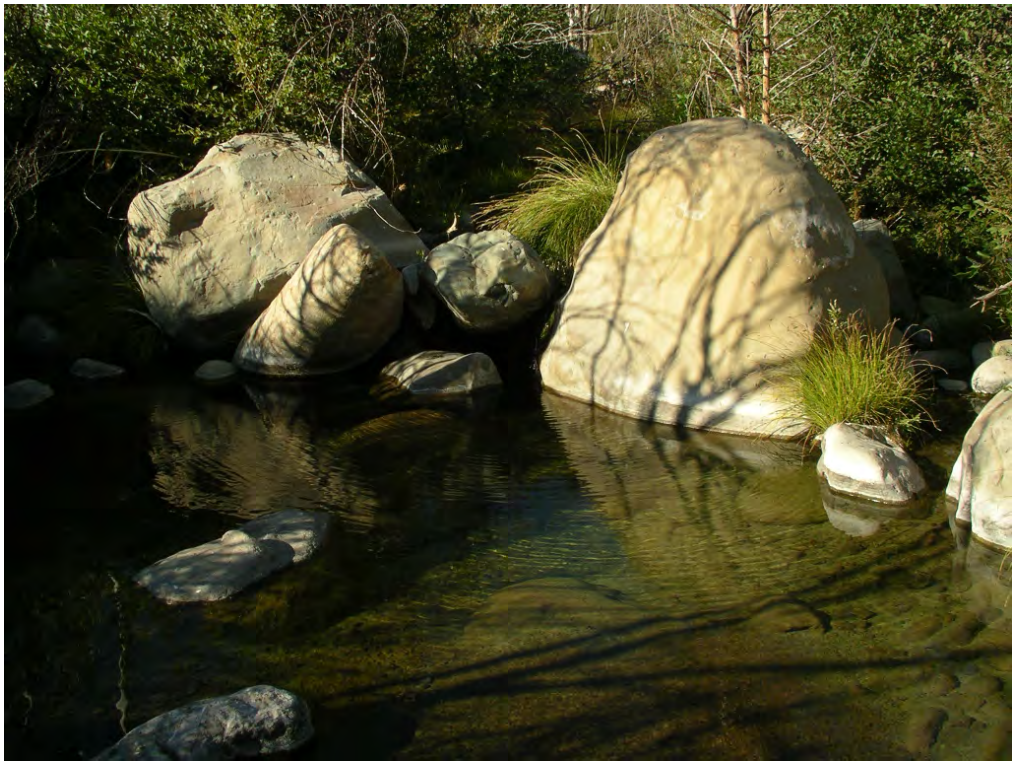
diversity and promoting inbreeding. Natural factors such as fires, geology, local rainfall differences, and others may also be influencing population size; as could urban impacts, water quality, fishing pressure, and past hatchery planting impacts.

Sisar Creek at Bear Creek (right) confluence

Sespe Creek

The high over-all productivity of Sespe Creek may be due to the high productivity of the tributaries to Sespe Creek where 98% of the fish were observed during the study. However, this distribution of fish between tributaries and the mainstem may fluctuate significantly in response to fire and rainfall/run-off patterns. The highly productive Piedras Blancas Creek accounted for 76% of trout observed within Sespe Creek, Howard Creek was second at 8.5%, and Bear, Lion, and West Fork Sespe Creeks were tied at third with 4% each. Other tributaries and the mainstem of Sespe Creek contribute smaller amounts.

Trout distribution and abundance within the Sespe Creek drainage is likely highly variable between seasons as stream flows fluctuate. These surveys were conducted in the summer and fall of 2004 following several relatively dry years. Because much of the mainstem of Sespe Creek was dry or had very low surface flows, much of the population likely migrated into the perennial tributaries to Sespe Creek. In addition, trout observations in the lower gorge section of Sespe Creek is extremely difficult due to pool depths over ten feet and high amounts of aquatic vegetation and/or algal growth. In the tributaries, trout observations were easy to make in the small, clear pools. If mainstem and tributary habitat characteristics are compared, the tributaries generally show higher quality *O. mykiss* habitat; especially for the low water summer and fall rearing conditions encountered during this surveying period.



Pool habitat on Piedras Blancas Creek downstream of the East Fork

Piedras Blancas Creek by itself has an overall habitat quality score of 7.35 out of a maximum of 10, almost two full points higher than that of the Sespe Creek drainage overall.

In general, as Sespe Creek tributary habitat quality rankings decline, the number of trout present declined as well. The Piedras Blancas Creek tributary was third in quality overall with the most trout observed. No tributaries rated low in habitat quality and high in trout abundance. No individual reaches in Sespe tributaries that had quality below 5.5 had trout observed in them, and trout did not start occurring in larger numbers and with regularity until quality scores reached 7.0.

The higher overall habitat quality score on Santa Paula Creek is likely due to almost all of the available habitat in the Santa Paula Creek drainage being of relatively high quality compared to Sespe Creek which has a high amount of high quality habitat in its tributaries and portions of its mainstem, but many tributaries and reaches in the middle and upper mainstem that have poor habitat. There are also dry reaches that bring down Sespe Creek's overall average habitat quality score. There are no dry reaches, except one on the East Fork of Sisar Creek that would lower Santa Paula Creek's habitat score.

Excellent spawning and rearing habitat on Lion Creek

Hopper Creek

Hopper Creek contains a limited amount of high quality salmonid habitat and an existing *O. mykiss* population that may contribute to the anadromous steelhead population.

Pole Creek

Pole Creek had both the lowest quality habitat scores and the least habitat available of all Santa Clara River mainstem tributaries measured, but could likely support a small population of *O. mykiss* with adequate fish passage in the lower reaches.

Habitat Recommendations

1. Based on *O. mykiss* occurrence and abundance and habitat quality the following tributaries should receive a high level of habitat protection to ensure preservation of reaches known to support significant stocks of *O. mykiss* during critical low water years: Piedras Blancas Creek, Howard Creek, W.F. Sespe Creek, Bear Creek, Lion Creek, Timber Creek, Sisar Creek, upper Santa Paula Creek, and Hopper Creek.
2. The scope of this study did not allow for ground survey efforts to occur throughout the entire Santa Clara River. Even within the project area not all stream reaches could be surveyed do to access, time, and budget restraints. Additional habitat surveying efforts are needed for the following stream reaches:

a. Piru Creek: Additional habitat and population surveys should be conducted throughout this tributary. Eastern Piru Creek tributaries downstream of, and including, Lockwood Creek to the Santa Clara River confluence were not surveyed. Additional surveying of these tributaries should be since historic documentation of trout in Lockwood Creek exists.
b. Upper Santa Clara River and Tributaries: The Santa Clara River mainstem and tributaries upstream of Piru Creek (including Castaic, San Francisquito, Newhall, Bouquet, Mint, Soledad, and Alisos Creeks) need surveys of their habitat, salmonid population, and migration barriers. While most of the Santa Clara River steelhead run was likely to have utilized the habitat downstream of and including Piru Creek, there may be adequate habitat further upstream. NOAA and CDFG have expressed interest in assessing habitat conditions and salmonid recovery potential in the upper watershed. In addition, excessive turbidity and suspended sediment coming from the upper watershed may be a significant factor in steelhead migration and survival in the mainstem and identification of erosion sources and sediment reduction planning should be conducted.
c. Hopper and Pole Creeks: Access to survey Hopper and Pole Creeks could not be obtained and additional efforts should be made to conduct habitat and population surveys on these tributaries with landowner permission.
d. Unsurveyed Private Reaches: Additional attempts should be made to conduct surveys on reaches where permission to access land was not obtained within the Sespe and Santa Paula Creek drainages.

Exotic Fish Species Priorities and Recommendations

At least two introduced fish species, the black bullhead and green sunfish, were observed while surveying Sespe Creek. These exotic species compete with, and prey upon, salmonids and other native fish species and a plan to eradicate them and prevent further planting of any non-native fish, including hatchery rainbow trout, should be formulated.

1. The three Rose Valley "Lakes" on the upper Sespe Creek tributary have been stocked with hatchery trout from the Fillmore Hatchery and records also show the planting of bullhead. These, and other reservoirs harboring non-native fish, should be eliminated and planting operations stopped. Even the planting of sterile hatchery *O. mykiss* still has the potential negative impacts of competition for limited resources, predation, introduction of disease, and consumption of limited resource funding.
2. Reservoirs located on Rancho Grande in the upper Howard Creek tributary to Sespe Creek may also be contributing to the spread of exotic fish species and degradation of water quality and downstream quantity within Sespe Creek. Removal of these dams would also provide upstream fish passage.
3. Additional small ponds at Tomas Aquinas College adjacent to Santa Paula Creek and a private pond adjacent to upper Bear Creek may be harboring exotic species and degrading water quality downstream.
4. The large reservoirs on Piru Creek and other upper Santa Clara River tributaries contribute to the spread of exotic fish species and hatchery trout that negatively impact native fish populations.

NOAA notes the “introduction and perpetuation of exotic fishes such as large mouth bass, channel catfish, black bullhead, green sunfish, and bluegill” in Lake Piru and identifies “the need for management measures to benefit native fishes” (USDC-NOAA 2005).

Rose Valley Lakes

Fish Passage Priorities and Recommendations

The recovery and long-term preservation of the Santa Clara River steelhead population depends on improved and maintained migratory access between the headwater habitat and the ocean. There are several studies ongoing or planned in the watershed. A brief description of each is below.

- Hydrologic Assessment of the Lower Santa Clara River (UCSB)
  A water budget study for the lower watershed that compares existing flow conditions to historic records, and an assessment of the stream flows necessary for steelhead passage in the lower river.
- Santa Clara River Watershed Study
  An overall watershed hydrology evaluation is planned by the Counties of Ventura and Los Angeles, and the Army Corps of Engineers.
- Water Resources Investigation: Land Use, Infrastructure, Hydrology, Hydraulics, and Water Quality (URS Corporation)
  The water resources assessment provides a general understanding of water resources in the lower Santa Clara River. Specifically, this report presents a history of the human induced changes in the Santa Clara River Valley, an analysis of baseline hydrology for the river in Ventura County, a hydrologic model of the Santa Clara River watershed, a

hydraulic model of the Santa Clara River from the Pacific Ocean to the Los Angeles-Ventura County Line and a synthesis of existing information regarding water and sediment quality in the lower river.

- FERC relicensing of the Pyramid and Santa Felicia Dams
  New licenses are being sought for the hydroelectric operations at these two dams on Piru Creek. State and Federal resource agencies are currently in discussion with the dam operators and water stakeholders.

If in the course of these studies, the following is not investigated, then it should be evaluated:

1. An assessment of all water storage facilities and operations, including groundwater withdrawal and recharge operations, surface diversions, and other natural influences to surface flows within the entire Santa Clara River Basin.
2. The consideration of and recommendations for the conjunctive operation of water facilities to provide dedicated steelhead passage flows to ensure fish migration between the mainstem of the Santa Clara River and the spawning and rearing habitat within major tributaries.

As noted in NMFS letter to FERC regarding Santa Felicia Dam re-licensing date February 5, 2001, "because of the competition for limited water resources in the Santa Clara River Basin, and the integrated operation of the Santa Felicia Hydroelectric Project with the State Water Project (including the operation of the upstream Pyramid Dam) and the UWCD's Vern Freeman Diversion, UWCD should evaluate and explore the potential to coordinate operations with other water management projects, including groundwater management efforts" (USDC-NOAA 2005).

Individual Barrier Discussion and Recommendations

Overall, the barrier rankings have a direct correlation to upstream habitat scoring for the watershed and tributary drainages (Tables F and G). The dam and migration flow barriers associated with the mainstem of the Santa Clara River and Piru Creek are the highest ranked, with the Vern Freeman Diversion Dam receiving the highest barrier ranking score. If we allow the low severity green barriers to fall out of the ranking, then the next significant barriers are within the Piru Creek watershed, with all mainstem barriers being listed in sequential order from the downstream to upstream location. The Santa Paula Creek watershed follows with its first five barriers, and the first barrier on Sisar Creek. At that point, Hopper Creek enters the barrier rankings, followed by more Sespe Creek tributary barriers, and finally Pole Creek.

The highest-ranking downstream barriers within tributary reaches need to be addressed with consideration for upstream barriers in order to ensure that steelhead access is provided to the upstream habitat and not impeded by additional barriers. The following migration barriers are listed in order of highest barrier ranking and restoration priority.

This study identified migration barrier locations and conducted a first round analysis and priority ranking. In some cases, only limited observations of barriers were possible and additional assessment is needed to determine fish passage severity. See each barrier description for additional site-specific survey needs. As fish passage improvement projects are identified and funded, additional surveys will be needed to acquire necessary data for project design and permitting.

Following completion of this report and barrier analyses, a 1999 Department of Fish and Game memorandum was obtained with comments from NOAA Fisheries. This document (CDFG 1999) describes a dam and two natural waterfall barriers observed in a 1992 survey of Pole Creek. This memorandum is attached in Appendix IV. Please refer to this memo for additional information regarding Pole Creek barriers.

The ranking method used in this report provides a useful guide for restoring fish passage to the Santa Clara River basin. However, the winter storms of 2005 had severe impacts on several fish passage facilities. We list below the fish passage facilities that require immediate attention and reconfiguration if migration into important spawning and rearing tributaries is going to be provided:

- The Vern Freeman Diversion Dam (SC-1)
- The ACOE Fishway (SC_SP_1,2,3) on Santa Paula Creek
- Harvey Diversion Dam (SC_SP_4) on Santa Paula Creek
- CALTRANS Highway 150 Bridge (SC_SP_5) on Santa Paula Creek

It would not be helpful to address only one of these barriers and ignore the others. Rather we recommend a concerted and coordinated effort by all vested parties to address the problems that the storms of 2005, combined with poor fish passage design, have brought to these various fishways.

Table F. Prioritized red and gray anthropogenic migration barriers.

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-1	SANTA CLARA RIVER	Dam	Gray	1598.03
BR-SC-PU-1	PIRU CREEK	Dam	Gray	668.12
BR-SC-PU-2	PIRU CREEK	Culvert	Gray	662.16
BR-SC-PU-3	PIRU CREEK	Dam	Gray	637.93
BR-SC-PU-4	PIRU CREEK	Dam	Red	636.68
BR-SC-PU-5	PIRU CREEK	Channelized	Gray	353.13
BR-SC-PU-6	PIRU CREEK	Road Crossing	Gray	347.36
BR-SC-PU-7	PIRU CREEK	Dam	Red	343.97
BR-SC-PU-8	PIRU CREEK	Road Crossing	Red	273.85
BR-SC-PU-9	PIRU CREEK	Road Crossing	Gray	208.28
BR-SC-SP-2	SANTA PAULA CREEK	Grade Control Structure	Red	94.58
BR-SC-SP-3	SANTA PAULA CREEK	Grade Control Structure	Red	94.40
BR-SC-SP-4	SANTA PAULA CREEK	Dam	Red	87.37
BR-SC-SP-5	SANTA PAULA CREEK	Grade Control Structure	Red	69.79
BR-SC-SP-SR-1	SISAR CREEK	Grade Control Structure	Gray	53.48
BR-SC-HR-1	HOPPER CREEK	Bridge	Gray	49.08
BR-SC-SP-SR-2	SISAR CREEK	Road Crossing	Gray	46.07
BR-SC-SP-SR-3	SISAR CREEK	Culvert	Gray	40.52
BR-SC-HR-2	HOPPER CREEK	Road Crossing	Gray	39.19
BR-SC-HR-3	HOPPER CREEK	Road Crossing	Gray	33.33
BR-SC-HR-4	HOPPER CREEK	Road Crossing	Gray	33.06
BR-SC-SE-BR-1	BOULDER CREEK	Road Crossing	Gray	25.31
BR-SC-SE-BR-2	BOULDER CREEK	Culvert	Red	24.22
BR-SC-SE-BR-3	BOULDER CREEK	Road Crossing	Gray	22.70
BR-SC-SE-BR-4	BOULDER CREEK	Culvert	Gray	22.65
BR-SC-SE-BR-5	BOULDER CREEK	Road Crossing	Gray	22.01
BR-SC-PE-1	POLE CREEK	Channelized	Red	20.88
BR-SC-PE-2	POLE CREEK	Road Crossing	Gray	17.27
BR-SC-HR-TS-1	TOMS CREEK	Road Crossing	Gray	14.59

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-SE-LN-4	LION CREEK	Dam	Red	14.02
BR-SC-PU-LE-1	LIME CREEK	Culvert	Gray	14.00
BR-SC-PU-LE-2	LIME CREEK	Culvert	Gray	12.50
BR-SC-PU-LE-3	LIME CREEK	Culvert	Gray	12.05
BR-SC-SE-HD-2	HOWARD CREEK	Culvert	Gray	10.84
BR-SC-PU-MO-1	MODELO CREEK	Culvert	Gray	10.84
BR-SC-SE-BO-1	BURRO CREEK	Culvert	Red	10.38
BR-SC-SE-HD-3	HOWARD CREEK	Road Crossing	Gray	8.76
BR-SC-SE-HD-4	HOWARD CREEK	Culvert	Gray	8.05
BR-SC-SE-HD-RV-1	ROSE VALLEY CREEK	Dam	Red	8.00
BR-SC-SE-HD-5	HOWARD CREEK	Dam	Gray	7.83
BR-SC-SP-SR-BR-1	BEAR CREEK	Road Crossing	Gray	7.81
BR-SC-SE-AE-1	ADOBE CREEK	Culvert	Gray	7.71
BR-SC-SE-HD-6	HOWARD CREEK	Dam	Gray	7.47
BR-SC-SE-HD-RV-2	ROSE VALLEY CREEK	Culvert	Red	7.34
BR-SC-SE-HD-7	HOWARD CREEK	Dam	Gray	7.17
BR-SC-SE-HD-8	HOWARD CREEK	Dam	Gray	6.70
BR-SC-SE-HD-RV-3	ROSE VALLEY CREEK	Dam	Red	6.36
BR-SC-SP-SR-BR-2	BEAR CREEK	Road Crossing	Gray	6.34
BR-SC-SE-HD-RV-4	ROSE VALLEY CREEK	Road Crossing	Gray	6.20
BR-SC-SP-SR-EF-1	E.F. SISAR CREEK	Bridge	Red	5.92
BR-SC-SE-HD-RV-5	ROSE VALLEY CREEK	Dam	Red	5.81
BR-SC-PE-3	POLE CREEK	Road Crossing	Gray	5.02
BR-SC-SE-AE-2	ADOBE CREEK	Road Crossing	Gray	4.97
BR-SC-PU-BD-1	BLANCHARD CREEK	Culvert	Gray	3.80
BR-SC-SE-2B0-1	#2 BURRO CREEK	Culvert	Red	2.31

Table G. Prioritized green migration barriers.

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-2	SANTA CLARA RIVER	Bridge	Green	697.06
BR-SE-1	SESPE CREEK	Dam	Green	588.79
BR-SC-SP-1	SANTA PAULA CREEK	Channelized	Green	94.79
BR-SC-SE-HD-1	HOWARD CREEK	Road Crossing	Green	32.70
BR-SC-SE-LN-1	LION CREEK	Dam	Green	18.96
BR-SC-SE-LN-2	LION CREEK	Dam	Green	18.69
BR-SC-SE-LN-3	LION CREEK	Dam	Green	17.94
BR-SC-SE-CY-1	CHERRY CREEK	Pipeline crossing	Green	5.23

Notes

Preferred Treatment for Migration Barriers

Recommended actions for fish passage improvement projects at migration barriers were formulated on a site-specific basis using "Preferred Treatment Options for Unimpeded Fish Passage" identified in the California Department of Fish and Game's *California Salmonid Stream Habitat Restoration Manual*, and the NOAA *Guidelines for Salmonid Passage at Stream Crossings*. While both of these guidelines focus on road crossings, the preference for eliminating "encroachment into the 100-year flood plain" can be applied to other structures within the stream channel that are impeding steelhead migration. The following top three recommendations for fish passage improvements at stream crossings are from the NOAA *Guidelines for Salmonid Passage at Stream Crossings* (NOAA 2001) and are listed in order of preference (for additional information obtain the NOAA Guidelines at http://swr.nmfs.noaa.gov/hcd/NMFSSCG.PDF).

1) Nothing: Road realignment to avoid crossing the stream
2) Bridge: Spanning the stream to allow for long term dynamic channel stability
3) Streambed alteration strategies: Bottomless arch culvert, embedded culvert design, or ford.

The California Department of Fish and Game guidelines also state that:

1) Entry jumps (into a culvert or onto a structure) should never exceed 1.0 foot for upstream adult steelhead passage.

Recommended actions for fish passage improvement projects were formulated to ensure effective passage over a wide range of flows and to be sustainable over the long term. NMFS and CDFG guidelines also state that upstream juvenile steelhead and rainbow trout passage must be included in fish passage improvement projects and recommended actions for barriers in this report are consistent with these guidelines.

Replacing Road Crossings Barriers with Bridges

Replacing road crossing barriers with bridges meets all CDFG and NMFS objectives for fish passage while allowing unimpeded migration during the widest range of stream flows for all salmonid life stages. There are many advantages to removing the culverts and replacing them with a bridge(s) including:

- Unimpeded migration for steelhead
- Restored streambed and aquatic habitat
- Improve wildlife and riparian connectivity
- Optimal sizing for peak stream flows improves safety
- Bridges last longer and require less maintenance
- Can be cost effective over time
- Aesthetically pleasing
- Elimination of public hazards
- Can improve a private landowners property value

Avoiding Ineffective Fish Passage Projects

The modification of existing barriers with baffles, fishways, or other "band-aid" projects that attempt to improve fish passage is highly discouraged for the following reasons:

- Biological Ineffectiveness -
  The effectiveness of baffles and fishways is limited to a narrow window of tolerable stream flows and is highly dependant on continual human maintenance and clearing of debris to be functional. With the flashy stream flows encountered in southern California streams, steelhead have a short window of opportunity to migrate upstream to adequate spawning and rearing habitat. Streams within the study area do not have the consistent flows needed to provide adequate fish passage over a long duration of time. Even the most ideal baffle design, in perfect operating condition, will impose a significant degree of difficulty to upstream passage when compared to a natural stream channel.

- Safety and Structural Integrity -
  Installing fish passage measures inside of a culvert causes damage to the culvert and can lead to reduced culvert life and cause safety hazards. Fishways and baffles can reduce the flow capacity of the culvert and increase the likelihood of debris blockage that could cause failure of the crossing.

- Ongoing Maintenance and Cost -
  During high stream flows, baffles or other internal culvert modification are highly prone to blowing out. This failure prevents upstream steelhead passage during the migration season and causes structural damage to the culvert. Baffles are usually replaced after the steelhead migration season has ended, when flows have subsided and maintenance crews can reinstall them. In order to be effective, baffles require continual maintenance costs, monitoring during the migration season, and replacement costs.

Vern Freeman Diversion Dam (SC-1) and Mainstem Surface Flows- Santa Clara River

Description: The structure is owned and operated by Bureau of Reclamation and United Water Conservation District (UWCD). The current dam measures 1200 feet across and 20 feet tall from the crest to the downstream concrete apron. The dam extends an additional 50 feet down through the substrate and keys into bedrock. The current Vern Freeman Diversion Dam and associated Denil Fishway were built in 1990. Prior to the construction of this concrete dam, various temporary earthen diversion dams existed and occurred upstream from the current diversion dam location. These older dams diverted flows into an earthen channel built along the side of the river and water moved downstream to near the existing holding ponds by gravity. Murray McEachron of UWCD reported that the first company to divert water started operation in 1875. UWCD bought the operation in 1927 and at this time surface flows were generally only diverted during lower flows encountered in the summer and fall with a temporary earthen dam that blew out during the winter. In the 1940's winter flows started being diverted and a steel and piling diversion structure was built in 1968 to increase the ability to withstand the high winter flows and expand the diversion season. The flood of 1969 reportedly destroyed this new structure. From 1970 to 1990, UWCD reportedly operated an earthen dam that could survive mainstem flows up to 2000 cfs at which point the dam was blown out. This dam reportedly diverted all steelhead smolts into the diversion channel when operating and was also impassable to upstream migrating adult steelhead due to the excessive outlet drop. For twenty years upstream steelhead passage could only occur during high flow years that exceeded 2000 cfs and destroyed the dam.

Diagnosis: There has been a good deal of discussion regarding the effectiveness of the fish ladder at the Vern Freeman Dam in allowing upstream adult steelhead migration. Mr.

McEachron reported that a trap set at the inlet (upstream end) of the fish ladder caught seven adult steelhead from 1994 to 2001 that apparently made it through the fish ladder and upstream into the river. No adult steelhead have been observed since the fish trap was removed, or since a fish counter/video system was installed in 2002 (pers. comm. McEachron 2005). One of the main problems with assessing the effectiveness of the fish ladder is that it is not possible to count how many steelhead are migrating into the river that may not be able to find the ladder and navigate through it successfully. Insufficient attraction flows, debris blockage, and elevated flow velocities within the ladder may also contribute to problems with the existing Denil Fishway. In addition, the fish ladder has a pipe outfall located directly above it that drops water at the entrance. This additional turbulence at the fish ladder entrance may confuse upstream migrating steelhead. The existing ladder and dam likely represent at least a partial barrier some of the time and a complete barrier when operations are not providing adequate fish ladder flows for passage, as was observed during a field visit in 2005.

The documented historic occurrence of adult steelhead and anadromous lamprey runs up the Santa Clara River prior to the construction of the current Vern Freeman Dam are well documented. Fish ladder designs such as the type at the Vern Freeman Diversion Dam are not a preferred NOAA or DFG fish passage alternative due to the many inherent problems associated with debris blockages, baffle failures, and difficulty in attracting and allowing effective fish passage. Attraction flows have been identified by NOAA personnel as a potential problem for upstream migrating steelhead trying to find a route around the dam.

Denil Fishway at the Vern Freeman Diversion

Mr. McEachron reported that UWCD does not need to start operating the fish ladder until January because there are no steelhead entering the river until around that time. When steelhead are prepared to enter the Santa Clara River is in fact, unknown. There is often a lack of early winter downstream water flow connectivity which may be delaying sandbar breaching at the mouth and/or preventing early upstream migration with rains and adequate stream flow. Long-time Santa Clara River steelhead fisherman recalled how adult steelhead "were always in the surf off the mouth by late November, waiting for the first rains to break the sandbar. You would often see a group of fisherman with shovels instead of fly rods, opening the bar… The fish would storm in and all hell would break loose…" (Moore 1981). Due to the flashy flow regimes of southern California streams and the opportunistic nature of southern steelhead, the lack of fish ladder operation and potential adequate bypass flows until sometime in January may be preventing upstream access during late November and December when, like in 2004, we had several days of connectivity between the ocean and the dam.

Recommended Action: Without effective upstream adult steelhead passage at the Vern Freeman Dam that mimics the timing, duration, and magnitude of natural flow events and flow range, steelhead restoration within the Santa Clara River will not be possible. Because the principal steelhead spawning and rearing habitats within the Santa Clara River system are located in

tributaries which join the mainstem of the Santa Clara River above the Vern Freeman Diversion Dam, steelhead restoration efforts within the watershed are dependant on effective upstream passage at this dam. In addition, effective, natural smolt outmigration is critical to reviving and maintaining a self-sustainable wild steelhead population on the Santa Clara River. The current Denil Fishway was not designed and is not capable of utilizing the majority of the non-diverted bypass flows to facilitate fish passage around the Vern Freeman Diversion. A more effective strategy and more efficient use of the non-diverted bypass flows would be modification of the existing diversion dam to allow fish to pass over the structure during a wider range of flows, rather than be solely dependent upon operation of the Denil Fishway.

An independent fish passage feasibility study of more effective fish passage alternatives at the Vern Freeman Diversion Dam should be conducted and assess each of the following options:

- Removal of the current Freeman Diversion Dam and establishment of a smaller diversion structure further upstream that connects into existing water diversion canals and incorporates an effective roughened channel design that conveys all by-pass flows for fish passage. An upstream diversion location may allow for a smaller dam height more suitable for an effective roughened fishway channel design and still allows for gravity diversion to downstream canals.

- Construction of a roughened channel type design on the downstream side of the existing dam that conveys all bypass flows not diverted and which functions for both upstream adult steelhead passage and outmigration of smolts. Effective fish passage flows through this roughened channel should occur independently of diversion flow operations by UWCD.

- Establishment of improved migration flows downstream of the dam for upstream adult steelhead and downstream smolt passage as well as adequate and coordinated migration flow conditions upstream with UWCD releases from Santa Felicia Dam. As noted in NMFS letter to FERC regarding Santa Felicia Dam re-licensing date February 5, 2001, “because of the competition for limited water resources in the Santa Clara River Basin, and the integrated operation of the Santa Felicia Hydroelectric Project with the State Water Project (including the operation of the upstream Pyramid Dam) and the UWCD’s Vern Freeman Diversion, UWCD should evaluate and explore the potential to coordinate operations with other water management projects, including groundwater management efforts” (USDC-NOAA 2005).

Gaging Weir Upstream of Modelo Creek (SC_PU_1) - Piru Creek

Description: Access to survey this structure was not obtained and limited observations were made from the air. This structure appears to be a gaging weir with a tall gaging-type structure occurring adjacent to the concrete weir on the river-right bank. Surface flows were observed to be focused across the weir on the far river-right side. Flows appeared to drop at least 2 feet 6 inches from the weir outlet to the surface of the downstream pool.

Diagnosis: Fish passage severity at this site is dependent on the downstream pool depth and jump height during various stream flows. Additional detailed assessment of the structure is needed to accurately determine the structures impact on fish passage. Due to the observed jump height, the weir likely prevents fish passage during lower flows and may limit passage during a wide range of flows for certain life stages.

Recommended Action: Additional assessment of this structure should be conducted with landowner permission. If the structure is not necessary, it should be removed to ensure the most effective upstream fish passage.

Piru Canyon Road Crossing #2 (SC_PU_2) - Piru Creek

Description: Due to lack of access to adjacent private land, limited observations of this culvert were made. This 6-box concrete culvert appears to have a mild gradient and approximately 12-inch outlet drop during the fall of 2004. The structure appears to be in good condition.

Diagnosis: While additional assessment of this culvert is needed to run FishXing software and determine the severity of this barrier, conditions do not appear to be adequate for all salmonid life stages and likely fail to meet DFG and NOAA passage criteria. McEachron of UWCD reported observing this structure with Mark Capelli of NOAA Fisheries after our assessment and that the outlet drop had increased to approximately 3 feet and Capelli reportedly thought the crossing was impassable for steelhead (pers. comm. McEachron 2005).

Recommended Action: The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001). This alternative would provide the most effective fish and wildlife passage for the greatest number of species and life stages.

Weir/Dam (SC_PU_3) - Piru Creek

Description: Access to survey this structure was not obtained and limited observations were made from the air. This structure appears to be a concrete weir or possible obsolete diversion dam. An outlet pipe was observed on the downstream side. The structure is approximately 4 feet thick with 6 feet of boulder rip-rap protection forming a cascade-like apron on the downstream side. The total height of the structure from the downstream pool surface to the outlet lip of the dam is approximately 4 feet 6 inches.

Diagnosis: Fish passage at this site is dependent on the downstream pool depth and resulting jump height during various stream flows. The slope of the boulder rip-rap needs to be further assessed. Access permission and a detailed assessment of the structure are needed to accurately determine the impact on fish passage. Due to the observed jump height, the weir likely prevents fish passage during low and moderate flows and may limit passage during a wide range of flows for all life stages. This structure likely fails DFG and NOAA passage criteria for all life stages.

Recommended Action: Additional assessment of this structure should be conducted with landowner permission. If the structure is not necessary, it should be removed to allow the most effective upstream fish passage.

Santa Felicia Dam (SC_PU_4) - Piru Creek

Description: Santa Felicia Dam was built in 1954. United Water Conservation District (UWCD) operates the Santa Felicia Dam in conjunction with the California State Water Project (Pyramid Dam) located upstream and the Vern Freeman Diversion Dam located approximately 15 miles downstream on the mainstem of the Santa Clara River (USDC-NOAA, 2005). This large dam was constructed without fish passage facilities and currently does not have any facilities or programs to allow upstream fish passage. A small hydro-project is associated with the facility.

Diagnosis: The dam fails to meet all DFG and NOAA passage criteria. "Because Santa Felicia Dam was built with the purpose of and has been operated to capture winter runoff for later re-diversion for groundwater storage in the lower Santa Clara River, the facility has not only blocked access to major spawning and rearing habitat, but has also reduced steelhead passage flows in the mainstem of the Santa Clara River which are necessary to access tributaries in the lower Santa Clara River (lower Piru Creek, Sespe Creek, and Santa Paula) [and Pole and Hopper Creeks]" (USDC-NOAA 2005). Conservation releases of 5 cfs downstream of the dam have also degraded habitat conditions in lower Piru Creek (USDC-NOAA 2005).

Recommended Action: The findings of this study regarding the quality and quantity of habitat for steelhead above Santa Felicia dam emphasizes the importance of Piru Creek for the steelhead trout run on the Santa Clara River. Re-establishing a steelhead run on Piru Creek would likely be a complex, time-consuming, and expensive undertaking. That said, the potential of opening up that habitat for steelhead should not be dismissed. Investigations should commence that examine re-integrating Piru Creek as part of the steelhead trout run and assess the likely benefits and costs of such a course. It would be helpful to review the benefits and costs in the scope of the entire watershed, the numbers of adult steelhead likely to be needed in order to re-establish the run, the carrying capacity of Santa Paula and Sespe Creeks for all lifestages of *O. mykiss*, and what role Piru Creek may play in the re-establishment of a sustainable and "recovered" run.

A variety of comments have been provided to UWCD by NOAA Fisheries regarding the functionality of Santa Felicia Dam. We provide them here in summary in addition to our recommendations above.

NOAA, in it's response to Scoping Document 1 for re-licensing of the Santa Felicia Hydroelectric Project, FERC Project No. 2153-012, recommended conservation measures at Santa Felicia Dam designed to achieve several objectives (See USDC-NOAA 2005 Letter for additional detail):

1) Provision of passage of adult steelhead from the ocean through the lower mainstem of the Santa Clara River to lower Piru Creek (below Santa Felicia Dam) potentially accomplished by modification of existing controlled release conservation flows and modification through screening and management of the temporary diversion dike.
2) Provision of access for adult steelhead to upper Piru Creek (above Santa Felicia Dam) and its major tributaries, as well as passage of juveniles from the upper Piru Creek basin to lower Piru Creek (below Santa Felicia Dam) and to the ocean via the Santa Clara River.
3) Maintenance of adequate spawning and rearing conditions for steelhead (and other native fishes) in lower Piru Creek (below Santa Felicia Dam); and
4) Provision of passage of juvenile steelhead (smolts) from lower Piru Creek (below Santa Felicia Dam) to the ocean, as well as provision of passage for fish attempting to emigrate out of tributaries to Piru Creek above Santa Felicia Dam.

As noted in NMFS letter to FERC regarding Santa Felicia Dam re-licensing date February 5, 2001, "because of the competition for limited water resources in the Santa Clara River Basin, and the integrated operation of the Santa Felicia Hydroelectric Project with the State Water Project (including the operation of the upstream Pyramid Dam) and the UWCD's Vern Freeman Diversion, UWCD should evaluate and explore the potential to coordinate operations with other water management projects, including groundwater management efforts" (USDC-NOAA 2005). The authors of this study strongly concur with the above NOAA Fisheries recommendation. Adequate water flow on the mainstem of the Santa Clara River during the steelhead migration season is critical to fish passage and inadequate stream flow is itself a barrier. Coordinated management efforts of all water resources are vital to effective re-establishment of the steelhead trout run.

In addition to the above needed studies and conservation recommendation for the existing facilities, NOAA also requested in a 2001 letter to FERC and UWCD that a dam decommissioning study be conducted to investigate “the feasibility of dam decommissioning to protect, conserve, and enhance steelhead and their habitat” (USDC-NOAA 2001). Part of such a study should identify local water supply alternatives and conservation measures to make up for the loss of Piru Reservoir water supply.

Concrete Channel (SC_PU_5) - Piru Creek

Description: Access to survey this structure was not obtained and limited observations were made from the air. This concrete channel appears to be several hundred feet long and is in poor condition with sediment deposits and riparian vegetation occurring within the channel. Concrete appears to be broken in several locations and an outlet drop of at least 5 feet has considerable downstream scour associated with it that has eroded adjacent banks and undercut the concrete channel.

Diagnosis: Fish passage at this site is dependent on the downstream pool depth and resulting jump height during various stream flows. Due to the observed outlet jump height, the weir likely prevents fish passage during low and moderate flows and may limit passage during a wide range of flows for all life stages. This structure likely fails DFG and NOAA passage criteria for all life stages.

Recommended Action: Following downstream fish passage improvements, additional assessment of this structure should be conducted. It appears likely that the channel could be removed to allow the most effective upstream fish passage and adjacent roadway protected using biotechnical engineering methods. This structure is not a road crossing so no crossing facility is needed, just removal and bank stabilization of the adjacent road.

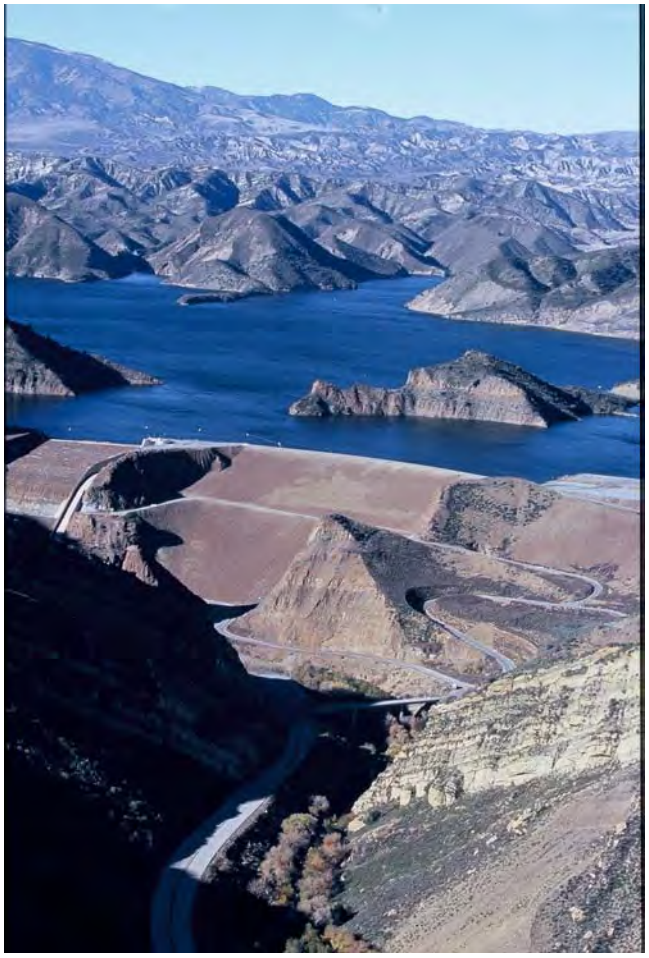
Concrete Crossing (SC_PU_6) - Piru Creek

Description: Access to survey this structure was not obtained and limited observations were made from the air. The exact purpose of this structure could not be determined, but it appears to be a concrete crossing or some type of grade control structure or utility protection.

Diagnosis: Thick riparian vegetation around the concrete structure prevented adequate observation to assess fish passage severity, but it seems likely that the structure impedes fish passage to some degree.

Recommended Action: Following downstream fish passage improvements, additional assessment of this structure should be conducted with landowner permission. If the structure is not necessary, it should be removed to allow the most effective upstream fish passage.

Pyramid Dam (SC_PU_7) - Piru Creek



Description: Pyramid Dam was built in 1973 and is owned and operated by California Department of Water Resources. This large dam was constructed without fish passage facilities and currently does not have any facilities or programs to allow upstream fish passage.

Diagnosis: The dam fails to meet all DFG and NOAA passage criteria. While the dam is located upstream from the impassable Santa Felicia Dam, Pyramid Dam significantly impacts water supply and quality downstream on Piru Creek and the Santa Clara River. The dam also blocks all upstream migration of native trout and other aquatic biota that occur downstream in Piru Creek and its tributaries. The reservoir harbors exotic fish species that spread downstream and compete with native fauna.

Recommended Action: As noted in the recommendations for Santa Felicia, Pyramid Dam should be incorporated in efforts to coordinate operations with other water management projects especially Santa Felicia Dam, in order to assist in the passage of steelhead trout (USDC-NOAA 2005). NOAA Fisheries response to DWR Draft Environmental Impact Report (Nov 2004) *Comments on Draft Environmental Impact Report for Simulation of Natural Flows in Piru Creek* January 11, 2005 (USDC-NOAA 2005), also provide some suggestions:

Of particular short-term importance with Pyramid Dam is ensuring that adequate salmonid habitat conditions occur in Piru Creek downstream of the dam where rainbow trout occur and who may be contributing to the Santa Clara River steelhead population. Habitat quality is highly impacted by stream flow releases from Pyramid Dam, water quality alterations caused by the dam and reservoir, and the presence and expansion of exotic fish populations and other aquatic species within the watershed. Improving salmonid habitat conditions in Piru Creek should also include improving trout migration from Piru Creek and tributaries between Santa Felicia Dam and Pyramid Dam downstream past Santa Felicia Dam and to the Santa Clara River and ocean. With adequate upstream fish passage provided at Santa Felicia Dam, fish passage at Pyramid Dam should also be considered.

There is considerable good quality spawning and rearing habitat located upstream of Pyramid Dam and the issue of fish passage around Pyramid Dam should be addressed if adequate passage at Santa Felicia Dam and barriers downstream is achieved.

Hard Luck Campground Road Crossing (SC_PU_8) - Piru Creek

Description: This concrete crossing measured 135 feet across the channel and 46 feet wide including the downstream concrete and boulder apron. The slope of the 16-foot wide road surface crossing measured 1% and the slope of the 30-foot long downstream apron measured 18%. All surface flows are conveyed on top of the crossing and apron and then drop 10 inches to the surface of the downstream 1-foot deep pool. The total height of the crossing from the downstream pool surface to the top of the road crossing measured 6 feet 3 inches.

Diagnosis: Due to the excessive slope of the riprap apron, this crossing fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present. During high stream flows as the water depth increases downstream of the crossing, limited upstream passage may be possible with adequate jump pool depth and jump height.

Recommended Action: In association with providing adequate fish passage at downstream barrier sites this crossing should be removed or modified to improve fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Gold Hill Road Crossing (SC_PU_9) - Piru Creek

Description: The concrete crossing measured 19 feet wide with a slope of 1.3%. All surface flows are conveyed on top of the crossing and then drop 1-foot 9 inches to the surface of the downstream 8-inch deep pool. Exposed re-bar was observed on the downstream side of this crossing that appears to be in fair condition.

Diagnosis: Due to the lack of jump pool depth downstream of the crossing during low to moderate flows, upstream fish passage is limited at this site. As flows and water depth increases downstream of the crossing, adequate jump pool depth may allow fish to jump onto the road crossing. During these higher flow conditions, excessive water velocities may limit or prevent upstream migration across the smooth concrete road.

Recommended Action: In association with providing adequate fish passage at downstream barrier sites this crossing should be removed or modified to improve fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

ACOE Channelization, Grade Control, and Fishway (SC_SP_1,2,3) - Santa Paula Creek

ACOE Channel adjacent to city of Santa Paula

Description: The Army Corps of Engineers built this extensive project in order to protect the City of Santa Paula from flooding. The channelized reach extends approximately 8625 feet from just upstream of the Santa Clara River to a concrete grade control structure downstream from a long fishway. The 215-foot long fishway rises 18 feet 6 inches with an overall slope of 8.6%. Following the 2005 flows the fishway and grade control were completely destroyed.

Grade control and fishway before 2005 failure

Diagnosis: The concrete channel is periodically dredged of sediments; this eliminates natural channel complexity and thus also creates unfavorable conditions for fish passage (pers. comm. Mark Capelli). Prior to the 2005 flows that destroyed the fishway and downstream grade control, this facility failed to meet DFG and NOAA fish passage criteria at all flows for strongest swimming species presumed present. The downstream grade control structure had an excessive outlet drop of 3 feet 4 inches and excessive concrete apron slope of 26%. Even the elaborate fishway failed to meet DFG and NOAA fish passage criteria at all flows due to inherent debris blockages that completely blocked the weir notches and produced drops exceeding 2 feet on 5 of the 17 weirs. In addition, many of the weirs were filled with substrate and some had large boulders located in the ideal steelhead jump location and landing zones.

Fishway failure following January 2005 flows

Recommended Action: A comprehensive alternatives analysis needs to be conducted and removal of the fishway and downstream grade control seriously considered. Reconstruction of similar fishway facilities will continue to have inherent failure risks, annual debris blockage, and require continual maintenance, or result in limiting or preventing upstream steelhead passage. Replacing the fishway with a roughened channel combined with channel-wide weirs tied into the existing trapezoidal concrete walls may provide the most effective steelhead passage and structural integrity with minimal maintenance. Such a design would need to extend downstream into the channelized reach to reduce the slope of the roughened channel and create a milder transition between the 18-foot 6-inch elevation difference between the current fishway inlet and outlet. The downstream channel appears to have sufficient capacity to allow for such an alternative.

Harvey Diversion Dam (SC_SP_4) – Santa Paula Creek

Dam and ladder before 2005 damage

Description: Permission to conduct a ground survey at Harvey Dam was not obtained and limited observations were made from Highway 150 before and after the record stream flows during January 2005. The concrete dam was built in 1923 and is owned and operated by Canyon Irrigation District. The dam occurs immediately upstream of Mud Creek. Though our initial observation of Harvey Dam was conducted in the fall of 2004, conditions at the dam and fishway were dramatically altered during the high stream flows of early 2005. We observed the dam again in the spring of 2005 and it is that observation that is presented here. Harvey Dam experienced major damage and substrate mobilization with the 2005 winter flows. The dam was side-cut by flows on the river-left side and flows were observed cutting between the concrete dam and adjacent bedrock. Much of the dam's concrete sill was destroyed exposing the re-bar underneath. The force of the high flows dropped the substrate elevation below the dam, downstream of the weir, by more than 5 feet, leaving a drop of greater than 7 feet. The fishway was also extensively damaged, completely filled in with substrate, and rendered ineffective following the high flows. The Fishway's outlet jump boxes were filled with substrate and the metal was so damaged they are likely destroyed. The outlet drop of the most-downstream jump box was observed to be over 4 feet in height following the elevation drop of downstream substrate. The inlet to the fishway at the upstream end of Harvey Dam was also completely buried by substrate.

Damage to dam during 2005 flood

Diagnosis: Even prior to the destructive flows of 2005, the fishway at Harvey Dam was reported to have significant problems with substrate accumulation in the fishway and ineffective fish passage. Fishways are known for their susceptibility to debris blockage and damage during high stream flows. Following the destruction of 2005, Harvey Dam represents a complete barrier to upstream fish passage. Even if the facilities are rebuilt in a similar configuration, steelhead passage at this site will continue to be questionable due to the inherent problems associated with fishway operations and debris blockage during steelhead migration flows.

Recommended Action: The reach of Santa Paula Creek below Steckel Park is experiencing severe down-cutting which affects not only Harvey Dam but also other infrastructures and adjacent developments (including agricultural land uses). Consequently, any treatment of the Harvey Diversion Dam should be predicated on a comprehensive geomorphic analysis, which will provide a better understanding of the hydro-geologic processes affecting fish passage directly, as well as the anthropogenic responses to these processes that also affect fish passage. Effective, long-term alternatives for obtaining an adequate water supply without the presence of Harvey Dam should be assessed and removal of the entire structure considered. Any structure constructed in the stream channel will continue to have failure risks, require continual maintenance, and will limit upstream steelhead passage. If surface water diversion is absolutely necessary in this stretch of Santa Paula Creek, removal of this dam should be considered in conjunction with extending the existing water diversion pipeline upstream to a new smaller diversion structure that incorporates a “roughened channel” fish passage design that conveys all

bypass flows for upstream and downstream fish migration and functions independently of surface diversion operations.

CALTRANS Highway 150 Bridge (SC_SP_5) – Santa Paula Creek

Downstream grade controls before 2005 flood

Description: Prior to the record rainfall and stream flows on Santa Paula Creek during January 2005, seven grade control structures occurred in association with the Highway 150 Bridge. These concrete curbs and associated concrete bank revetment stretched for over 400 feet from the upstream side of the Highway 150 Bridge downstream. During November 2004 surveys several of the curb drops exceeded 3 feet and the most severe drop measured 6 feet 4 inches in height. Large boulder cascades also occurred on the downstream side of several curbs and interfered with ideal steelhead jump locations. The fifth curb upstream also contained a steeply sloped apron extending 8 feet and with a slope exceeding 26%. High stream flows in January 2005 devastated much of Santa Paula Creek and dramatically changed the configuration of these Highway 150 grade control structures. The two most downstream curbs and bank revetments were completely destroyed and washed downstream.

Failure of downstream grade controls following 2005 flood

Diagnosis: Even prior to changes caused by the 2005 stream flows, this series of grade controls represented a severe migration barrier to upstream migrating steelhead. The pre-2005 conditions failed to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present due to excessive outlet drops on 4 of 7 curbs and excessive slope on one curb. Following the devastation caused by the 2005 flows the series of grade controls continues to fail DFG and NOAA passage requirements for the same reasons mentioned above minus one curb that was eliminated.

Recommended Action: As with the Harvey Dam Diversion, any treatment of the Highway 150 Bridge should be predicated on a comprehensive geomorphic analysis, which will provide a better understanding of the hydro-geologic processes that affects fish passage directly, as well as the anthropogenic responses to these processes which affect fish passage. The curbs and drops of the existing structures are not well designed for fish passage or structural integrity during high stream flows due to the large downstream migrating boulders impacting the curbs and blowing them out, as was seen in 2005. All of the curbs in this entire 400-foot reach should be removed and a new strategy should be incorporated that utilizes more effective fish passage technology and a biotechnical bank stabilization approach. Additional studies are needed to analyze the stream channel and existing bridge supports. The most effective option that should be investigated may be a combination of a roughened channel and large boulder protection through this reach that protects the bridge supports and does not contain any weirs or curbs that are susceptible to blowing out. To the extent feasible the new design should incorporate as much natural stream channel and biotechnical bank stabilization as possible. Reestablishing native riparian vegetation at current rip-rap revetment location will help to stabilize the banks.

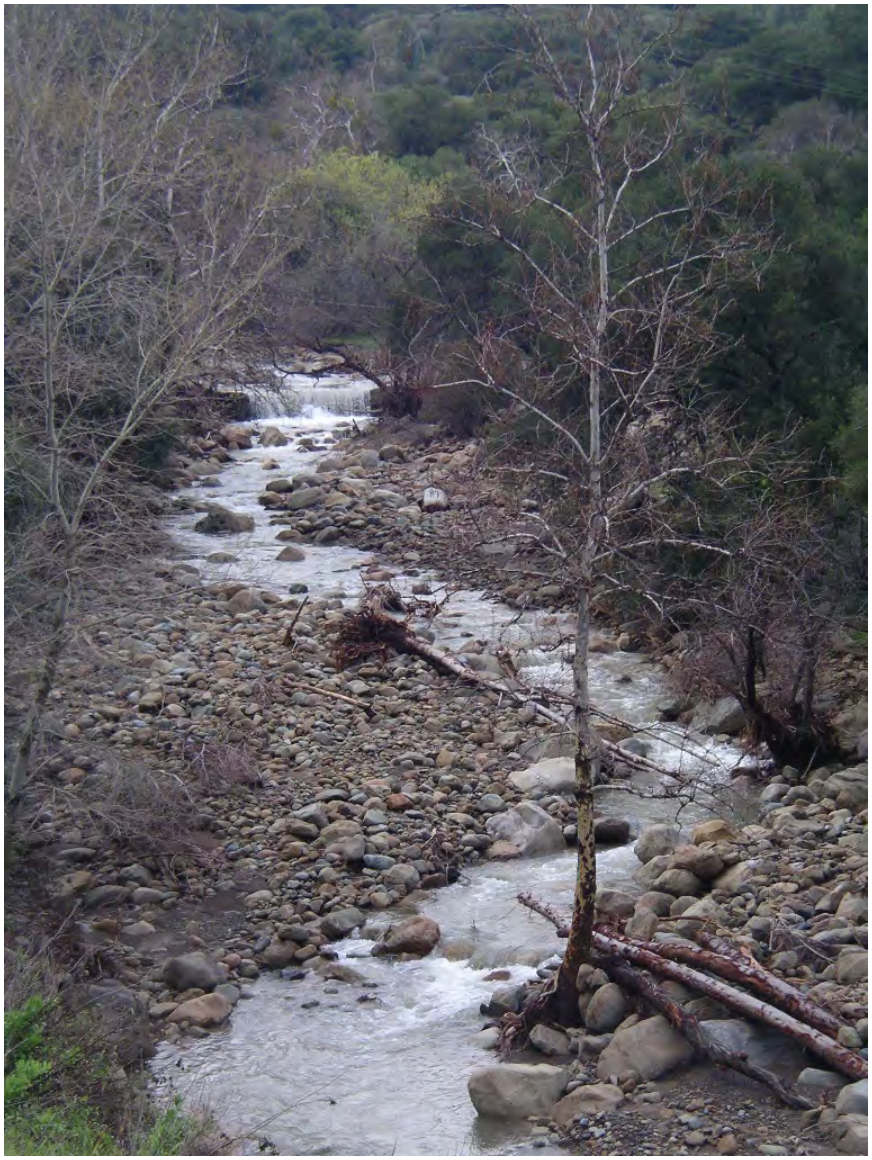
Highway 150 Bridge Grade Control Structure (SC_SP_SR_1) - Sisar Creek

Description: This concrete grade control structure occurs under the Highway 150 Bridge and extends 25 feet 6 inches from the upstream lip to the sill of the downstream concrete and boulder apron. The upstream portion of concrete extends 13 feet with an elevation change of 1-foot 4 inches and a slope of 10%. The lower apron extends a maximum of 12 feet 6 inches and is relatively flat with numerous large embedded boulders. Flows drop 1-foot 2 inches off the apron into a pool with a maximum depth of 1-foot 2 inches. The structure ties into the vertical concrete bridge supports. Substrate occurs on top of the river-left side of the grade control structure.

Diagnosis: This structure occurs on an important steelhead spawning and rearing tributary and this structure significantly impedes fish migration during certain flows and life stages. Upstream steelhead migration is prevented during low flows due to shallow water conditions on the steep grade control inlet. During high flows excessive velocities are likely encountered on this inlet, but large boulders on river-left may provide velocity breaks along the stream margin.

Recommended Action: As with the Harvey Dam Diversion and the Highway 150 Bridge at Santa Paula Creek, any treatment at the Highway 150 Bridge at Sisar Creek should be predicated on a comprehensive geomorphic analysis which will provide a better understanding of the hydro-geologic processes which affects fish passage directly, as well as the anthropogenic responses to these processes which affect fish passage. Further analysis is needed to determine feasible alternatives that will not jeopardize the integrity of the Highway 150 Bridge supports. Investigations should assess the feasibility of removing most or all of the grade control and stabilizing the toe of the bridge supports. The 46 feet between bridge supports and presence of large deposited substrate suggest that there is sufficient flow capacity to remove the grade control and stabilize a natural or semi-natural streambed with adjacent boulder toe protection.

Private Road Crossing, 14145 Santa Paula/Ojai Rd (SC_SP_SR_2) - Sisar Creek



Description: Permission to survey this crossing was not obtained and observations were limited from Highway 150. Following the high stream flows of January 2005, an outlet drop of greater than 5 feet was observed on the downstream side of the concrete crossing.

Diagnosis: Due to the excessive outlet drop, the structure fails to meet DFG and NOAA fish passage criteria at all flows.

Recommended Action: Contact the landowner again and request permission to survey the culvert crossing and discuss potential grant opportunities to improve the crossing for vehicle access and provide fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Private Road Crossing Near Bear Creek Confluence (SC_SP_SR_3) - Sisar Creek

Description: Permission to survey this crossing was not obtained and observations were limited from Highway 150. Low surface flows were not observed on top of the crossing indicating the presence of a culvert under the concrete crossing. Additional characteristics could not be determined.

Diagnosis: As with most culvert crossings of this type there is likely an impact on upstream fish migration. Additional assessment is needed to determine the impacts of this crossing on fish passage.

Recommended Action: Contact the landowner again and request permission to survey the culvert crossing and discuss potential grant opportunities to improve the crossing for vehicle access and provide fish passage. If the crossing is limiting fish passage on this important steelhead creek, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Private Crossing upstream of Sisar Creek (SC_SP_SR_BR_1) - Bear Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. This private crossing appears to have an apron and outlet drop of at least 2 feet.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage, but it is likely that the outlet drop is excessive and impedes upstream fish passage during certain flows.

Recommended Action: Contact the landowner and request permission to survey the crossing and discuss potential grant opportunities to improve the crossing for vehicle access and provide fish passage. If the crossing is limiting fish passage, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Private Crossing Upstream of Upper Residence (SC_SP_SR_BR_2) - Bear Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. This private crossing appears to be constructed of some concrete and packed dirt, and appears to be close to stream grade.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage.

Recommended Action: Contact the landowner and request permission to survey the crossing and discuss potential grant opportunities to improve the crossing for vehicle access and provide fish passage if the crossing is limiting fish migration. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001). Additional ground surveying of Bear Creek should also be conducted to determine if any natural barriers occur in downstream reaches that were not surveyed and to assess whether upstream habitat conditions warrant any project at this site.

Bridge Blockage (SC_SP_SR_EF_1) - East Fork Sisar Creek

Description: This old, wood bridge spans 18 feet between concrete footings that are poured on large boulders within the stream channel. While the channel is natural underneath the bridge, the active channel width of the creek upstream and downstream is 24 to 28 feet across and the constricted bridge footings appear to have created a boulder blockage barrier. The concrete footings may be preventing large substrate mobility and exacerbating the steep boulder cascades occurring upstream and downstream of the bridge. Clearance under the bridge is only 5 feet 6 inches and the owner informed us that during the1969 floods large boulders and flow by-passed the bridge on the river-right (pers. comm. B. Dron 2004). The original bridge was reportedly built in the 1930's. Surface flows also subside immediately upstream of the bridge for over 100 feet further indicating that substrate is being deposited upstream of the bridge. Downstream of the bridge a drop measuring 8 feet 8 inches occurs to a small 2-foot 1-inch deep pool. The bridge is partially burned from local fires and is in poor condition.

Diagnosis: The excessive jump height of the boulder cascade and excessive gradient upstream of the dam prevent all fish passage. *O. mykiss* were observed downstream of the bridge, but not upstream.

Recommended Action: Coordinate with the cooperative landowner and offer assistance with removal of the bridge and installation of a wider span bridge that may allow for improved large substrate mobility and eventual fish passage upstream following several large flushing flow events. Additional surveying should be conducted to analyze the stream's long profile and eventual "stable" slope through the site.

Private Road Crossing Upstream of Sisar Creek (SC_SP_SR_BT_1) - Bartlett Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. This private crossing appears to be constructed of concrete.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage.

Recommended Action: Additional ground surveying of Bartlett Creek should be conducted to determine if upstream habitat conditions warrant any project at this site. Contact the landowner and request permission to survey the crossing and upstream habitat and if fish passage improvements are desirable, discuss potential grant opportunities to improve the crossing for vehicle access and provide fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

CALTRANS Highway 126 Bridge Apron (SC_HR_1) - Hopper Creek

Description: Permission to access adjacent private lands to survey this crossing was not obtained and observations were limited from the bridge and air. The concrete apron occurs just upstream of the bridge and continues under the bridge. No drops were observed and the slope of the apron could not be determined.

Diagnosis: Additional ground surveying is needed to determine the impact of this apron on upstream fish passage, but limited observations from Highway 126 indicate that the apron represents a partial barrier to upstream fish migration to excellent habitat located upstream.

Recommended Action: Additional ground surveying should be conducted to analyze fish passage conditions at this apron. If feasible the preferred NOAA Fish Passage alternative would be removal of the concrete apron and protection of the bridge using biotechnical methods that maintain a natural streambed under the bridge (NOAA 2001). Effective upstream fish passage at this site is critical to allow quick upstream migration through the poor habitat and intermittent steam flow conditions within this lower migration corridor reach.

Private Road Crossings Upstream of Highway 126 (SC_HR_2,3,4) – Hopper Creek

Hopper Creek barrier #2

Description: Permission to survey upper Hopper Creek was obtained, but access through locked gates on private land was never provided and observations were limited from the air and adjacent road up to the locked gate. A total of 14 private road crossings were observed on Hopper Creek upstream of Highway 126 while conducting the aerial survey. Three of the crossings appear to be constructed of concrete, while the remaining 11 appear to be in-stream fords on natural substrate that may not impede fish passage. The 3 concrete crossings were observed to have considerable outlet drops associate with them up to 4 or more feet in height. The crossings appear to service oil facilities in the canyon.

Hopper Creek Barriers #3 and #4 and other at-grade oil facility road crossings

Diagnosis: Ground surveys are needed to determine the impacts of these crossings on fish passage, but aerial observations indicate that the three concrete crossings represent partial or complete barriers to upstream fish migration and limit or prevent upstream fish passage to excellent habitat located upstream. SC_HR_2 appears to have a 2-foot outlet drop while SC_HR_3 and SC_HR_4 appear to have outlet drops exceeding 4 feet in height.

Recommended Action: Additional ground surveying of Horse Creek should be conducted to analyze fish passage conditions at all road crossings, especially the concrete ones. Contact the landowners and request permission to survey the crossings and obtain access through the locked gate. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001). Due to the number of crossings and associated erosion, a long-term road planning strategy would be beneficial in reducing the number of crossings needed, reducing maintenance, providing effective fish passage, and reducing erosion impact on the creek.

Road/Tractor Crossing (SC_HR_TS_1) - Toms Creek

Description: Permission to survey this Hopper Creek tributary crossing was not obtained and observations were limited from the air. This private crossing occurs east of Hutton Peak and appears to be constructed of concrete and may function as a heavy equipment crossing or 4x4 crossing. Heavy riparian growth limited additional observation.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage.

Recommended Action: Additional ground surveying of Toms Creek should be conducted to determine if downstream access and upstream habitat conditions warrant any fish passage project at this site. Contact the landowner and request permission to survey the crossing and habitat. If fish passage improvements are desirable, discuss the desirability of the crossing, potential natural ford options, or potential grant opportunities to improve the crossing for vehicle access and fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Private Nursery Road Crossing (SC_SE_BR_1) – Boulder Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. The concrete crossing occurs adjacent to a nursery just upstream from the confluence with Sespe Creek and the Santa Clara River flood plain. This private crossing appears to be in extremely poor condition with noticeable concrete failure and downstream scour and undercutting observed. An outlet drop of at least 5 feet occurs. The crossing appears to be approximately 12 feet wide and no culvert was observed from the air.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage. The excessive outlet drop likely prevents all upstream fish passage during all flows and fails and to meet DFG and NOAA passage criteria.

Recommended Action: Contact the landowner and request permission to survey the crossing and discuss the desirability of the crossing and potential grant opportunities to improve the crossing for vehicle access and provide fish passage. If the crossing is limiting fish passage, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

CALTRANS Highway 126 Double-Box Culvert (SC_SE_BR_2) – Boulder Creek

Description: This barriers total length measured 191 feet from the inlet apron to the sill of the downstream apron. The inlet apron measured 18 feet long with a rise of 4 feet above the culvert inlet bottom and steep slope of 22.2%. The double-box culvert measured 115 feet long with a slope of approximately 1%. Each box culvert measured 7 feet 11 inches tall by 12 feet wide. Downstream of the culvert a concrete and boulder rip-rap apron extends 58 feet and spans 39 feet across the channel to the base of sloping concrete and boulder bank revetment. Downstream of the apron flows drop 4 feet 2 inches into a 3-foot deep scour pool that is undermining the apron.

Diagnosis: Due to the excessive slope of this long culverts inlet apron and excessive outlet apron drop, the structure fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present.

Recommended Action: The preferred NOAA Fish Passage alternative is removal of the crossings and installation of a bridge (NOAA 2001). This alternative would provide the most effective fish and wildlife passage and would eliminate blockage hazards and downstream erosion and scour associated with the current structure.

Private Crossing Downstream of the Railroad Crossing (SC_SE_BR_3) – Boulder Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. The crossing occurs just downstream from the railroad crossing culvert. This private crossing appears to be in poor condition. An outlet drop of at least 5 feet occurs. The crossing appears to be approximately 12 feet wide and no culvert was observed from the air.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage. The excessive outlet drop likely prevents all upstream fish passage during all flows and fails and to meet DFG and NOAA passage criteria.

Recommended Action: Contact the landowner and request permission to survey the crossing and discuss the desirability of the crossing and potential grant opportunities to improve the crossing for vehicle access and provide fish passage. If the crossing is limiting fish passage, The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Railroad Culvert Crossing (SC_SE_BR_4) – Boulder Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. A concrete double-box culvert occurs under the railroad crossing. An outlet drop of approximately1-foot occurs. The crossing appears to extend at least 25 feet underneath the railroad.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage. The short outlet drop likely allows upstream fish passage into the culvert during most flows. The slope and configuration of the culvert bottom could not be determined and may limit upstream fish passage.

Recommended Action: Contact the adjacent landowners or railroad contact and request permission to survey the crossing and adjacent stream channel. Following downstream fish passage projects this culvert should be modified to enhance fish passage with special consideration to maintaining the structural integrity of the railroad crossing.

Private Crossing Upstream of the Railroad Crossing (SC_SE_BR_5) – Boulder Creek

Description: Permission to survey this crossing was not obtained and observations were limited from the air. The crossing occurs just upstream from the railroad crossing culvert. This private crossing appears to be in poor condition. An outlet drop of at least 3 feet occurs. The crossing appears to be approximately 10 feet wide and no culvert was observed from the air.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing on fish passage. The excessive outlet drop likely prevents all upstream fish passage during all flows and fails and to meet DFG and NOAA passage criteria.

Recommended Action: Contact the landowner and request permission to survey the crossing and discuss the desirability of the crossing and potential grant opportunities to improve the crossing for vehicle access and provide fish passage. If the crossing is limiting fish passage, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Concrete Channel (SC_PE_1) – Pole Creek

Description: Project budget and scope precluded ground surveying efforts on Pole Creek, but limited observations were made from the air. This concrete channel extends approximately 6,500 feet in length from the Santa Clara River upstream adjacent to the eastern end of Fillmore. The lower portion contains earthen levees, while the upper portion is a concrete box culvert with a steep inlet apron. The earthen and concrete channels appear to have mild gradients with deposited substrate present. The concrete inlet apron appears to be steeply sloped.

Diagnosis: Additional assessment is needed to determine the impacts of the channel and inlet apron on fish passage. It appears likely that the inlet apron presents a complete barrier to upstream fish passage during all flows due to either shallow water depth or excessive water velocities during low and moderate to high stream flows, respectively.

Recommended Action: Additional ground surveying of Pole Creek should be conducted to determine if upstream habitat quality and quantity warrant a fish passage improvement project at this site. Adequate salmonid habitat conditions appear to occur on Pole Creek, but a thick riparian canopy prevented observations of much of the stream and potential natural migration barriers downstream of the observed bedrock waterfall (SC_PE_4).

Private Road Crossings (SC_PE_2,3) – Pole Creek

Description: Project budget and scope precluded ground surveying of Pole Creek, but limited observations were made from the air. Two concrete road crossings were observed on Pole Creek, but the USGS 7.5 Minute Topo map shows at least 7 additional road crossings on Pole Creek between the observed SC_PE_2 and SC_PE_3. These crossings could not be observed due to thick riparian canopy conditions. SC_PE_3 appears to have a steep outlet apron with outlet drop exceeding 2 feet in height.

Diagnosis: Additional assessment is needed to determine the impacts of this crossing and other potential crossings on fish passage. SC_PE_3 appears to represent a partial or complete fish passage barrier due to an excessive outlet drop and excessive apron slope.

Recommended Action: Additional ground surveying of Pole Creek should be conducted to determine if habitat conditions warrant fish passage improvement projects at these sites. Contact the landowners and request permission to survey the crossings and habitat. If fish passage improvements are desirable, discuss potential grant opportunities to improve the crossings for vehicle access and provide fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Following completion of this report and all barrier analysis, a 1999 Department of Fish and Game memorandum was obtained with comments from NOAA Fisheries. This document (CDFG 1999) describes a dam and two natural waterfall barriers observed in a 1992 survey of Pole Creek. This memorandum is attached in Appendix IV. Please refer to this memo for additional information.

Old Diversion Dam Upstream of Upper Lion Campsite (SC_SE_LN_4) – Lion Creek

Description: This abandoned old diversion dam has an inscription in the concrete that appears seems to read “6/22/37 CO 2925”. It appears that this dam was built to divert water along the river-left banks downstream to Lower Lion Campsite almost 70 years ago. Remains of old metal pipes can be seen downstream. The dam measured 4 feet tall from the downstream tail-water control to the top of the dam. The dam measured 25 feet across the channel and 6 feet thick at its maximum point. The downstream pool measured 1-foot 9 inches at its maximum depth. A 12-inch diameter metal diversion pipefitting passes though the dam and is capped on the downstream side and buried with deposited substrate on the upstream side.

Diagnosis: Due to the excessive outlet drop, this dam fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present. During moderate to high stream flows, adult steelhead should be able to migrate upstream of this dam as downstream jump depth increases. The dam does narrow the window of opportunity for upstream fish passage especially during lower flows and for smaller salmonids. Exposed re-bar and other metal may injure jumping salmonids.

Recommended Action: This obsolete dam should be removed to assist the current prolific *O. mykiss* population that occurs upstream and downstream of the dam. In addition to improved fish migration, removal of the dam may improve surface flow conditions upstream. Surface flows were present for 285 feet upstream of the dam then disappeared subsurface for 216 feet. The permeable substrate deposits upstream of the dam may be impacting surface flow conditions during late summer and fall. Excellent spawning and rearing habitat occur in Lion Creek.

Los Padres National Forest Road 5N05 Culvert (SC_SE_HD_2) – Howard Creek

Description: This corrugated steel pipe-arch culvert measured 54 feet 8 inches long with an 8-inch rise and overall slope of 1.2%. The culvert outlet occurs at the same elevation as the outlet pools thalweg. The dry outlet pool's maximum depth measured 2 feet 3 inches below the thalweg elevation. The culvert measured 13 feet at the widest point and 7 feet 6 inches tall. No inlet or outlet aprons occur and the outlet of the culvert is significantly undercut. The culvert has significant rust and a damaged metal bottom.

Diagnosis: Using FishXing software and estimating flows for Howard Creek show that this culvert would prevent upstream steelhead passage below 16 cfs due to insufficient water depth in the culvert. Excessive water velocities in the culvert would also prevent upstream passage above 62 cfs Between 22 and 53 cfs limited upstream passage may be possible, but Fish Xing noted excessive outlet leap heights during these flows.

Recommended Action: Due to the mobile nature of downstream tailwater control substrate, this structure and the outlet jump height should be further assessed during the potentially passable flows identified. In addition to further migration flow assessment at the culvert site, downstream migration conditions should be assessed between the culvert and Rose Valley Creek. During our survey of Howard Creek, most of the stream was dry between Rose Valley Creek and this culvert and dry boulder cascades with moderate gradients occur. This reach should be further assessed for adequate upstream migration during moderate to high stream flows and prior to any fish passage projects at this culvert site and upstream barriers.

Rose Valley Road Crossing (SC_SE_HD_3) – Howard Creek

Rose Valley Road (bottom) and Airstrip (top)

Description: This concrete low-flow crossing spans 198 feet across a braided and unconfined reach of Howard Creek at the edge of a large meadow and private ranch (Rancho Grande). The crossing is 22 feet wide with a slope of 1.5 %. The outlet sill drops flows 1-foot 4 inches to the downstream substrate.

Diagnosis: Due to the highly unconfined channel and braided nature of Howard Creek at this crossing, stream flows spread out extensively across this crossing producing shallow conditions that limit salmonid passage during low to moderate stream flows. During moderate to high stream flows, adequate water depth conditions may develop for a limited duration and possibly allow limited fish passage, depending on the extent of upstream braiding and downstream scour and channel conditions.

Recommended Action: See habitat survey recommendation for the downstream culvert (SC_SE_HD_2). This crossing should be further assessed in coordination with unsurveyed upstream barriers and habitat on private land that will influence potential alternatives at this site.

Private Airstrip Culverts on Rancho Grande (SC_SE_HD_4) – Howard Creek

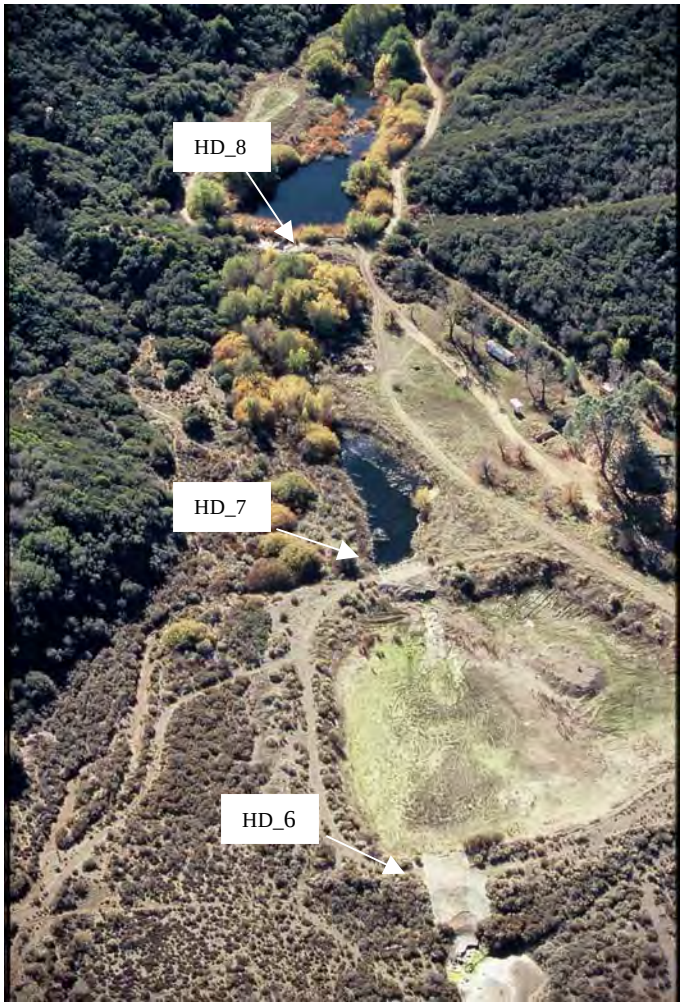
(Photo for previous barrier (SC_SE_HD_3) also shows the Airstrip at the top of the photo)

Description: Access to survey this structure was not obtained and limited observations were made from Rose Valley Road and the air. At least two culvert pipes appear to convey braided reaches of Howard Creek under the private dirt airstrip. The culverts occur approximately 200 feet apart and at grade level.

Diagnosis: As with most culvert crossings there is likely an impact on upstream fish migration. Additional assessment is needed to determine the severity of this crossing on fish passage.

Recommended Action: See survey recommendation for the downstream culvert (SC_SE_HD_2). These culverts should be further assessed in coordination with unsurveyed upstream barriers and habitat on Rancho Grande that will influence potential alternatives at this site.

Four Dams on Rancho Grande (SC_SE_HD_5,6,7,8) – Howard Creek



Upper Three Dams and Reservoirs #6-#8 (lower dam not visible)

Description: Access to survey these four dams was not obtained and limited observations were made from the air. All dams appear to be earth filled dams with concrete spillways. The dams occur in sequence with the reservoir elevation at the next upstream dam. The concrete spillways also appear to be used for vehicle access across the dam crest.

Diagnosis: Additional assessment is needed to determine the configuration and severity of these dams on fish passage. All four dams are likely impassable to all upstream fish migration during all flow conditions, but are given a “gray” barrier status due to minimal information about the structures.

Recommended Action: These dams should be assessed and their desirability determined with the owners of Rancho Grande to determine possible fish passage alternatives through the private land. In addition, permission should be sought to conduct additional habitat surveys upstream of the upper dam to determine if adequate salmonid habitat occurs. Also see habitat survey recommendations for SC_SE_HD_2. In addition to potential impacts to fish passage, these dammed reservoirs may harbor exotic fish species and other fauna that spills into critical

downstream steelhead habitat. The potential negative impacts of exotic fish and hatchery trout on the steelhead population downstream cannot be over-stated. Efforts should be made to eliminate any risk of future exotic fish or hatchery trout escapement downstream. Removal of the dams, stream restoration, and conservation easement options and financial incentives should be discussed with the owners.

Lower Rose Valley "Lake" Dam (SC_SE_HD_RV_1) – Rose Valley Creek

Description: This earthen dam has a concrete spillway that also serves as a road crossing. This spillway road measured 14 feet wide and 70 feet across. The total height of the dam measured 5 feet 3 inches from the spillway inlet to the downstream substrate. The slope on the spillway measured 2.3% and drops flows 2 feet 6 inches to a concrete shelf measuring 2 feet 7 inches out from the spillway. This shelf contains a 1-foot tall 6-inch wide concrete curb with 3 notches down to shelf level. Flows then drop 1-foot 9 inches to another concrete shelf and then spill onto a downstream boulder apron. This boulder apron measured 12 feet downstream from the concrete with an average slope of 40%.

Diagnosis: Due to the excessive outlet drop, this dam fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present.

Recommended Action: In addition to being a migration barrier to a known downstream steelhead population and upstream trout population, this dam produces a reservoir that is planted with exotic fish species and hatchery trout that compete with and prey upon protected steelhead downstream. This and the other two upstream dams on Rose Valley Creek should be removed to open up habitat to the existing steelhead population, eliminate the exotic fish and hatchery trout stocking programs that are negatively impacting the entire Sespe/Santa Clara River ecosystem, and improve stream flows and water quality downstream.

Rose Valley Road Culvert (SC_SE_HD_RV_2) – Rose Valley Creek

Description: This corrugated metal culvert pipe measured 84 feet long with 16-foot long concrete aprons at the inlet and outlet giving a total length of 116 feet. Concrete headwalls and wingwalls encase the culvert pipe and aprons. The culvert slope measured 3.3% with similar slopes occurring at both aprons. The culvert width measured 11 feet and the height measured 11 feet 8 inches. During dry survey conditions, a 1-foot 2-inch outlet drop occurred from the outlet apron to the downstream substrate. This loose downstream substrate is mainly smaller sand and gravel and will mobilized during moderate stream flows and scour may produce a greater outlet jump height for fish.

Diagnosis: Due to the steep slope of this long culvert and excessive water velocities conveyed through it, the structure fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present.

Recommended Action: In association with providing adequate fish passage at the downstream Lower Rose Valley Dam site, the preferred NOAA Fish Passage alternative is removal of the crossing and installation of a bridge or streambed alteration strategy such as a bottomless arch culvert, embedded culvert, or ford (NOAA 2001).

Middle Rose Valley "Lake" Dam (SC_SE_HD_RV_3) – Rose Valley Creek

Description: This concrete dam measured 27 feet across the channel. The total height of the dam measured 10 feet 4 inches from the spillway inlet to the downstream substrate. The spillway drops 7 feet 8 inches to a concrete shelf measuring 21 feet out from the spillway. This shelf contains a 2-foot tall 6-inch wide concrete curb with 2 notches down to shelf level. Flows then drop 8 inches to a 5-foot long concrete apron and then spill 2 feet onto the downstream substrate.

Diagnosis: Due to the excessive outlet drop, this dam is a complete barrier to salmonids and fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present.

Recommended Action: In addition to being a migration barrier to a known downstream steelhead population in Howard and Rose Valley Creeks, this dam produces a reservoir that is planted with exotic fish species and hatchery trout that compete with and prey on protected steelhead downstream. This and the other two dams on Rose Valley Creek should be removed to open up habitat to the existing steelhead population, eliminate the exotic fish and hatchery trout stocking programs that are negatively impacting the entire Sespe/Santa Clara River ecosystem, and improve stream flows and water quality downstream.

LPNF Rose Valley Campground Crossing (SC_SE_HD_RV_4) – Rose Valley Creek

Description: The concrete crossing measured 67 feet 6 inches across the channel and 20 feet wide. The slope of the crossing is 1.5%. Surface flows are conveyed on top of the crossing and drop 3 feet onto the downstream substrate. Large boulders occur on a portion of the outlet and produce a 10-foot long apron with an average slope of 25%.

Diagnosis: Due to the excessive outlet drop this crossing fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present. The partial boulder apron may provide limited upstream passage during ideal flow conditions.

Recommended Action: In association with providing adequate fish passage at the downstream barrier sites this crossing should be removed or modified to improve fish passage. The preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001). Due to the unconfined stream channel in this reach and dry stream conditions for much of the recreational year, elimination of the concrete crossing and creation of a natural bottom ford should be considered as an economical and effective fish passage option.

Upper Rose Valley "Lake" Dam (SC_SE_HD_RV_5) – Rose Valley Creek

Description: This earthen dam does not have a concrete spillway similar to the downstream dams. Apparently the dam was built across Rose Valley Creek and then an outlet channel was dug around the east side of the dam. This new channel contains one significant drop that measured 8 feet tall with a dry downstream pool that likely fills up to 3 feet in depth. The side channel also appears to lack perennial flow due to its exposed location.

Diagnosis: Due to the excessive outlet drop, within the altered side channel, this dam fails to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present.

Recommended Action: In addition to being a migration barrier to a known downstream steelhead population in Howard and Rose Valley Creeks, this dam and side channel produce a reservoir that is planted with exotic fish species and hatchery trout that compete with and prey on protected steelhead downstream. This and the other two dams on Rose Valley Creek should be removed to open up habitat to the existing steelhead population, eliminate the exotic fish and hatchery trout stocking programs that are negatively impacting the entire Sespe/Santa Clara River ecosystem, and improve stream flows and water quality downstream.

Culvert Crossings (SC_PU_LE_1,2,3, MO_1, BD_1) Lime, Modelo, and Blanchard Creek

Private Box Culvert (SC_PU_LE_1) on Lime Creek

Description: Permission to survey these lower Piru Creek tributary crossings was not obtained and observations were limited from Piru Canyon Road and the air. The downstream-most box culvert on Lime Creek occurs downstream of Piru Canyon Road. Concrete box culverts occur on Modelo and Blanchard Creek under Piru Canyon Road and Lime Creek has a circular culvert. The remains of an old structure that appears to be a failed culvert crossing occur upstream of Piru Canyon Road on Lime Creek.

Piru Canyon Road Culvert (SC_PU_LE_2) on Lime Creek

Diagnosis: Additional assessment is needed to determine the impacts of these crossing on fish passage and ground surveying of upstream habitat conditions and summer flows is needed to determine if fish passage projects are warranted. Each culvert likely limits fish passage to some degree during various flow conditions.

Old structure (SC_PU_LE_3) on Lime Creek

Recommended Action: Contact the landowners and request permission to survey the crossings and upstream habitat. Discuss the desirability of the crossings and potential grant opportunities to improve the crossings for vehicle access and fish passage. If the crossings are limiting fish passage and restoration projects are warranted, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Piru Canyon Road Box Culvert SC_PU_MO_1 on Modelo Creek

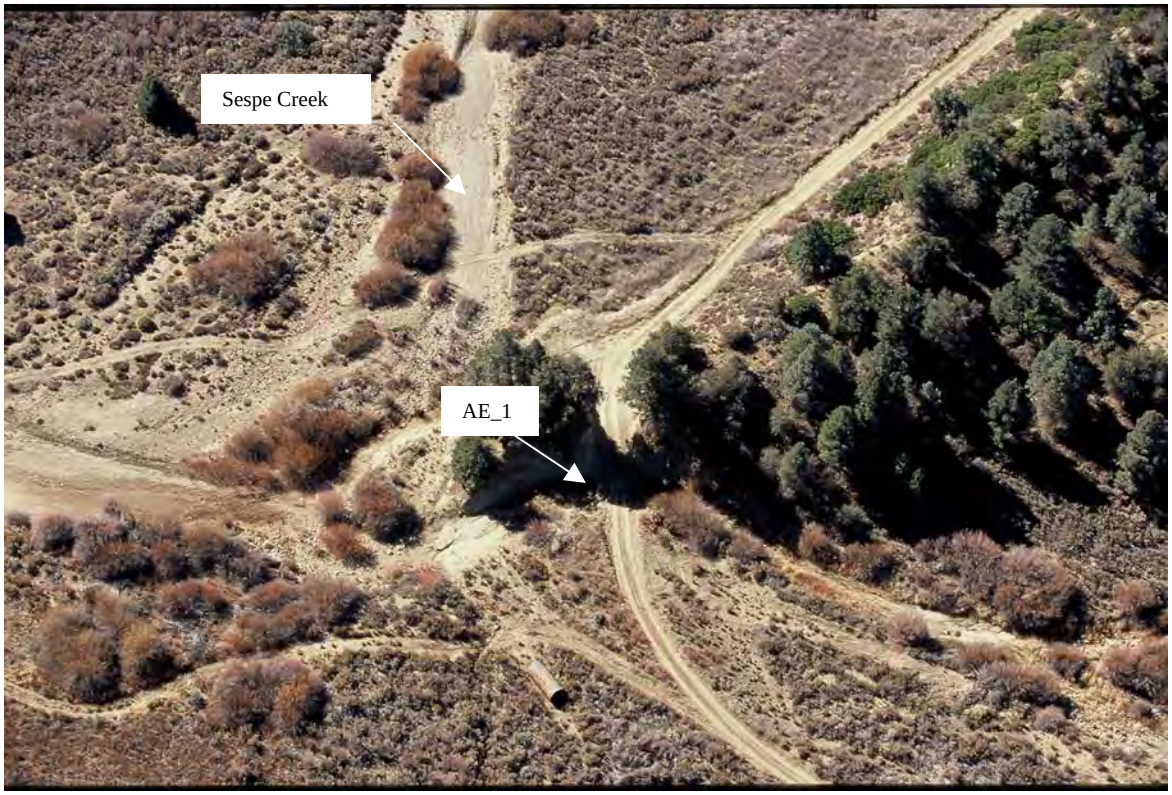
So. Cal. Gas Pipeline Crossing (SC_SE_CY_1) - Cherry Creek

Description: This high-pressure gas line is highly exposed in the stream channel and presents a partial barrier to trout migrating into Cherry Creek from Sespe Creek. The 2-foot diameter pipeline has natural substrate occurring on top of it on the far river-left side of the channel and produced a 12-inch drop to the downstream pool that measured 12 inches in depth. Spray painted on the side is “High Pressure Gas” and “So. Cal. Gas Co. (805) 967-4612”

Diagnosis: The short jump height required to clear this pipeline would likely not limit upstream fish migration during moderate and high flows, but imposes a moderate degree of difficulty during lower flows and especially for small salmonids that occur upstream in Cherry Creek.

Recommended Action: So. Cal. Gas Co. should remove this pipeline and reroute it aerially in a “gooseneck” design to allow unimpeded fish passage and eliminate damage from the stream channel. A small population of *O. mykiss* were observed in Cherry Creek upstream of this pipeline this partial barrier and potential pollution hazard should be rerouted out of the active stream channel.

Private Crossings (SC_SE_AE_1,2) - Adobe Creek



Private culvert crossing on Abode Creek just upstream of Sespe Creek

Description: Permission to survey these crossings was not obtained and observations were limited from the air. The most downstream crossing appears to be a culvert pipe and dirt road crossing that occurs immediately upstream from the Sespe Creek confluence. The upstream crossing occurs upstream of the Highway 33 Bridge and observations could not determine the configuration of the crossing due to excessive vegetation cover.

Diagnosis: Additional assessment is needed to determine the impacts of these crossings on fish passage and ground surveying of upstream habitat conditions is needed to determine if fish passage projects are warranted. The downstream culvert likely limits fish passage to some degree during various flow conditions.

Recommended Action: Contact the landowners and request permission to survey the crossings and discuss the desirability crossings and potential grant opportunities to improve the crossings for vehicle access and provide fish passage. If the crossings are limiting fish passage and habitat conditions warrant restoration projects, the preferred NOAA Fish Passage guideline alternatives are removal of the crossing and road realignment to avoid crossing the stream, installation of a bridge, or streambed simulation strategy (NOAA 2001).

Highway 33 Culverts (SC_SE_BO_1, SC_SE_2BO_1) - Burro Creek #1 and #2

Burro Creek Highway 33 Box Culvert

Description: Two Highway 33 concrete box culverts occur on Burro Creek and the adjacent (unnamed) Burro Creek #2. The Burro Creek #2 box culvert measured 56 feet long and 6 feet wide by 8 feet tall. The steep slope of the culvert measured 11.8% with a total rise of 6 feet 7 inches from the inlet to the outlet at substrate level. The culvert bottom is damaged with exposed metal re-bar and worn concrete. No access was obtained to survey the Burro Creek culvert, but observations from the road reveal a similarly steep slope and approximately 2-foot outlet drop.

Burro Creek #2 Highway 33 Box Culvert

Diagnosis: Due to the steep slope of these culverts, the structures fail to meet DFG and NOAA passage criteria at all flows for strongest swimming species presumed present. During low flow conditions encountered in late November only 214 feet of habitat with surface was observed upstream of the Burro Creek #2 culvert and below an impassable 19-foot tall waterfall. However, much of the habitat observed was step-pool habitat with pools over 2 feet deep and one large plunge pool over 6 feet deep. This limited habitat may be able to support a small number of trout and provide one large over-summering pool. In accessible private lands occur upstream of Burro Creek #1 and habitat conditions were not surveyed upstream from the ground.

Recommended Action: Both culverts should be removed in conjunction with future planned CALTRANS work. The preferred NOAA fish passage alternative is removal of the crossing and installation of a bridge or streambed alteration strategy such as a bottomless arch culvert or embedded culvert (NOAA 2001). Additional surveying should be conducted on Burro Creek #1 upstream of the culvert to determine the exact amount and quality of habitat and whether trout are present.

Torrey Road Bridge (SC_2) - Santa Clara River

Description: This short-span bridge crossing occurs downstream from Piru Creek. Elevated dirt road fill occurs across much of the Santa Clara River channel on either side of the Torrey Road Bridge.

Diagnosis: While natural substrate conditions were observed underneath the road crossing, there may be concrete buried underneath, which could impact fish passage during higher stream flows when substrate is mobilized. The road crossing may also confine stream flows under the bridge and cause accelerated water velocities during high stream flows that may limit fish passage during high flows.

Recommended Action: Additional assessment of this crossing is needed during and following high stream flows to determine if this crossing is limiting fish passage during migration flows. In addition, if upstream flow releases are modified at Santa Felicia Dam and other upstream dams to improve steelhead migration flows on the Santa Clara River this confined crossing may need to be removed and redesigned to facilitate greater flow capacity and improved fish migration conditions.

Mulholland Dam and Fillmore Irrigation Diversion (SC_SE_1) - Sespe Creek

Description: James Van Trees, whose family has owned the lands adjacent to this dam for several generations, informed me that this historic, failed dam was built in the 1930's or 1940's by Los Angeles water figure William Mulholland (pers. comm. Van Trees 2004). The stone block and concrete diversion dam reportedly was destroyed in the 1969 flood and only remnants of the dam survived. The dam remains were reportedly buried by sediment for many years following 1969 and then were uncovered in recent decades. The original dam spanned approximately 200 feet across the stream channel and measured 5 feet thick and at least 10 feet in height above the substrate. Only 80 feet of the dam still remains on the river-left side and a small, stream-polished section occurs on top of a native boulder near the river-right side of the channel. Two 10-inch metal diversion pipes occur within each remaining part of the dam. Metal rebar anchors can also be observed protruding from some of the native boulders were the dam once stood.

Following the destruction of the dam, Fillmore Irrigation began to built a temporary diversion dam immediately downstream with large boulders from a small river-left tributary (pers. comm. Moore, Van Trees). Department of Fish and Game informed Fillmore Irrigation that the dam construction was not permitted and the water company has since abandoned the seasonal dam building and now diverts surface flows from just upstream of the old dam with a 8-inch pipeline that is installed seasonally in the spring and summer with a DFG agreement (pers. comm. Moore). A water diversion pipeline facility occurs 441 feet downstream from the dam site on the river-right bank. This facility is constructed of concrete with the date Jan 12, 1973 written in the concrete. A 4-foot diameter diversion pipeline begins at this site and extends downstream to agricultural lands along lower Sespe Creek. A metal plate insert occurs just before the concrete

pipeline intact and likely served to regulated intact flows and function as a bypass. In addition to this surface flow diversion operation, Fillmore Irrigation also built a groundwater pumping facility adjacent to Sespe Creek downstream near the agricultural operations. Fillmore Irrigation is currently looking to expand their water extraction capabilities on lower Sespe Creek and associated groundwater table.

Diagnosis: While this dam was functioning during the middle part of the 1900's it likely represented a significant migration barrier to steelhead migration. The subsequent seasonal boulder diversion may have also limited steelhead migration into the late 1900's. Only adult steelhead may have been able to migrate upstream during high stream flows when stream water depths were greatest and the jump height over the dam was reduced. In addition to impeding upstream passage, the diversion dam was apparently unscreened and would entrap downstream migrating steelhead whose carcasses were observed in agricultural orchards being watered (pers, comm. Moore). Currently, the dam remains have a negligible impact on stream flows and fish passage. On the river-left side of the stream channel the dam remains tie into native bedrock and produce a 3-foot 6-inch outlet drop to a 4-foot downstream pool. On the river-right side of the stream channel, the dam remains do not impact surface flows and fish passage over native substrate is possible.

Recommended Action: While this destroyed dam does not need immediate action to improve fish passage, the structure should be monitored yearly in the fall to assess weather streambed or dam conditions have changed and impede fish passage. A small portion of the dam edge that occurs near the river-left edge of the stream channel could be removed to eliminate the influence of the dam and the small jump height observed. Fillmore irrigation operations should be monitored to ensure continued adequate diversion screening and fish passage at the seasonal diversion site. Potential impacts to steelhead from the proposed Fillmore Irrigation increases in water extraction from Sespe Creek and adjacent groundwater table need to be studied in detail.

Private Natural Bottom Road Crossing (SC_SE_HD_1) - Howard Creek

Description: A private natural-bottom road crosses Howard Creek to a private inholding just upstream from Sespe Creek. The concrete footing remains of an older, now washed out, bridge crossing occur downstream from the current crossing.

Diagnosis: The concrete bridge footing remains and an at-grade crossing do not limit fish migration. The crossing does enable frequent vehicle access into the stream channel and this perennial flowing reach of stream. *O. mykiss* occur upstream and downstream of this crossing and elevated siltation conditions and reduced habitat quality were observed downstream due to the crossing. In addition, vehicle pollution can enter the stream at this site. Trout and other aquatic fauna are also at risk of being killed by vehicle and heavy equipment passage at this site.

Recommended Action: Assist the owners in funding a bridge installation project at this site. The owners were very helpful in providing access to survey the creek and expressed interest in helping restore steelhead to the Sespe and Howard Creek. They would like to remove old concrete remains of a past bridge and install something that did not negatively impact the creek and aquatic resources and would allow year-round vehicle access to their property. There is a great opportunity to construct a creative low-cost bridge crossing at this site as this would only be utilized by the owners and they appear to be open to options such as a railroad car crossing or other low-cost solution.

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Whitman, Marcin. California Department of Fish and Game

Appendix I

Habitat Unit Scores

Table 1. Habitat scores by habitat unit for the Santa Clara mainstem, Pole Creek, and Hopper Creek. Habitat score = quality of habitat x quantity of habitat.

Santa Clara Mainstem	
Habitat Number	***Score***
SC-1	3.52
SC-2	18.50
SC-3	8.38
SC-4	16.80
SC-5	21.35
SC-6	0.86
SC-7	0.11
SC-8	0.09
SC-9	0.69
SC-10	0.13
SC-11	0.45
SC-12	55.69
SC-13	17.03
Pole Creek	
Habitat Number	***Score***
SC-PE-1	2.76
SC-PE-2	18.12
Hopper Creek	
Habitat Number	***Score***
SC-HR-1	3.19
SC-HR-2	4.40
SC-HR-3	14.07
SC-HR-4	16.34
SC-HR-5	0.17
SC-HR-TS-1	14.59

Table 2. Habitat scores for Santa Paula Creek in alphabetical order, by habitat unit. Habitat score = quality of habitat x quantity of habitat.

Habitat Number	*Score*		*Habitat Number*	*Score*		*Habitat Number*	*Score*
SC-SP-1	0.39		SC-SP-30	0.46		SC-SP-SR-16	1.17
SC-SP-2	0.10		SC-SP-31	0.46		SC-SP-SR-17	0.60
SC-SP-3	0.78		SC-SP-32	0.16		SC-SP-SR-18	0.52
SC-SP-4	8.17		SC-SP-33	4.20		SC-SP-SR-19	0.05
SC-SP-5	0.21		SC-SP-34	0.07		SC-SP-SR-20	2.02
SC-SP-6	0.18		SC-SP-35	2.91		SC-SP-SR-21	0.06
SC-SP-7	1.08		SC-SP-36	0.06		SC-SP-SR-22	2.29
SC-SP-8	3.86		SC-SP-37	5.06		SC-SP-SR-23	0.07
SC-SP-9	0.22		SC-SP-38	0.61		SC-SP-SR-24	1.11
SC-SP-10	2.56		SC-SP-39	0.17		SC-SP-SR-25	3.90
SC-SP-11	0.07		SC-SP-40	0.16		SC-SP-SR-26	0.10
SC-SP-12	0.17		SC-SP-41	0.18		SC-SP-SR-27	2.91
SC-SP-13	0.80		SC-SP-42	1.79		SC-SP-SR-28	0.30
SC-SP-14	0.08		SC-SP-43	0.04		SC-SP-SR-29	0.03
SC-SP-15	1.14		SC-SP-SR-1	0.45		SC-SP-SR-30	1.15
SC-SP-16	0.25		SC-SP-SR-2	12.96		SC-SP-SR-31	0.03
SC-SP-17	1.00		SC-SP-SR-3	0.34		SC-SP-SR-BR-1	2.31
SC-SP-18	0.11		SC-SP-SR-4	1.35		SC-SP-SR-BR-2	0.19
SC-SP-19	0.39		SC-SP-SR-5	1.07		SC-SP-SR-BR-3	1.35
SC-SP-20	0.15		SC-SP-SR-6	0.03		SC-SP-SR-EF-1	4.38
SC-SP-21	1.36		SC-SP-SR-7	4.39		SC-SP-SR-EF-2	0.10
SC-SP-22	0.43		SC-SP-SR-8	0.16		SC-SP-SR-EF-3	3.89
SC-SP-23	0.44		SC-SP-SR-9	0.09		SC-SP-SR-EF-4	0.92
SC-SP-24	1.79		SC-SP-SR-10	0.83		SC-SP-SR-EF-5	1.01
SC-SP-25	0.09		SC-SP-SR-11	0.06			
SC-SP-26	0.61		SC-SP-SR-12	1.62			
SC-SP-27	2.13		SC-SP-SR-13	0.04			
SC-SP-28	1.18		SC-SP-SR-14	0.05			
SC-SP-29	4.24		SC-SP-SR-15	0.03			

Table 3. Habitat scores for Sespe Creek in alphabetical order, by habitat unit. Habitat score = quality of habitat x quantity of habitat.

Habitat Number	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*
SC-SE-1	4.00	SC-SE-31	0.46	SC-SE-61	0.42	SC-SE-91	0.65
SC-SE-2	4.60	SC-SE-32	0.36	SC-SE-62	1.21	SC-SE-92	0.16
SC-SE-3	0.18	SC-SE-33	0.35	SC-SE-63	2.05	SC-SE-93	0.27
SC-SE-4	0.35	SC-SE-34	0.20	SC-SE-64	0.17	SC-SE-94	0.92
SC-SE-5	0.25	SC-SE-35	0.66	SC-SE-65	0.50	SC-SE-95	1.73
SC-SE-6	0.36	SC-SE-36	0.40	SC-SE-66	0.62	SC-SE-96	0.26
SC-SE-7	0.43	SC-SE-37	0.91	SC-SE-67	0.09	SC-SE-97	0.15
SC-SE-8	0.33	SC-SE-38	0.21	SC-SE-68	1.43	SC-SE-98	0.65
SC-SE-9	0.58	SC-SE-39	0.38	SC-SE-69	0.14	SC-SE-99	0.34
SC-SE-10	0.67	SC-SE-40	0.30	SC-SE-70	0.61	SC-SE-101	0.32
SC-SE-11	1.21	SC-SE-41	2.20	SC-SE-71	0.18	SC-SE-102	0.55
SC-SE-12	0.46	SC-SE-42	0.42	SC-SE-72	0.65	SC-SE-103	0.11
SC-SE-13	0.29	SC-SE-43	2.26	SC-SE-73	0.14	SC-SE-104	1.43
SC-SE-14	0.67	SC-SE-44	0.15	SC-SE-74	0.80	SC-SE-105	0.91
SC-SE-15	0.45	SC-SE-45	0.26	SC-SE-75	0.53	SC-SE-106	0.28
SC-SE-16	0.56	SC-SE-46	0.16	SC-SE-76	0.37	SC-SE-107	0.60
SC-SE-17	4.65	SC-SE-47	0.28	SC-SE-77	0.27	SC-SE-108	0.70
SC-SE-18	0.35	SC-SE-48	0.24	SC-SE-78	0.20	SC-SE-109	0.48
SC-SE-19	0.24	SC-SE-49	1.66	SC-SE-79	0.84	SC-SE-110	0.33
SC-SE-20	0.60	SC-SE-50	0.81	SC-SE-80	0.27	SC-SE-111	0.11
SC-SE-21	6.80	SC-SE-51	0.49	SC-SE-81	0.13	SC-SE-112	0.39
SC-SE-22	1.59	SC-SE-52	0.29	SC-SE-82	0.23	SC-SE-113	0.99
SC-SE-23	1.13	SC-SE-53	0.68	SC-SE-83	0.28	SC-SE-114	1.37
SC-SE-24	0.61	SC-SE-54	0.12	SC-SE-84	0.39	SC-SE-115	0.31
SC-SE-25	1.38	SC-SE-55	0.64	SC-SE-85	0.48	SC-SE-116	1.14
SC-SE-26	0.34	SC-SE-56	0.07	SC-SE-86	0.96	SC-SE-117	0.22
SC-SE-27	0.35	SC-SE-57	0.08	SC-SE-87	0.25	SC-SE-118	0.54
SC-SE-28	0.18	SC-SE-58	0.51	SC-SE-88	0.39	SC-SE-119	0.62
SC-SE-29	0.40	SC-SE-59	2.28	SC-SE-89	0.16	SC-SE-120	0.23
SC-SE-30	0.29	SC-SE-60	1.19	SC-SE-90	0.60	SC-SE-121	1.02

Habitat Number	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*
SC-SE-122	0.42	SC-SE-154	0.50	SC-SE-186	0.35	SC-SE-218	0.45
SC-SE-123	0.59	SC-SE-155	1.58	SC-SE-187	0.31	SC-SE-219	2.55
SC-SE-124	0.15	SC-SE-156	0.39	SC-SE-188	0.06	SC-SE-220	0.05
SC-SE-125	1.58	SC-SE-157	0.85	SC-SE-189	0.59	SC-SE-221	0.32
SC-SE-126	0.55	SC-SE-158	0.31	SC-SE-190	0.16	SC-SE-222	0.09
SC-SE-127	1.40	SC-SE-159	0.28	SC-SE-191	2.25	SC-SE-223	0.23
SC-SE-128	0.67	SC-SE-160	1.52	SC-SE-192	0.72	SC-SE-224	3.93
SC-SE-129	0.59	SC-SE-161	0.56	SC-SE-193	0.17	SC-SE-225	0.31
SC-SE-130	0.12	SC-SE-162	0.78	SC-SE-194	0.98	SC-SE-226	0.13
SC-SE-131	0.33	SC-SE-163	0.18	SC-SE-195	0.18	SC-SE-227	0.09
SC-SE-132	0.19	SC-SE-164	0.19	SC-SE-196	0.24	SC-SE-228	0.48
SC-SE-133	0.54	SC-SE-165	0.27	SC-SE-197	0.11	SC-SE-229	0.06
SC-SE-134	4.33	SC-SE-166	0.34	SC-SE-198	0.55	SC-SE-230	1.17
SC-SE-135	0.13	SC-SE-167	0.25	SC-SE-199	0.30	SC-SE-231	0.23
SC-SE-136	0.71	SC-SE-168	1.38	SC-SE-200	1.73	SC-SE-232	0.50
SC-SE-137	0.24	SC-SE-169	0.19	SC-SE-201	1.11	SC-SE-233	1.14
SC-SE-138	0.54	SC-SE-170	0.09	SC-SE-202	1.47	SC-SE-234	0.34
SC-SE-139	0.39	SC-SE-171	1.36	SC-SE-203	1.27	SC-SE-235	5.19
SC-SE-140	0.16	SC-SE-172	0.17	SC-SE-204	0.42	SC-SE-236	0.13
SC-SE-141	0.31	SC-SE-173	1.50	SC-SE-205	5.77	SC-SE-237	1.90
SC-SE-142	0.89	SC-SE-174	0.06	SC-SE-206	0.03	SC-SE-238	0.33
SC-SE-143	0.38	SC-SE-175	0.44	SC-SE-207	0.93	SC-SE-239	1.09
SC-SE-144	0.26	SC-SE-176	0.15	SC-SE-208	0.03	SC-SE-240	0.67
SC-SE-145	0.77	SC-SE-177	1.00	SC-SE-209	1.03	SC-SE-241	1.79
SC-SE-146	0.31	SC-SE-178	0.09	SC-SE-210	0.25	SC-SE-242	0.98
SC-SE-147	1.28	SC-SE-179	0.21	SC-SE-211	0.41	SC-SE-243	0.13
SC-SE-148	0.21	SC-SE-180	0.04	SC-SE-212	0.04	SC-SE-244	0.89
SC-SE-149	0.28	SC-SE-181	1.27	SC-SE-213	0.39	SC-SE-245	0.41
SC-SE-150	0.27	SC-SE-182	0.07	SC-SE-214	0.13	SC-SE-246	0.17
SC-SE-151	0.20	SC-SE-183	0.43	SC-SE-215	0.92	SC-SE-247	0.40
SC-SE-152	0.13	SC-SE-184	0.15	SC-SE-216	0.12	SC-SE-248	0.76
SC-SE-153	0.52	SC-SE-185	1.71	SC-SE-217	0.30	SC-SE-249	0.15

Habitat Number	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*
SC-SE-250	0.10	SC-SE-282	0.05	SC-SE-BE-4	0.09	SC-SE-HD-3	0.83
SC-SE-251	0.56	SC-SE-283	0.71	SC-SE-BE-5	0.84	SC-SE-HD-4	0.16
SC-SE-252	1.30	SC-SE-284	0.46	SC-SE-BE-6	0.18	SC-SE-HD-5	0.55
SC-SE-253	0.05	SC-SE-285	0.04	SC-SE-BE-7	0.41	SC-SE-HD-6	10.38
SC-SE-254	0.40	SC-SE-286	0.60	SC-SE-BE-8	0.03	SC-SE-HD-7	3.44
SC-SE-255	1.28	SC-SE-287	0.13	SC-SE-BE-9	0.24	SC-SE-HD-RV-1	0.68
SC-SE-256	0.24	SC-SE-288	1.03	SC-SE-BE-10	0.92	SC-SE-HD-RV-2	0.06
SC-SE-257	0.01	SC-SE-289	1.68	SC-SE-BO-1	2.88	SC-SE-HD-RV-3	1.25
SC-SE-258	0.66	SC-SE-290	2.06	SC-SE-BO-2	8.06	SC-SE-HD-RV-4	0.58
SC-SE-259	0.38	SC-SE-291	0.36	SC-SE-BO2-1	2.07	SC-SE-HD-RV-5	1.30
SC-SE-260	1.71	SC-SE-292	0.08	SC-SE-BO2-2	0.21	SC-SE-HD-RV-6	6.71
SC-SE-261	1.80	SC-SE-293	0.94	SC-SE-BO2-3	0.02	SC-SE-HD-RV-7	1.03
SC-SE-262	0.39	SC-SE-294	0.21	SC-SE-BR-1	11.11	SC-SE-HD-RV-8	0.93
SC-SE-263	0.14	SC-SE-295	0.35	SC-SE-BR-2	14.73	SC-SE-HD-RV-9	0.02
SC-SE-264	0.06	SC-SE-296	0.29	SC-SE-BR-SC-1	2.80	SC-SE-HD-RV-10	0.30
SC-SE-265	0.28	SC-SE-297	1.59	SC-SE-CG-1	2.73	SC-SE-HD-RV-WF-1	3.46
SC-SE-266	2.23	SC-SE-298	0.10	SC-SE-CG-2	0.07	SC-SE-HS-1	0.13
SC-SE-267	0.10	SC-SE-299	0.68	SC-SE-CR-1	3.81	SC-SE-HS-2	0.04
SC-SE-268	3.41	SC-SE-300	0.16	SC-SE-CY-1	2.53	SC-SE-HS-3	0.03
SC-SE-269	0.88	SC-SE-301	1.07	SC-SE-CY-2	0.12	SC-SE-HS-4	4.50
SC-SE-270	17.65	SC-SE-302	0.78	SC-SE-CY-3	0.19	SC-SE-HS-5	0.02
SC-SE-271	0.27	SC-SE-303	4.85	SC-SE-CY-4	5.92	SC-SE-HS-6	3.55
SC-SE-272	0.11	SC-SE-304	14.11	SC-SE-CY-5	0.41	SC-SE-HS-7	0.06
SC-SE-273	4.14	SC-SE-305	30.98	SC-SE-CY-6	3.31	SC-SE-HS-8	2.02
SC-SE-274	0.97	SC-SE-AE-1	7.71	SC-SE-DE-1	0.10	SC-SE-HS-JN-1	0.10
SC-SE-275	0.04	SC-SE-AI-1	6.54	SC-SE-DE-2	10.37	SC-SE-HS-JN-2	16.98
SC-SE-276	0.69	SC-SE-AI-2	3.85	SC-SE-DE-3	0.15	SC-SE-LB-1	1.38
SC-SE-277	0.04	SC-SE-AI-3	8.68	SC-SE-GN-1	2.77	SC-SE-LB-2	0.28
SC-SE-278	0.65	SC-SE-AI-4	0.74	SC-SE-GN-2	0.32	SC-SE-LB-3	0.06
SC-SE-279	1.14	SC-SE-BE-1	1.02	SC-SE-GN-3	0.05	SC-SE-LB-4	0.10
SC-SE-280	1.05	SC-SE-BE-2	0.09	SC-SE-HD-1	2.78	SC-SE-LB-5	0.25
SC-SE-281	0.56	SC-SE-BE-3	0.18	SC-SE-HD-2	0.13	SC-SE-LN-1	0.15

Habitat Number	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*	*Habitat Number*	*Score*
SC-SE-LN-2	1.15	SC-SE-MN-3	0.02	SC-SE-PJ-4	5.54	SC-SE-TR-10	0.64
SC-SE-LN-3	0.15	SC-SE-MN-4	0.56	SC-SE-PK-1	0.38	SC-SE-TR-11	0.12
SC-SE-LN-4	0.94	SC-SE-MN-5	0.02	SC-SE-PK-2	0.98	SC-SE-TR-12	0.53
SC-SE-LN-5	0.29	SC-SE-MN-6	0.10	SC-SE-PK-3	0.28	SC-SE-TR-13	2.58
SC-SE-LN-6	1.94	SC-SE-MN-7	0.02	SC-SE-PK-4	0.39	SC-SE-TR-14	0.21
SC-SE-LN-7	0.07	SC-SE-PB-1	0.16	SC-SE-PK-5	4.50	SC-SE-TT	10.36
SC-SE-LN-8	0.98	SC-SE-PB-2	2.35	SC-SE-PK-6	1.94	SC-SE-WF-1	0.06
SC-SE-LN-9	0.20	SC-SE-PB-3	0.42	SC-SE-RK-1	2.88	SC-SE-WF-2	0.20
SC-SE-LN-10	0.71	SC-SE-PB-4	1.06	SC-SE-RK-2	0.16	SC-SE-WF-3	0.10
SC-SE-LN-11	0.37	SC-SE-PB-5	0.41	SC-SE-RK-3	0.02	SC-SE-WF-4	0.30
SC-SE-LN-12	0.44	SC-SE-PB-6	0.07	SC-SE-RK-4	1.36	SC-SE-WF-5	0.16
SC-SE-LN-13	0.17	SC-SE-PB-7	2.78	SC-SE-RK-5	0.12	SC-SE-WF-6	0.54
SC-SE-LN-14	1.63	SC-SE-PB-8	0.26	SC-SE-RK-6	5.71	SC-SE-WF-7	0.10
SC-SE-LN-15	0.12	SC-SE-PB-9	1.02	SC-SE-RK-7	2.59	SC-SE-WT-1	0.18
SC-SE-LN-16	2.38	SC-SE-PB-10	0.17	SC-SE-RK-8	0.13	SC-SE-WT-2	0.13
SC-SE-LN-17	0.20	SC-SE-PB-11	4.64	SC-SE-RK-EF-1	6.51		
SC-SE-LN-18	0.21	SC-SE-PB-12	0.88	SC-SE-TE-1	9.35		
SC-SE-LN-19	0.23	SC-SE-PB-13	3.50	SC-SE-TE-2	0.62		
SC-SE-LN-20	0.13	SC-SE-PB-14	0.10	SC-SE-TE-3	3.08		
SC-SE-LN-21	0.33	SC-SE-PB-15	1.55	SC-SE-TE-4	9.95		
SC-SE-LN-22	0.08	SC-SE-PB-16	0.07	SC-SE-TE-5	4.46		
SC-SE-LN-23	1.59	SC-SE-PB-17	10.18	SC-SE-TE-SG-1	2.85		
SC-SE-LN-24	0.09	SC-SE-PB-18	0.27	SC-SE-TR-1	0.81		
SC-SE-LN-25	1.85	SC-SE-PB-19	2.44	SC-SE-TR-2	0.02		
SC-SE-LN-26	3.67	SC-SE-PB-20	0.20	SC-SE-TR-3	0.14		
SC-SE-LN-EF-1	3.05	SC-SE-PB-21	4.44	SC-SE-TR-4	0.70		
SC-SE-LN-WF-1	2.16	SC-SE-PB-NF-1	5.06	SC-SE-TR-5	0.21		
SC-SE-LN-WF-2	0.50	SC-SE-PE-1	7.94	SC-SE-TR-6	0.62		
SC-SE-LN-WF-3	0.13	SC-SE-PJ-1	0.06	SC-SE-TR-7	0.04		
SC-SE-MN-1	2.73	SC-SE-PJ-2	7.73	SC-SE-TR-8	0.57		
SC-SE-MN-2	1.72	SC-SE-PJ-3	0.02	SC-SE-TR-9	0.55		

Table 4. Habitat scores for Piru Creek, in alphabetical order, by habitat unit. Habitat score = quality of habitat x quantity of habitat.

Habitat Number	***Score***		***Habitat Number***	***Score***
SC-PU-1	25.61		SC-PU-AB2	0.80
SC-PU-2	2.17		SC-PU-AB3	60.94
SC-PU-3	1.25		SC-PU-AB4	2.49
SC-PU-4	7.84		SC-PU-AB5	3.74
SC-PU-5	9.76		SC-PU-AB-NF-1	0.77
SC-PU-6	10.12		SC-PU-BD-1	3.80
SC-PU-7	90.42		SC-PU-BK-1	2.87
SC-PU-8	0.88		SC-PU-BK-2	21.35
SC-PU-9	6.82		SC-PU-BK-3	6.59
SC-PU-10	2.74		SC-PU-CR-1	8.45
SC-PU-11	11.52		SC-PU-CR-SF-1	9.41
SC-PU-12	27.10		SC-PU-FH-1	7.90
SC-PU-13	0.29		SC-PU-FH-2	30.28
SC-PU-14	0.18		SC-PU-FH-NF-1	6.02
SC-PU-15	0.58		SC-PU-LE-1	2.19
SC-PU-16	55.44		SC-PU-LE-2	12.05
SC-PU-17	0.13		SC-PU-MO-1	10.84
SC-PU-18	0.46		SC-PU-MU-1	42.02
SC-PU-19	0.35		SC-PU-MU-AO-1	15.79
SC-PU-20	0.17		SC-PU-MU-LM-1	23.32
SC-PU-21	0.13		SC-PU-RR-1	1.97
SC-PU-22	1.09		SC-PU-RR-2	2.66
SC-PU-23	27.61		SC-PU-RR-3	14.33
SC-PU-24	19.90		SC-PU-RR-DZ-1	10.18
SC-PU-25	58.22		SC-PU-SY-1	5.66
SC-PU-26	2.34		SC-PU-SY-2	2.60
SC-PU-AB1	18.09			

Appendix II

Barrier Scores

Table 1. Barriers in descending order of score. The barrier identifier indicates the location of the barrier. The main codes are: BR = barrier, SC= Santa Clara River, PU = Piru Creek, SE = Sespe Creek, SP = Santa Paula Creek, HR = Hopper Creek, PE = Pole Creek. For example the barrier identifier BR-SC-SP-SR-1 refers to the most downstream barrier on Sisar Creek, which is a tributary to Santa Paula Creek, which is a tributary to the Santa Clara River. Barriers with "No score" refer to barriers for which no habitat survey was conducted above the barrier. Barriers with "Upstream limit" label, indicates that the barrier was the natural upstream limit for that watercourse.

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-1	SANTA CLARA RIVER	Dam	Gray	1598.03
BR-SC-2	SANTA CLARA RIVER	Bridge	Green	697.06
BR-SC-PU-1	PIRU CREEK	Dam	Gray	668.12
BR-SC-PU-2	PIRU CREEK	Culvert	Gray	662.16
BR-SC-PU-3	PIRU CREEK	Dam	Gray	637.93
BR-SC-PU-4	PIRU CREEK	Dam	Red	636.68
BR-SE-1	SESPE CREEK	Dam	Green	588.79
BR-SC-PU-5	PIRU CREEK	Channelized	Gray	353.13
BR-SC-PU-6	PIRU CREEK	Road Crossing	Gray	347.36
BR-SC-PU-7	PIRU CREEK	Dam	Red	343.97
BR-SC-PU-8	PIRU CREEK	Road Crossing	Red	273.85
BR-SC-PU-9	PIRU CREEK	Road Crossing	Gray	208.28
BR-SC-SP-1	SANTA PAULA CREEK	Channelized	Green	94.79
BR-SC-SP-2	SANTA PAULA CREEK	Grade Control Structure	Red	94.58
BR-SC-SP-3	SANTA PAULA CREEK	Grade Control Structure	Red	94.40
BR-SC-SP-4	SANTA PAULA CREEK	Dam	Red	87.37
BR-SC-SP-5	SANTA PAULA CREEK	Grade Control Structure	Red	69.79
BR-SC-SP-SR-1	SISAR CREEK	Grade Control Structure	Gray	53.48
BR-SC-HR-1	HOPPER CREEK	Bridge	Gray	49.08
BR-SC-SP-SR-2	SISAR CREEK	Road Crossing	Gray	46.07
BR-SC-SP-SR-3	SISAR CREEK	Culvert	Gray	40.52
BR-SC-HR-2	HOPPER CREEK	Road Crossing	Gray	39.19
BR-SC-HR-3	HOPPER CREEK	Road Crossing	Gray	33.33
BR-SC-HR-4	HOPPER CREEK	Road Crossing	Gray	33.06
BR-SC-SE-HD-1	HOWARD CREEK	Road Crossing	Green	32.70
BR-SC-SE-BR-1	BOULDER CREEK	Road Crossing	Gray	25.31
BR-SC-SE-BR-2	BOULDER CREEK	Culvert	Red	24.22

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-SE-BR-3	BOULDER CREEK	Road Crossing	Gray	22.70
BR-SC-SE-BR-4	BOULDER CREEK	Culvert	Gray	22.65
BR-SC-SE-BR-5	BOULDER CREEK	Road Crossing	Gray	22.01
BR-SC-PE-1	POLE CREEK	Channelized	Red	20.88
BR-SC-SE-LN-1	LION CREEK	Dam	Green	18.96
BR-SC-SE-LN-2	LION CREEK	Dam	Green	18.69
BR-SC-SE-LN-3	LION CREEK	Dam	Green	17.94
BR-SC-PE-2	POLE CREEK	Road Crossing	Gray	17.27
BR-SC-HR-TS-1	TOMS CREEK	Road Crossing	Gray	14.59
BR-SC-SE-LN-4	LION CREEK	Dam	Red	14.02
BR-SC-PU-LE-1	LIME CREEK	Culvert	Gray	14.00
BR-SC-PU-LE-2	LIME CREEK	Culvert	Gray	12.50
BR-SC-PU-LE-3	LIME CREEK	Culvert	Gray	12.05
BR-SC-SE-HD-2	HOWARD CREEK	Culvert	Gray	10.84
BR-SC-PU-MO-1	MODELO CREEK	Culvert	Gray	10.84
BR-SC-SE-BO-1	BURRO CREEK	Culvert	Red	10.38
BR-SC-SE-HD-3	HOWARD CREEK	Road Crossing	Gray	8.76
BR-SC-SE-HD-4	HOWARD CREEK	Culvert	Gray	8.05
BR-SC-SE-HD-RV-1	ROSE VALLEY CREEK	Dam	Red	8.00
BR-SC-SE-HD-5	HOWARD CREEK	Dam	Gray	7.83
BR-SC-SP-SR-BR-1	BEAR CREEK	Road Crossing	Gray	7.81
BR-SC-SE-AE-1	ADOBE CREEK	Culvert	Gray	7.71
BR-SC-SE-HD-6	HOWARD CREEK	Dam	Gray	7.47
BR-SC-SE-HD-RV-2	ROSE VALLEY CREEK	Culvert	Red	7.34
BR-SC-SE-HD-7	HOWARD CREEK	Dam	Gray	7.17
BR-SC-SE-HD-8	HOWARD CREEK	Dam	Gray	6.70
BR-SC-SE-HD-RV-3	ROSE VALLEY CREEK	Dam	Red	6.36
BR-SC-SP-SR-BR-2	BEAR CREEK	Road Crossing	Gray	6.34
BR-SC-SE-HD-RV-4	ROSE VALLEY CREEK	Road Crossing	Gray	6.20
BR-SC-SP-SR-EF-1	E.F. SISAR CREEK	Bridge	Red	5.92
BR-SC-SE-HD-RV-5	ROSE VALLEY CREEK	Dam	Red	5.81
BR-SC-SE-CY-1	CHERRY CREEK	Other	Green	5.23
BR-SC-PE-3	POLE CREEK	Road Crossing	Gray	5.02
BR-SC-SE-AE-2	ADOBE CREEK	Road Crossing	Gray	4.97

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-PU-BD-1	BLANCHARD CREEK	Culvert	Gray	3.80
BR-SC-SE-2B0-1	#2 BURRO CREEK	Culvert	Red	2.31
BR-SC-SP-BT-1	BARLETT CREEK	Road Crossing	Gray	No score
BR-SC-SP-BT-2	BARLETT CREEK	Excessive Gradient	Red	No score
BR-SC-SP-EF-1	ECHO FALLS	Excessive Gradient	Red	No score
BR-SC-SP-LB-1	LA BROCHE CREEK	Waterfall	Red	No score
BR-SC-PU-FR-1	FRAZIER CREEK	Waterfall	Red	No score
BR-SC-HR-5	HOPPER CREEK	Waterfall	Red	Upstream Limit
BR-SC-PE-4	POLE CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-10	PIRU CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-AB-1	AGUA BLANCA CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-AB-NF-1	N.F. AGUA BLANCA CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-BD-2	BLANCHARD CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-BK-1	BUCK CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-CR-SF-1	S.F. CEDAR CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-DZ-1	DOMINGUEZ CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-FH-1	FISH CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-FH-WF-1	W.F. FISH CREEK	Natural	Red	Upstream Limit
BR-SC-PU-FH-SF-1	S.F. FISH CREEK	Natural	Red	Upstream Limit
BR-SC-PU-FH-NF-1	N.F. FISH CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-LE-4	LIME CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MO-2	MODELO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-1	MUTUA CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-AO-1	ALAMO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-LM-1	LITTLE MUTAU CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-RR-1	REASONER CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-SY-1	SNOWY CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-2BO-2	#2 BURRO CREEEK	Waterfall	Red	Upstream Limit
BR-SC-SE-AE-3	ADOBE CREEK	Excessive Gradient	Gray	Upstream Limit
BR-SC-SE-AI-1	ABADI CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-AR-1	ALDER CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-BE-1	BEAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-BO-2	BURRO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-BR-6	BOULDER CREEK	Waterfall	Red	Upstream Limit

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-SE-BR-SC-1	SAN CAYETANO CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CG-1	CHORRO GRANDE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CR-1	COLDWATER CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CY-1	CHERRY CREEK	Road Crossing	Red	Upstream Limit
BR-SC-SE-DE-1	DERYDALE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-GN-1	GODWIN CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-HD-9	HOWARD CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-HD-RV-6	ROSE VALLEY CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-HD-RV-WF-1	W.F. ROSE VALLEY CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-HS-1	HOT SPRINGS CREEK	Other	Red	Upstream Limit
BR-SC-SE-HS-JN-1	JOHNSTON CREEK	Natural	Red	Upstream limit
BR-SC-SE-LB-1	LADYBUG CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-LN-EF-1	E.F. LION CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-LN-WF-1	W.F. LION CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-MN-1	MUNSON CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PB-1	PIEDRAS BLANCAS CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-PB-NF-1	N.F. PIEDRAS BLANCAS CK.	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PE	PINE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-PJ-1	POTRERO JOHN CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PK-1	PARK CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-RR-1	RED REEF CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-SC-1	STONE CORRAL CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-TE-1	TULE CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-TE-SG-1	SPRING CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-TR-1	TAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-TR-1	TIMBER CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-TT-1	TROUT CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-WF	W.F. SESPE CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-WT-1	WILLETT CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SP-6	SANTA PAULA CREEK	Natural	Red	Upstream Limit
BR-SC-SP-SR-4	SISAR CREEK	Cascade	Red	Upstream Limit
BR-SC-SP-SR-BR-3	BEAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SP-SR-EF-2	E.F. SISAR CREEK	Bridge	Red	Upstream Limit
BR-SE-2	SESPE CREEK	Waterfall	Red	Upstream Limit

Table 2. Barriers by watershed, and order of priority.

The Santa Clara River Mainstem				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-1	SANTA CLARA RIVER	Dam	Gray	1598.03
BR-SC-2	SANTA CLARA RIVER	Bridge	Green	697.06

Santa Paula Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-SP-1	SANTA PAULA CREEK	Channelized	Green	94.79
BR-SC-SP-2	SANTA PAULA CREEK	Grade Control Structure	Red	94.58
BR-SC-SP-3	SANTA PAULA CREEK	Grade Control Structure	Red	94.40
BR-SC-SP-4	SANTA PAULA CREEK	Dam	Red	87.37
BR-SC-SP-5	SANTA PAULA CREEK	Grade Control Structure	Red	69.79
BR-SC-SP-SR-1	SISAR CREEK	Grade Control Structure	Gray	53.48
BR-SC-SP-SR-2	SISAR CREEK	Road Crossing	Gray	46.07
BR-SC-SP-SR-3	SISAR CREEK	Culvert	Gray	40.52
BR-SC-SP-SR-BR-1	BEAR CREEK	Road Crossing	Gray	7.81
BR-SC-SP-SR-BR-2	BEAR CREEK	Road Crossing	Gray	6.34
BR-SC-SP-SR-EF-1	E.F. SISAR CREEK	Bridge	Red	5.92
BR-SC-SP-6	SANTA PAULA CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SP-SR-4	SISAR CREEK	Cascade	Red	Upstream Limit
BR-SC-SP-SR-BR-3	BEAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SP-SR-EF-2	E.F. SISAR CREEK	Bridge	Red	No score
BR-SC-SP-BT-1	BARLETT CREEK	Road Crossing	Gray	No score
BR-SC-SP-BT-2	BARLETT CREEK	Excessive Gradient	Red	No score
BR-SC-SP-EF-1	ECHO FALLS	Excessive Gradient	Red	No score
BR-SC-SP-LB-1	LA BROCHE CREEK	Waterfall	Red	No score

Sespe Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SE-1	SESPE CREEK	Dam	Green	588.79
BR-SC-SE-HD-1	HOWARD CREEK	Road Crossing	Green	32.70
BR-SC-SE-BR-1	BOULDER CREEK	Road Crossing	Gray	25.31
BR-SC-SE-BR-2	BOULDER CREEK	Culvert	Red	24.22
BR-SC-SE-BR-3	BOULDER CREEK	Road Crossing	Gray	22.70
BR-SC-SE-BR-4	BOULDER CREEK	Culvert	Gray	22.65
BR-SC-SE-BR-5	BOULDER CREEK	Road Crossing	Gray	22.01
BR-SC-SE-LN-1	LION CREEK	Dam	Green	18.96
BR-SC-SE-LN-2	LION CREEK	Dam	Green	18.69
BR-SC-SE-LN-3	LION CREEK	Dam	Green	17.94
BR-SC-SE-LN-4	LION CREEK	Dam	Red	14.02
BR-SC-SE-HD-2	HOWARD CREEK	Culvert	Gray	10.84
BR-SC-SE-BO-1	BURRO CREEK	Culvert	Red	10.38
BR-SC-SE-HD-3	HOWARD CREEK	Road Crossing	Gray	8.76
BR-SC-SE-HD-4	HOWARD CREEK	Culvert	Gray	8.05
BR-SC-SE-HD-RV-1	ROSE VALLEY CREEK	Dam	Red	8.00
BR-SC-SE-HD-5	HOWARD CREEK	Dam	Gray	7.83
BR-SC-SE-AE-1	ADOBE CREEK	Culvert	Gray	7.71
BR-SC-SE-HD-6	HOWARD CREEK	Dam	Gray	7.47
BR-SC-SE-HD-RV-2	ROSE VALLEY CREEK	Culvert	Red	7.34
BR-SC-SE-HD-7	HOWARD CREEK	Dam	Gray	7.17
BR-SC-SE-HD-8	HOWARD CREEK	Dam	Gray	6.70
BR-SC-SE-HD-RV-3	ROSE VALLEY CREEK	Dam	Red	6.36
BR-SC-SE-HD-RV-4	ROSE VALLEY CREEK	Road Crossing	Gray	6.20
BR-SC-SE-HD-RV-5	ROSE VALLEY CREEK	Dam	Red	5.81
BR-SC-SE-CY-1	CHERRY CREEK	Other	Green	5.23
BR-SC-SE-AE-2	ADOBE CREEK	Road Crossing	Gray	4.97
BR-SC-SE-2B0-1	#2 BURRO CREEK	Culvert	Red	2.31
BR-SC-SE-2BO-2	#2 BURRO CREEEK	Waterfall	Red	Upstream Limit
BR-SC-SE-AE-3	ADOBE CREEK	Excessive Gradient	Gray	Upstream Limit
BR-SC-SE-AI-1	ABADI CREEK	Waterfall	Red	Upstream Limit

Sespe Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-SE-AR-1	ALDER CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-BE-1	BEAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-BO-2	BURRO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-BR-6	BOULDER CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-BR-SC-1	SAN CAYETANO CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CG-1	CHORRO GRANDE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CR-1	COLDWATER CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-CY-1	CHERRY CREEK	Road Crossing	Red	Upstream Limit
BR-SC-SE-DE-1	DERYDALE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-GN-1	GODWIN CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-HD-9	HOWARD CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-HD-RV-6	ROSE VALLEY CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-HD-RV-WF-1	W.F. ROSE VALLEY CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-HS-1	HOT SPRINGS CREEK	Other	Red	Upstream Limit
BR-SC-SE-HS-JN-1	JOHNSTON CREEK	Natural	Red	Upstream limit
BR-SC-SE-LB-1	LADYBUG CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-LN-EF-1	E.F. LION CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-LN-WF-1	W.F. LION CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-MN-1	MUNSON CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PB-1	PIEDRAS BLANCAS CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-PB-NF-1	N.F. PIEDRAS BLANCAS CK.	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PE	PINE CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-PJ-1	POTRERO JOHN CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-PK-1	PARK CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-RR-1	RED REEF CREEK	Cascade	Red	Upstream Limit
BR-SC-SE-SC-1	STONE CORRAL CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-TE-1	TULE CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-TE-SG-1	SPRING CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-SE-TT-1	TROUT CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-WF	W.F. SESPE CREEK	Bedrock Chute	Red	Upstream Limit
BR-SC-SE-WT-1	WILLETT CREEK	Bedrock Chute	Red	Upstream Limit
BR-SE-2	SESPE CREEK	Waterfall	Red	Upstream Limit

Sespe Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-SE-TR-1	TAR CREEK	Waterfall	Red	Upstream Limit
BR-SC-SE-TR-1	TIMBER CREEK	Cascade	Red	Upstream Limit

Pole Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-PE-1	POLE CREEK	Channelized	Red	20.88
BR-SC-PE-2	POLE CREEK	Road Crossing	Gray	17.27
BR-SC-PE-3	POLE CREEK	Road Crossing	Gray	5.02
BR-SC-PE-4	POLE CREEK	Waterfall	Red	Upstream Limit

Hopper Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-HR-1	HOPPER CREEK	Bridge	Gray	49.08
BR-SC-HR-2	HOPPER CREEK	Road Crossing	Gray	39.19
BR-SC-HR-3	HOPPER CREEK	Road Crossing	Gray	33.33
BR-SC-HR-4	HOPPER CREEK	Road Crossing	Gray	33.06
BR-SC-HR-TS-1	TOMS CREEK	Road Crossing	Gray	14.59
BR-SC-HR-5	HOPPER CREEK	Waterfall	Red	Upstream Limit

Piru Creek				
Barrier Identifier	***Stream Name***	***Barrier Type***	***Barrier Severity***	***Barrier Score***
BR-SC-PU-1	PIRU CREEK	Dam	Gray	668.12
BR-SC-PU-2	PIRU CREEK	Culvert	Gray	662.16
BR-SC-PU-3	PIRU CREEK	Dam	Gray	637.93
BR-SC-PU-4	PIRU CREEK	Dam	Red	636.68
BR-SC-PU-5	PIRU CREEK	Channelized	Gray	353.13
BR-SC-PU-6	PIRU CREEK	Road Crossing	Gray	347.36
BR-SC-PU-7	PIRU CREEK	Dam	Red	343.97
BR-SC-PU-8	PIRU CREEK	Road Crossing	Red	273.85
BR-SC-PU-9	PIRU CREEK	Road Crossing	Gray	208.28
BR-SC-PU-LE-1	LIME CREEK	Culvert	Gray	14.00
BR-SC-PU-LE-2	LIME CREEK	Culvert	Gray	12.50

Piru Creek

Barrier Identifier	*Stream Name*	*Barrier Type*	*Barrier Severity*	*Barrier Score*
BR-SC-PU-LE-3	LIME CREEK	Culvert	Gray	12.05
BR-SC-PU-MO-1	MODELO CREEK	Culvert	Gray	10.84
BR-SC-PU-BD-1	BLANCHARD CREEK	Culvert	Gray	3.80
BR-SC-PU-FH-WF-1	W.F. FISH CREEK	Natural	Red	Upstream Limit
BR-SC-PU-FH-SF-1	S.F. FISH CREEK	Natural	Red	Upstream Limit
BR-SC-PU-10	PIRU CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-AB-1	AGUA BLANCA CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-AB-NF-1	N.F. AGUA BLANCA CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-BD-2	BLANCHARD CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-BK-1	BUCK CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-CR-SF-1	S.F. CEDAR CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-DZ-1	DOMINGUEZ CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-FH-1	FISH CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-FH-NF-1	N.F. FISH CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-LE-4	LIME CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MO-2	MODELO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-1	MUTUA CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-AO-1	ALAMO CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-MU-LM-1	LITTLE MUTAU CREEK	Excessive Gradient	Red	Upstream Limit
BR-SC-PU-RR-1	REASONER CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-SY-1	SNOWY CREEK	Waterfall	Red	Upstream Limit
BR-SC-PU-FR-1	FRAZIER CREEK	Waterfall	Red	Upstream Limit

Appendix III

Excerpt from Titus *et al.* 2000

The following is an excerpt from Robert Titus and Don Erman's report on the history and status of steelhead in California (Titus, R. G., D. C. Erman, and W. M. Snider. History and status of steelhead in California coastal drainages south of San Francisco Bay. *In preparation*.).

Santa Clara River Drainage, Including Portions in Los Angeles County

The Santa Clara River system once supported a popular winter steelhead sport fishery based on its apparently "large and consistent runs" (Hubbs 1946; see also Kreider 1948). The average annual run in the Santa Clara may have been on the order of about 9,000 adult steelhead (Moore 1980a). Steelhead migrated upstream through the lower Santa Clara River to reach spawning grounds in Santa Paula, Sespe, and Piru creeks, and perhaps in other tributaries and reaches of the upper Santa Clara itself (see below). However, the steelhead stock has declined precipitously since the mid-1950's, primarily due to an increase in surface water diversion in the lower Santa Clara by the United Water Conservation District. The unscreened diversion near Saticoy has historically blocked upstream migration of adult steelhead, entrained emigrating smolts into percolation basins, or eliminated fish movements to and from the ocean altogether by dewatering the river channel during critical migration periods. The current diversion structure, the Vern Freeman Diversion Dam, was equipped with a fish ladder and intake screens in 1989 to enhance fish passage, and the effectiveness of these features are being evaluated (ENTRIX reports). The steelhead decline has also been attributed, in part, to altered flow patterns and blocked access to historic spawning grounds by upstream dams (see below). Nehlsen et al. (1991) listed the Santa Clara River steelhead stock as having a high risk of extinction.

The following is a chronological rundown of information from CDFG files regarding the presence or stocking of steelhead and rainbow trout in the main stem Santa Clara River. Early CDFG records showed that 5,000 juvenile steelhead were stocked in 1938 in the "River of Doubt" area, and 21,600 were planted in the lagoon in 1944, the latter being steelhead which were rescued from the Santa Ynez River. In a CDFG survey in the River of Doubt area in 1949, no rainbow trout were found despite stocking of hatchery rainbows in 1939 and during 1942–48. The main stem river was apparently not surveyed again for O. mykiss for many years. Bell (1978) found no O. mykiss by seining in the main stem Santa Clara from its mouth, although hatchery escapees of rainbow trout which live in the tailwater of the Fillmore Fish Hatchery were observed. Areta and Willsrud (1980) also captured no O. mykiss by seining the main stem

during 8–24 May 1980. In both of these surveys, most of the fishes captured reflected an assemblage of warmwater and euryhaline species.

In a two-year CDFG study of steelhead in the lower Santa Clara River system, Puckett and Villa (1985) reported the steelhead captures presented in Table 3. In addition, 25 other O. mykiss were captured during the study ranging in fork length from 20.3 to 45.7 cm, and in age from 1 to 3 years old. Some of these fish may have been pre-smolted steelhead, and others resident rainbow trout. No emigrating smolts were captured in a fyke net set in the Vern Freeman Diversion canal at Saticoy during both years. Eleven other species of fish were captured during the study, including both emigrating juvenile and spent adult Pacific lampreys (Lampetra tridentata). Most adult lampreys were captured at the Sespe Creek weir although a few were also caught at Saticoy. Puckett and Villa (1985) concluded that the lower Santa Clara River served primarily as a migration corridor for both adult and juvenile steelhead, and was less important as a spawning and rearing area, with the exception of the estuary as potential rearing habitat. Fish movements, both upstream and downstream, were coincident with flow pulses following major storm events.

Piru Creek and Tributaries, including Portions of the Creek System in Los Angeles County

Piru Creek was historically a major steelhead spawning tributary in the Santa Clara River system. Steelhead reportedly ascended Piru Creek occasionally as far as Buck and Snowy creeks (W. A. Evans, CDFG, unpubl. field notes from 1946). However, since 1955, Santa Felicia Dam at Lake Piru has blocked steelhead access to Piru Creek beyond the lowermost 9.7 km of the stream. The dam at Pyramid Reservoir blocks fish migration further upstream as well.

Upstream portions of the stream are currently managed for both catchable and wild rainbow trout fisheries (e.g. Deinstadt et al. 1990). Hatchery rainbow trout stocking records date back to 1931. A mid-1930's CDFG survey mentioned the presence of both rainbow trout and juvenile steelhead. Some 5,000 juvenile steelhead were stocked in 1938, and an anecdote indicated the presence of steelhead spawners in 1944–45 as far upstream as the Gold Hill area.

No trout were seen in the stream below Frenchman's Flat in a 1946 survey, nor in a 1949 survey. Low summer flow and correspondingly high water temperature, and siltation were cited as problems in the suitability of this section of Piru Creek as salmonid habitat. The exception was some large, deep pools which held trout, such as in 1951 when several 31–36 cm rainbows

were observed. Bell (1978) found no O. mykiss in Piru Creek below Lake Piru during a seining survey. However, this portion of the stream may have some potential as a steelhead spawning and rearing area since a flow of 5 cfs is guaranteed below Santa Felicia Dam.

Agua Blanca Creek flows into Piru Creek upstream from Lake Piru. A mid-1930's CDFG survey indicated the presence of resident rainbow trout and juvenile steelhead, although the stream was not considered a valuable resource because of low late-summer flows which reduced available salmonid habitat. The stream had been stocked with 20,000 steelhead in each of 1930 and 1931. There was no mention of steelhead in a 1949 survey, and few rainbow trout were seen despite stocking in 1939, 1942, 1944, and 1946.

Buck Creek enters Piru Creek above Pyramid Reservoir. Steelhead apparently entered this stream on occasion (W. A. Evans, CDFG, unpubl. field notes from 1946). It is a small, intermittent tributary stream which has been stocked with hatchery rainbow trout at least as early as 1942.

Lockwood Creek is a headwater tributary to Piru Creek upstream from Pyramid Reservoir with a record of presumably wild rainbow trout being present in 1946. These fish could have also been juvenile steelhead although there is no mention of an historical steelhead run. Seymour Creek is a tributary to Lockwood Creek for which stocking records of rainbow trout date back to 1943–44. Catchable size trout were observed in the stream in 1946 but no young-of-the-year.

Snowy Creek is a tributary to Piru Creek above Pyramid Reservoir which was apparently used by steelhead on occasion (W. A. Evans, CDFG, unpubl. field notes from 1946). Rainbow trout stocking records for this stream date back to 1942.

Santa Paula Creek and Tributaries

Santa Paula Creek is known historically as a major spawning tributary for Santa Clara River steelhead, but there is no formal record on stock size. It is the first major tributary above the Vern Freeman Diversion available to steelhead spawners returning from the Pacific Ocean. About 6.4 km upstream from the confluence with the Santa Clara River, the Santa Paula Diversion greatly reduces or eliminates stream flow below the dam during much of the year. During periods of high runoff, steelhead may gain access to the base of the dam but lack of an

operable fishway blocks access to several (≥ 8) kilometers of suitable steelhead spawning habitat upstream from the diversion.

Juvenile steelhead and rainbow trout were noted as being present in the stream in a mid-1930's CDFG survey. Since the 1940's, Santa Paula Creek above the diversion has been managed intensively as a catchable rainbow trout fishery, the activities of which included a stocking and creel census experiment in 1947 (W. A. Evans, CDFG, unpubl. file report). The presence of naturally propagated O. mykiss juveniles was noted during the experiment, and it was indicated that these fish were probably the progeny of both resident rainbow trout and steelhead. The steelhead population was supplemented with 5,000 juveniles in each of 1930 and 1931, 15,000 in 1938, and 3,500 in 1943. Stocking records for rainbow trout date back to 1930.

In March 1987, the USFWS conducted an electrofishing survey in Santa Paula Creek below the diversion site which produced two adult steelhead (37.5 and 38.0 cm FL) and two adult resident rainbow trout (30.0 and 31.0 cm FL). These fish were captured in the pool at the base of the diversion dam, which is where an angler had also caught two adult steelhead. In addition, one 16.0 cm FL steelhead smolt was captured. The pool below the dam was also electrofished in March 1988 and one, possibly two, adult steelhead was seen but not captured. These surveys (B. Harper, USFWS, unpubl. file report) demonstrated that adult steelhead still occurred in Santa Paula Creek but only in low numbers. Decimation of the population to this level was primarily due to operational changes in the Vern Freeman Diversion, the inoperable fishway at the Santa Paula Diversion, and drought. However, with the construction of fish passage facilities at the Vern Freeman Diversion in 1989, the lower Santa Clara River should be functional as a migration corridor for steelhead during periods of sufficient flow, and restoration of the fishway at the Santa Paula Diversion would allow steelhead to take advantage of the spawning and rearing habitat in upper Santa Paula Creek. The CDFG electrofished a 100 m reach immediately below the Santa Paula Diversion Dam during 21–23 January 1992, but no steelhead or rainbow trout were captured or observed (D. McEwan, CDFG, unpubl. memo. of 26 March 1992).

Sisar Canyon Creek is a headwater tributary to Santa Paula Creek. There was no mention of steelhead using the stream historically via Santa Paula Creek although 5,000 steelhead (@ 847/kg) were planted in the stream in 1938. Rainbow trout stocking records date back to 1939,

1943–47, and suitable spawning habitat and young-of-the-year O. mykiss were noted in a 1947 CDFG survey.

Sespe Creek and Tributaries

Sespe Creek is the only major steelhead spawning tributary in the Santa Clara River system which remains unregulated. Access to the Sespe by steelhead spawners returning from the Pacific Ocean has been impeded by the Vern Freeman Diversion in the lower Santa Clara River (see main heading for Santa Clara River Drainage). There is no formal record of the steelhead population size at Sespe Creek.

Much of the stream has been managed for a catchable rainbow trout fishery. Rainbow trout stocking records date back to 1930–31, 1939, and 1942–48. A 40 km section of Sespe Creek was added to the California Wild Trout Program in 1986, a measure which protects the stream's free-flowing status.

The steelhead population was supplemented with 40,000 juveniles in 1930, 38,000 in 1931, and 20,000 in 1938. In 1944, 35,000 juvenile steelhead rescued from the Santa Ynez River were planted in upper Sespe Creek.

Juvenile steelhead and rainbow trout were present during a mid-1930's CDFG survey. Juvenile steelhead were seen in the stream in 1937 although young-of-the-year were reportedly rare. Steelhead were mentioned as being present in 1947. Juvenile rainbow trout or steelhead (10–15 cm), but no young-of-the-year, were present in a 1949 CDFG survey. Steelhead reportedly occurred in the upper Sespe during the winter of 1953–54.

Bell (1978) reported the presence of O. mykiss in the middle and upper Sespe during a seining survey. Puckett and Villa (1985) reported small numbers of both juvenile and adult steelhead captured during 1982–84, and a fair abundance of juvenile and adult Pacific lampreys (see synopsis under the main heading for Santa Clara River Drainage). CDFG fish surveys, conducted during 1983–86 in preparation of the Sespe Creek Wild Trout Management Plan, also demonstrated the presence of wild rainbow trout (possibly including juvenile steelhead as well) and juvenile Pacific lamprey (Sasaki 1986; S. Sasaki, CDFG, unpubl. file report). In both of these cases, the presence of lampreys confirmed that anadromous fishes had access to Sespe Creek via the lower Santa Clara River. No adult or juvenile steelhead were observed or captured during a walk-through survey in April 1988 from Alder Creek to the West Fork Sespe Creek,

although several year classes of rainbow trout occurred in abundance including several fish ≥ 35 cm in length. Suitable steelhead spawning and rearing habitat was noted as being abundant, and no barriers to adult migration were seen (M. Moore, Calif. Dept. Trans., unpubl. file report). About 80 km of Sespe Creek remains available to steelhead for spawning and rearing.

Abadi Creek is a headwater tributary to Sespe Creek for which there are stocking records for rainbow trout dating back to 1942 and 1946, but for which there is no record of an historical steelhead run.

In the Sespe tributary, Bear Canyon Creek, juvenile steelhead and rainbow trout were present during a mid-1930's CDFG survey of this seasonal stream. Some 5,000 Mt. Whitney steelhead (@ 847/kg) were stocked in the stream on 30 September 1938. Juvenile O. mykiss were observed in the stream in 1949.

Howard Creek is a seasonal tributary to Sespe Creek and in a mid-1930's CDFG survey, juvenile steelhead and resident rainbow trout were present. Steelhead use of the stream was mentioned in field notes from 1949, and what were listed as 10–15 cm rainbow trout were seen in the same year. Rainbow trout (15–25 cm) were seen in 1951. Howard Creek has been managed primarily as a catchable rainbow trout stream. Stocking records date back to 1940, 1948, 1953, and 1956 for rainbow trout.

Rose Valley Creek is a seasonal tributary to Howard Creek. Although there is no explicit mention of it in CDFG files, steelhead probably used this stream as they did Howard Creek. Stocking records for rainbow trout date back to 1948. Dams have blocked steelhead access to the upper portion of the stream since 1955.

Lion Canyon Creek is a tributary to Sespe Creek. In mid-1930's CDFG stream survey, juvenile steelhead and resident rainbow trout were listed as present. After this time, the stream was managed primarily for a catchable trout fishery with rainbow trout stocking records dating back to 1948. Juvenile O. mykiss were seen in the stream in 1949. Stream flow accelerators were constructed in 1956 to increase pool habitat.

Lords Creek is a tributary to Sespe Creek. Stocking records for fingerling rainbow trout date back to 1945 and 1947, but there was no mention in the CDFG file of steelhead in this stream.

Piedra Blanca Creek is a tributary stream located in the upper Sespe drainage. Stream flow in the Piedra Blanca is intermittent after late spring. Some 5,000 steelhead (@ 847/kg)

were stocked into the stream in 1938, but there was no mention in the CDFG file about an historical steelhead run. Rainbow trout stocking records date back to 1942 and 1945, and presumably wild rainbows were observed in the stream in 1949 and 1963.

Pine Canyon Creek is a tributary to Sespe Creek which has been stocked with rainbow trout since at least 1946. No record was discovered of steelhead use of this stream.

Tule Creek is a headwater tributary to Sespe Creek. In a mid-1930's CDFG survey, juvenile steelhead and resident rainbow trout were listed as present. Spawning habitat was noted as being common but the stream was not considered to be of much value because of its seasonal flow. No formal record of steelhead use in this stream was discovered, although it was likely when flow conditions were suitable. Rainbow trout stocking records date back to 1942.

Minor Mainstem Santa Clara River Tributaries

Lost Creek is a Santa Clara River tributary for which there is mention of steelhead. W. A. Evans (CDFG, unpubl. field notes) wrote on 30 April 1947, "Steelhead enter this stream." Bell (1978) found no O. mykiss in Todd Barranca, a tributary to the main stem below Santa Paula Creek, during a seining survey.

The following are other minor tributaries to the main stem Santa Clara River that have been stocked with hatchery rainbow trout, but whose CDFG files lack any mention or record of an historical steelhead run: Hopper Canyon Creek, for which there are rainbow trout stocking records dating back to 1942, 1944, and 1946, and its tributary, Tom Creek, which was planted with fingerling rainbow trout in 1946 and contained 10–15 cm trout in 1947; Pole Creek with stocking records dating back to 1940 and 1941, and as recently as 1984 (both Hopper Canyon and Pole Creek are southward flowing streams which enter the Santa Clara between Sespe and Piru creeks); and Willard Creek where 10 cm rainbow trout were seen in 1949 but no natural propagation was thought to have occurred.

Santa Clara River Headwater Tributaries in Los Angeles County

CDFG records show that hatchery rainbow trout were stocked and present in the upper sections of Bouquet Canyon Creek during the 1940's and 1950's, but there was no mention of an historical steelhead run. The dam creating Bouquet Reservoir would now block steelhead access to the most upstream portion of this stream.

Bell (1978) found no O. mykiss in Castaic Creek below Castaic Lake during a seining survey.

No O. mykiss were seen in Elizabeth Lake Canyon Creek in a 1948 CDFG survey, and there was no mention of an historical steelhead run. Steelhead access to the upper portion of this stream would now be blocked by the dam at Castaic Lake.

Fish Canyon Creek is a tributary to Castaic Creek, above Castaic Lake. This is a highly intermittent stream for which there are hatchery rainbow trout stocking records dating back to 1945 and 1948. There is no mention of an historical steelhead run in the CDFG file. Steelhead access to this stream would now be blocked by the dam at Castaic Lake.

San Francisquito Canyon and Soledad Canyon creeks are two streams for which there are CDFG records for rainbow trout presence and/or stocking dating back to c. 1930, but for which there is no mention of historical steelhead runs. Bell (1978) found no O. mykiss in these streams during a seining survey.

Appendix IV

1999 Department of Fish and Game memorandum

State of California

Memorandum

To: Files

Date : November 29, 1999

From : Department of Fish and Game - Steve Parmenter and Dennis McEwan

Subject : 1992 Stream Surveys of Several Ventura and Los Angeles County Streams

Introduction

During the last three weeks of June 1992, stream surveys were conducted on selected southern California streams by Department Scientific Aides Michael Embury, Gale Bustillos, and Karl Chang. The purpose of these surveys was to: 1) locate and examine existing steelhead/wild rainbow trout (*Oncorhynchus mykiss*)[1] populations, 2) locate and describe both natural and man-made barriers to upstream fish migration and, 3) describe spawning, rearing, and migration habitat. Streams surveyed were Hopper, Pole, and Santa Paula creeks (all tributaries to Santa Clara river), and Matilija, North Fork Matilija, and San Antonio creeks (all tributaries to the Ventura river). Portions of the Ventura River and Malibu and Gaviota creeks were also surveyed. Surveying methods included electrofishing, snorkeling, and visual observations. Photographs were taken of all migratory impediments, selected habitat characteristics, and captured fish. Approximate locations of photographs were marked on topographic maps (note: as of 11/29/99, the topo maps have not been located, hence are not attached to this report).

Hopper Creek

Hopper Creek was surveyed on June 7 and 8, 1992 by Michael Embury and Gale Bustillos. The survey began at the confluence of the Santa Clara River. Surface flow within the Hopper Creek channel was present to approximately 200 meters above the main channel of the Santa Clara River. From this point, both Hopper Creek and the Santa Clara River have subsurface flows. Water temperature at the lowest reaches of Hopper Creek was 30.5° C at 1300 hrs.

Surveying was continued by walking the creek bed making visual observations. Hopper Creek is confined by levees from approximately 1 km above confluence to approximately 600 m upstream of Highway 126 bridge. Substrate is natural gravel/cobble.

[1] In this report, the term "rainbow trout" refers to the biological species *O. mykiss* and includes all life-history forms (steelhead and resident).

Riparian vegetation within this area is rare but present. Abundant filamentous algae (*Cladofera*) is present throughout creek. Water temperature at Highway 126 crossing was 28.5° C. First fish observed were located approximately 1 km upstream of Highway 126 bridge. Fish were captured using electrofisher and identified as arroyo chub *(Gila orcutti)*. Riparian vegetation became increasingly abundant along with chub as we continued upstream. Access above locked gate on Hopper Canyon Road was granted by Commander Oil Inc. Habitat became increasingly better as we continued upstream through the series of Hopper Canyon Road crossings. The stream became narrower, water velocity increased, and there was better shading from riparian vegetation resulting in lower water temperatures(19° C. at 1500 hrs). The first rainbow trout (RT) was observed approximately 2.5 to 3 km upstream of the road end (marked on topo map as #7). Additional adult rainbow trout were observed (1-4 per pool) as the survey continued upstream. All fish were in the 180 mm to 280 mm size range and appeared to be in very good condition. The first natural barrier was located approximately 1.5 km from first RT siting. This barrier (photo 1; #16 on topo map) is a 10 to 15 meter waterfall with a large, deep pool at its base. This pool was snorkel-surveyed and an estimated population of 20-30 RT was observed. Length of fish varied from 120 mm to 250 mm, all in very good condition, and most with visible parr marks. No young of the year (YOY) fish were observed in this pool. Water above this barrier was not surveyed due to poor access and time constraints. One YOY was observed 200 meters downstream of pool on the walk out. Fair to good spawning areas are located throughout the upper portions of Hopper Creek.

Other species observed in Hopper creek were western pond turtles, numerous water snakes, fresh scat and prints of black bear, deer, and raccoon.

Toms Canyon was spot checked to approximately 1.5 km above confluence of Hopper Creek. Very low, turbid flows existed and no fish were observed. We were told by the foreman of oil wells that water in Toms canyon has gone dry during the last five summers.

Pole Creek

Pole Creek was surveyed on June 18, 1992 by Michael Embury and Gale Bustillos. Visual observation began at the confluence with the Santa Clara River located near the Highway 23 bridge. Water temperature at confluence was 17 ° C at 0900 hrs. A few, widely scattered arroyo chub were observed in the lowest reaches of the creek. Water south of the city of Fillmore is clear and contains moderate *Cladofera* growth. Water temperature at Highway 126 crossing was 17 °C. at 1100 hrs. Pole Creek flows through a concrete channel for approximately 1 km from Highway 126 northward (photo 2?). A potential artificial barrier was located 300 meters above upstream end of concrete channel. It consisted of heavy wooden dam approximately 1.1 meter high used to impound water to power a makeshift waterwheel pump (photo 3). Approximately 80 meters upstream of dam is a chain link fence that was strung across the creek. This fence is not securely fastened to the stream bed (photo 4). A 1.1 meter water fall with shallow pool at base was located 3 km upstream of Fillmore city limits (photo 5?; marked on topo map). This waterfall would most likely be passable during higher stream flows. The first natural, impassable barrier

was located approximately 6.5 km upstream of Fillmore city limits. This barrier (photo 6, and marked on topo map) is a 10 meter waterfall. No RT or other fish were observed in Pole Creek, other than the first chub observed in the vicinity of the Santa Clara River.

Trout habitat above the concrete channel is generally good. Thick riparian vegetation exists, along with abundant spawning gravel throughout Pole Creek.

Other species observed were widespread, abundant tadpoles, water snakes, and western pond turtles.

Santa Paula Creek

Santa Paula Creek was surveyed on June 19, 22, and 23, 1992 by Michael Embury and Gale Bustillos. Survey began with visual observations at confluence of Santa Clara River. Both Santa Paula Creek and Santa Clara River have significant surface flows. Water temperature in this area was 18° C at 0930 hrs. Water is very turbid throughout lower reaches. Observed large schools of arroyo chub, and abundant tadpoles in this area. Approximately 0.5 km from the Santa Clara River, Santa Paula Creek enters a concrete channel which runs approximately 1 km through the east end of the city of Santa Paula. Water temperature at railroad crossing was 24 °C at 1245 hrs. Continuing upstream, large pools were snorkel-surveyed and abundant arroyo chub and threespine stickleback (*Gasterosteus aculeatus*) were observed. Santa Paula Creek was electrofished from approximately 1 km downstream of Bridge Road crossing (#29 & 30 on topo map) to the Santa Paula Water Works (SPWW) diversion structure. This 6 meter high dam represents the first artificial fish barrier (photo 7). Chub, stickleback, fathead minnow (*Pimephales promelas*), sucker (*Catostomus* sp.), redear sunfish (*Lepomis microlophus*), and approximately 12 RT that appeared to be of hatchery origin were found within this section. Habitat throughout this area was poor with high turbidity, high temperatures (26° C at 1330hrs), little to no riparian vegetation, and poor spawning areas. Habitat improves above SPWW dam. Other artificial impediments exists below the Highway 150 bridge, just downstream of the Sisar and Santa Paula creeks confluence (photo 8). Visual observations continued up Santa Paula Canyon revealing good trout habitat, ie. clear water, lower water temperatures, and abundant spawning areas. Only three wild RT, two adults, and one YOY, were observed below a series of large, 4-10 meter high water falls in the Big Cone Camp area located approximately 6 km upstream from Ferndale Ranch (photos 9 and 11).

Sisar Creek was also spot checked during this time. No RT were observed from confluence with Santa Paula Creek to approximately 2.5 km upstream. One potential artificial barrier was located at a road crossing 2 km upstream of confluence. This consists of a 1.5 meter cascade/waterfall directly adjacent upstream of a 18" culvert. The proximate end of this culvert allows for no resting pool at the bottom of the falls. Sisar Creek has generally good trout habitat including adequate spawning areas.

Matilija Creek and North Fork Matilija Creek

Both forks of Matilija Creek were surveyed on June 24, 1992 by Michael Embury. Matilija Creek, from the confluence with the North Fork to the base of Matilija Dam, was surveyed by visual observations and snorkeling. A very large pool, 800 meters downstream from the dam (adjacent to a gaging station), was snorkeled and largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), crayfish, and large tadpoles were observed. Temperature in this pool was 25° C at 1100 hrs. Largemouth bass were also observed below the pool and in areas up to the base of the dam. No RT were observed. There are few to no spawning areas within this portion of the creek.

North Fork Matilija Creek was surveyed by visual observations from the confluence with Matilija Creek to approximately 5 km upstream. A series of 5, 1.5 to 2.5 meter-high cascades extending over 300 to 400 m exists 200 m upstream of the confluence. This area is probably passable to steelhead under all but the most extreme flow conditions. Habitat and spawning areas above the cascades look very good though no RT were observed.

Ventura River

Sections of the Ventura River were surveyed on June 25 and 26, 1992 by Michael Embury and Gale Bustillos. A 2.5 km section was electrofished from the Robles Diversion Dam to Sopers Ranch. Water temperature at the dam was 21° C at 0930 hrs. The first 0.5 km of river upstream of dam is wide, has various braided stream channels, and possesses little riparian vegetation. The river quickly becomes narrower, water velocity increases, and riparian vegetation becomes abundant. This is the approximate area where the first wild RT was located (photo 12?). This fish was approximately 100 mm and in excellent condition. Throughout the next 2 km, seven other wild RT, in the range of 70 to 150 mm were observed. A large pool, 0.5 km downstream from Sopers Ranch, was snorkel-surveyed. Fishes present were largemouth bass, redear sunfish, chub, 2 adult RT (250-350 mm), and 3 smaller RT (90-120 mm). This area of the Ventura River has very good spawning habitat and good rearing habitat.

At the time of these surveys, all water in the Ventura River was bypassing the diversion structure and continued as surface flow to approximately 0.5 km downstream of the Highway 150 bridge. From here, the water flows subsurface to the Oak View area where it returns to surface flow. The area between the dam and the Highway150 bridge was surveyed by snorkeling large pools and visually observing all other water. No RT were observed in this area. Habitat below the diversion dam is generally poor.

An artificial barrier is present at a road crossing 150 meters downstream of the diversion dam (photo 13). Here, the stream flows over a concrete road and drops down a 1.5-2 meter slide into a large pool. This barrier may be passable during periods of high flows.

The next area surveyed was in the Casitas Springs area. This area was recommended by Mark Capelli, of the California Coastal Commission, as a likely steelhead rearing area. Capelli was also present during surveying. Electrofishing began at the end of Edison Road (off of Ranch Road) and continued to 250 meters above the confluence of San Antonio Creek, totaling approximately 1.5 km. This portion of the river runs parallel to the Ojai bike trail and is very accessible. Habitat in this area is very good with thick riparian coverage and abundant spawning areas. High densities of stickleback and arroyo chub were found. No RT were observed. Water temperature was 19° C at 0930 hrs and 21° C at 1130 hrs.

San Antonio Creek

San Antonio Creek was surveyed by electrofishing on June 29, 1992 by Michael Embury and Karl Chang. Surveying began at the intersection of Signal Road and Creek Road in Ojai and continued by electrofishing seven 100 - 800 meter sections to the confluence with the Ventura River. Habitat throughout San Antonio Creek is very good and this stream possesses the most abundant steelhead spawning areas presently available in the Ventura River system. One RT was located approximately 1 km upstream of the confluence with the Ventura River. This fish was 250-300 mm in length and in good condition. The fish was dull in color, had an incomplete dorsal fin, and had the appearance of a hatchery RT. No other RT were observed in San Antonio Creek. Other species present were arroyo chub and threespine stickleback.

Malibu Creek

Malibu Creek was surveyed on June 30, 1992 by Michael Embury and Karl Chang. The creek was accessed by a fire road approximately 1.5 km downstream of Rindge Dam. The creek was surveyed by snorkeling all pools and deep runs and visually observing all other water from approximately 200 meters below the dam to the Malibu lagoon. The first pool snorkeled was approximately 200 meters below the dam. Seven adult RT, 300-350 mm in length and one juvenile RT 90-100 min were observed. All fish were in excellent condition. The next pool downstream contained 3 adult RT with the same size and condition as the previous fish. The third pool downstream contained 2 adult RT, 300-350 mm in length and one juvenile, 90-100 mm in length. The fourth pool downstream of the dam contained 3 adult RT, 250-350 mm in length. One adult RT was observed in a riffle, between pools two and three. Arroyo chub were also present in most of the pools. Water temperature in pool #2 was 22° C at the surface and 20° C on the bottom at a depth of 2.5-3.5 meters at 1330 hrs. No other RT were observed below pool #4. Habitat throughout Malibu Creek is generally good and adequate spawning areas exist. We elected not to survey the Malibu lagoon due to posted warnings of high bacteria levels.

Gaviota Creek

A short section of Gaviota Creek was surveyed by electrofishing and snorkeling by Michael Embury and Karl Chang on July 2, 1992. The 100 meter section surveyed is

located directly across northbound rest area on Highway 101, approximately 1 mile north of Gaviota State Park. One RT, 250-300 mm in length, was observed in a large pool. A series of road grade stabilization structures are present in the reach adjacent to Highway 101 between Gaviota State Park and the Highway 1 - 101 junction. These structures are approximately 1 to 2 m high and drop off a concrete apron, and probably impede or block passage at low flows. Another seasonal barrier is located downstream at the Gaviota State Park road crossing. Here the creek passes through two 50 cm culverts set in a concrete "fair weather" road crossing then falls 0.5-1 meter to a pool on the downstream side of the road[2] (photo 14).

Conclusions and Recommendations

Populations of wild steelhead/rainbow trout were observed in the headwaters of Hopper Creek, the headwaters of Santa Paula Creek, the Ventura River above the Robles Diversion Dam, Malibu Creek, and Gaviota Creek. Migratory steelhead trout face both artificial barriers and habitat constraints as obstacles to continued survival.

Recommendations are, first and foremost, habitat restoration, including elimination of artificial barriers or modification to allow fish passage. This is essential to all existing populations of steelhead trout and to make it possible for reintroduction programs in the future. Now that some populations have been identified and critical habitat located, a monitoring program should be implemented. Fish in the headwaters of Hopper Creek and the entire Malibu Creek should be censused on a yearly bases to determine if these fish are migratory. A defined section on the Ventura River and San Antonio Creek should be censused by electrofisher on a yearly bases since this is the most likely area for future steelhead spawning and rearing in the Ventura River system. Long-term population data can be compared with stream flow data for streams with altered or diverted flows. This may give insight to effects of altered stream flows on steelhead trout migration and reproduction.

[2] These culverts were replaced with a bridge in 1997, hence passage is no longer blocked or impeded at this site.

Photo #1 Hopper Creek

Photo Pole eek

Photo ole Creek

Photo #7
Santa Paula Creek

Photo #8
Santa Paula Creek

Photo #9
Santa Paula Creek

Photo #10 Santa aula Creek

Photo Santa Paul eek

Photo #1 Ventur

Photo # 13 Ventura River

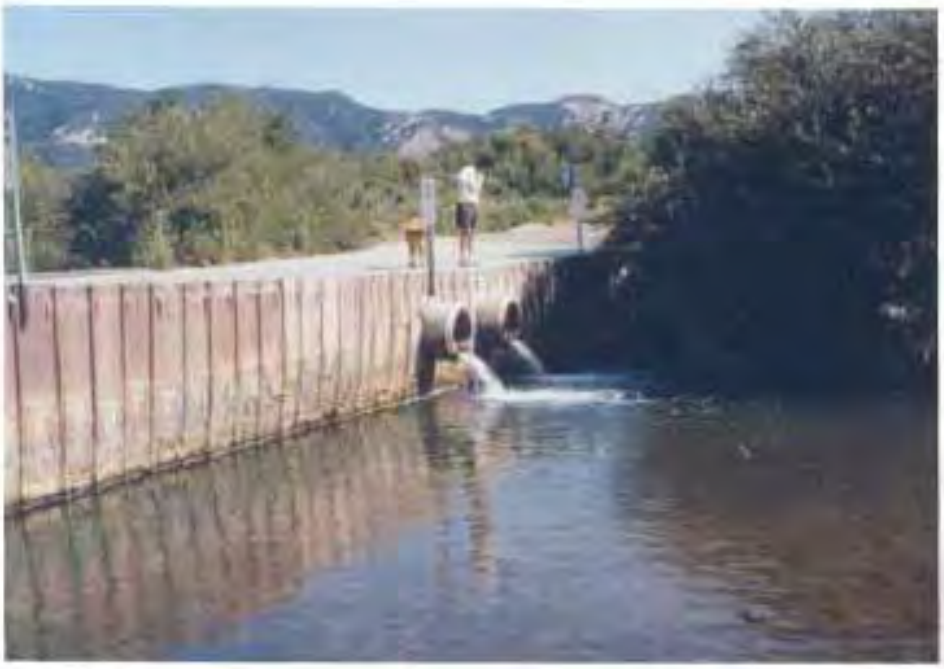


Photo #14 Gaviota Creek

Appendix V

Tributary descriptions from surveys conducted by the US Forest Service, 1979.

Santa Paula Creek. 7 pages.

Santa Paula Creek June 6-7,19,1979

0-½ mile
Survey started at Current Forest Service Boundary, Stream Elev. 1180'

Lower Section:

Rapid flow, pools and riffles abundant, clean bottom, evidence of heavy scour, (1978, 1979) floods. Bottom mostly rock and gravel, some sand, both pools and riffles minimum width 3' for this section.

Rapid-cascading, cover mainly boulder pockets, shade sparse, algae not blooming yet, provides limited cover, mostly in backwater pockets. Blackfly very abundant (larvae) on rocky-boulder cascades. Food not limiting.

Riparian vegetation recovering from '78 flood, mostly set back from stream in flood channel. Mulefat dominant 1979 re-invader along streambank. Air 68, water 65°, @1030.

Mostly medium grade with short (50') areas of cascades, stream has only few side channels with flow, mostly holds good channel. Flowing stream stable but subject to movement w/in flood channel from year to year.

Stream runs against mountain in few places, good pools where this occurs. Stream splits for approx. 100 yds. in 2 equal channels, both adequate for trout. Maximum pool depth approx. 4 ft, many small polls, few large pools; approx. 60% riffle 40% pools, all made up primarily of rubble, rock, gravel, some sand, little sediment.

MILE ½ - Second Crossing

Canyon tightening, recovered much more fresh and sulphur spring enters on west side of canyon, "½ hose worth." Better shade, from trees on west bank, bedrock wall on e. bank. Stream runs against bedrock in one pool with a minimum width 2 feet. More bedrock here, larger boulders, few riffles, mostly pools with blackfly rich headwaters. Unnamed spring on w. bank below 2nd crossing in dense alder thicket approx. 2 hose worth. Flow EST. approx. 10 CFS (17' wide, 1/3' deep, .7 ft/sec.) Photo 1: Barrier possible to small fish (one seen attempting passage, probably no problem to larger fish).

Summary of this area: Steeper, more exposed bedrock, better recovered than lower area. Stream split in 2 equal channels at crossing, both adequate habitat. Road completely washed out. At the crossing heading up the hill to Big Cone Camp.

2nd Crossing: Elevation approximately 1370', upstream to confluence of Santa Paula Creek and East Fork Santa Paula Creek:

Canyon starts to narrow further as E. Fork confluence is approached more and larger boulders, more sand in pool bottoms. Faster, rapid water breaking into cascades. Canyon more protected (more stream in shade from canyon walls). 6'-7' deep pools, rock crevices and undercuts provide good cover, but no vegetation or debris for cover instream. Photo 2 & 3: Bedrock falls barrier upstream approx. ¼ mile from second crossing. Approximately 15'-20' drop. Definite barrier to upstream migrating resident trout. Trout are present above barrier, stream alternates between boulder strewn cascades and swift heavily cobbled and graveled riffles. Canyon walls narrow, channel approx. 30-50 yds. wide. Stream runs against East Canyon wall in a number of places, forming well shaded pools and riffles.

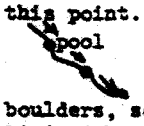
Photo 4: Significant barrier to upstream migrating resident trout, large bedrock boulder jam approx. 10 ft; high velocity, vertical drops into plunge pool. This is an area ¼ mile below E. Fork Main Fork confluence where stream makes a bend and large boulders are in a jammed matrix. Many deep (7'-10') bedrock pools abundant, instream or streamside vegetation; approx. none.

Photo 5: Main and East Fork Santa Paula Creek confluence.
Photo 6: Santa Paula Falls on Santa Paula Creek Main Fork just above E. Fork Main Fork confluence. 1400 hrs., air 70°, stream below Main and East Fork confluence = 63°, East Fork=69°, Main Fork=61° overcast.

Middle Stream Section: East Fork Confluence to Jackson Falls, about 2.5 miles:

Photos 7 & 8 : Pool immediately above Santa Paula Falls; this also sig. barrier. Stream runs through short, steep gorge, along uplifted "slab of bedrock" stream elevation approx. 1700'. Much more exposed bedrock: → Alders 20'-25' recovering and stable on east bank. Stream appears smaller, approx. 6 CFS, 0+ fry seen. gradient steeper, stream tight among large boulders or across slab rock with small pockets. Canyon walls steeper, better shade potential. 1st Tributary from west bank to Santa Paula Creek up from E. Fork Main Fork confluence has 0 flow entering Santa Paula Creek, but approx. "½" hose flow about 100 yds. upstream from Santa Paula Creek. See Photo 9. Elevation 1760'. Many small pools, boulder strewn, partially shaded stream, few riffles. A number of potential low flow barriers for upstream migrating resident trout in vicinity of Cross Camp, but resident population exists upstream. Water temp. 60, Air 66 @1500 in Santa Paula Creek. 100 yds. upstream from Cross Camp, elev. 1800'. Temp. of small trib. (.5 CFS) entering .5 miles upstream from East Fork Main Fork confluence = 63° Falls approximately 150 yds. upstream from Santa Paula Creek on tributary.

This tributary is at Cross Camp (1st surface flow containing tributary above Santa Paula and East Fork confluence). Upstream to Jackson Falls from this tributary Santa Paula Creek enters a very narrow gorge, canyon is heavily shaded by overhanging to vertical cliffs. A series of barriers exist here to U.S. migrating RBT, the most formidable being the creek as it enters "the Punch Bowl" (known well by U.S.F.S. in area as such.) Access beyond the Punch Bowl is by roping across a slick, narrow slab which tends to lighten human use and fishing impacts on stream considerably beyond this point. Above Punch Bowl Canyon very steep, profile like this:



with old growth alder & maple, canyon bottom and walls approx. 30-50 yds. wide, stream bottom large boulders, some rocks but mostly medium to small gravel, spawning areas limited but good quality. Water and air 57°, sky overcast and drizzly. Many trout 8-11 inches caught here; trout abundant. From about ½ mile above Punch Bowl to Jackson Falls are extensive areas of more level stream gradient, with fewer large pools, much large boulder strewn areas. More filamentous algae in this entire stream section. Watercress present in some side pools, some carex sp. also present. Canyon showing flood effects more severely due to reduced gradient, small and large boulders from creek bed and adjacent flood plain. Trout present all the way to base of Jackson Falls, Canyon opens up a bit more.

Photo 12: Trout at Jackson Camp, caught in large pool below Jackson Falls.
Photo 13: Falls above Jackson Camp (est. flow = 2CFS)
Photo 14: Springs coming in at the Falls above Jackson Camp, est. flow 3-4 CFS, Spring temp. 55° @ 1030. These springs provide more surface flow than coming down Santa Paula Creek.

Upper Section: Jackson Falls to 2,880' contour Crossing Creek (approx. 1.5 miles above Jackson Falls:

Canyon above Jackson Falls heavily disturbed from flooding. Stream flows through boulder strewn canyon, surface flow continuous, no canopy, poor canyon shade, poor fish holding water in summer; subject to flood flow re-arrangement winter. Unstable. Stream bottom has numerous angular U.S. smooth rocks: Also unstable. Spring enters bank at elevation 2760' on stream; about 1/3CFS. Santa Paula Creek flowing about 2 CFS, going underground for 25-200 yds. then resurfacing. No trout or other fish seen above Jackson Falls stream elev. 2520'. From these Falls upstream to where all surface flow ceases, stream elev. 2880, there exists only one stable stream section with old trees and cliff over-hanging protection that appears to have adequate summer flow and stable pools to provide suitable yearround trout habitat. The remainder of this section is flood ravaged and in the process of long term recovery. From 2,880' contour crossing Santa Paula Creek upstream to headwaters: See page 7.

UPPER STREAM SECTION - From Elev. 3800'-4600'

Access to the uppermost portions of the upper stream sections was via the old Forest Service "trail". From its junction with the Red Reef Trail at Hines Peak down into the very headwaters of Santa Paula Creek. Access was difficult, stream walking difficult due to abundant sedges, woody debris, willow thickets, etc. We walked downstream as far as is possible to an impassible waterfall about 150' high w. vertical walls on both sides.

Streamflow existed below the falls but it is not known if the streamflow contained trout. From the waterfall upstream to 4200' trout were abundant, up to 18", along with many only 1" long. Reproduction good, both spawning and nursery areas abundant. Flow averaged about 2 CFS (est) which was sufficient to fill large bedrock and boulder pools and maintain adequate surface flow to very headwaters except for a 200 yd. stretch of dry stream at elev. approx. 4200' (see map)

Summary of Upper Section: Upper section has no trout except in area from about 3600' to 4200'/ The upper section is difficult to reach, contains areas of stable, perennial surface flow with well established high overhead riparian community, areas void of riparian growth due to flood scour and mass wasting, and from 4400' upstream areas of "low overhead" growth i.e., willows, sedges, instream from nearly to headwaters. A diverse and unique canyon.

41. Fish Stocking Program: Santa Paula Creek, Main Fork

Santa Paula Creek is stocked with catchable rainbow trout in its lower portion along Highway 150 from Steckel Park upstream to Peradale Ranch (at the confluence of Santa Paula Creek and Sisar Creek.) Trout plants are typically from January - May depending on temperature and flow conditions.

Middle and Upper portions of Santa Paula Creek, Main Frok have been planted with fingerling Rainbow and Brown Trout. Brown trout are no longer planted due to potential problems if anadromy occurrs. The following fingerling trout plants have been made within the U.S. Forest Service boundaries on Santa Paula Creek, Main Fork since 1970:

4-26-76 - 5,000 fingerling Brown Trout planted by truck approx. .5 miles upstream from the forest boundary, or approx. 1 mile below the confluence of Main and East Forks Santa Paula Creek.

7-7-76 - 500 fingerling Rainbow Trout planted in headwaters of main fork, Santa Paula Creek approx. 5 miles upstream from the confluence of Main and East Forks Santa Paula Creek.

Spring of 1979 - 2,000 fingerling Rainbow Trout fingerlings were planted at approximately the same location as the plant of 4-26-76.

The present policy of the California Department of Fish and Game (Fillmore Fish hatchery) has been to periodically boost trout populations via fingerling plants following years of adverse flow conditions; either flood or drought, when natural recruitment would have been depressed. These plants also depend upon availability of fingerling trout, which carries from year to year. Santa Paula Creek, Main Fork, has been planted previously (prior to 1970) but the status of thes plants is unknown.

MARK MOORE

June 14, 1979

Santa Paula Creek, East Fork

Lower Section: From confluence w. Santa Paula Creek Main Fork upstream to first tributary entering from the North (stream elev. 2200').

From confluence w. Santa Paula Creek Main Fork upstream 300 yards East Fork runs through narrow canyon with bedrock walls. Canyon bottom ≈20 yds. wide, stream ave. 5 ft. wide, flow estimated at 3-4 CFS. No riparian community, stream channel stable but subject to scour due to narrow canyon bottom. About 1/8 mile upstream from East and Main Fork confluence on the East Fork is a 59° spring with a "3 hose" flow. An alder thicket 25'-30' tall associated w. spring, providing East Fork with ≈40 yds. of partial canopy. No fish seen or caught in entire East Fork. Photo 1: Typical stream section in lower section; note numerous small bedrock falls, instability of canyon walls where they meet stream channel. Deer tracks of all sizes very numerous. Evidence of mass wasting into stream channel during flooding, numerous mud, shale, rock slides into canyon bottom; often associated w. a spring. Pools have adequate depth to hold fish through summer; 2'-3'.

Stream velocity is fast, cascading, food sources abundant, mainly simulid blackfly larva, small mayfly larvae, and some caddis larvae. Water chem. appears harder, more conductive than other local streams. Low flow barriers numerous.

Summary of lower section: Canyon walls steep and unstable, stream gradient moderate, channel subject to some migration during flooding, stable and nonbraided during baseflow period. Numerous low flow barriers to U.S. migrating fish. Canyon has been degraded by clay and reddish sand buildups in pools from mass wasting at high flows; water subject to more temperature flux due to east-west alignment of canyon and loss of riparian community. Nevertheless, this stream has enough cover, low enough temperatures (much ground water input) and sufficient food to warrant the re-establishment of a RB trout population.

Upper Stream Section: From tributary entering from the north at elev. 2200' upstream to where stream splits into springs and low mainstem flow, elev. 2800'. Stream climbs more steeply, more large boulders in canyon bottom, flow 2.5 CFS Est. A large area of stream passes through a 1/8 mile section of severe rock, clay, mud, shale mass wasting. See map. stream elevation 2400'. Above this, stream more natural and stable, riparian community exists, but

stream splits into springs, leaving a mainfork Eastfork flow of only 1CFS. Fish habitat would end below the area of mass wasting ±1/8 mile upstream from tributary which marks the border between lower and upper stream sections. Summary of Upper Stream Section: Steep, rugged, little potential fisheries value, headwaters beautiful scenic area, springs and conifers. Stream unstable through slide area, moderate-stable above slide area.

MARK MOORE

Sisar Creek, tributary to Santa Paula Creek. 3 pages.

June 12, 1979

Sisar Creek

Lower Section: Forest Service boundary U.S. to confluence East and Main Forks: Start @0800, June 12, 1979. Streamflow 5 CFS Est. A number of fish seen in each pool; 1" to 10" in length. Stream completely shaded by canyon and alders at 0800. Stream cascading into boulder formed pools, (Photos 1 & 2) few riffles 5' long. From first road crossing D.S. 75 yards bottom and benthos covered with silt - crossing needs to be rocked in where vehicles cross to avoid this sedimentation. Road crossing also forms barriers to U.S. migrating resident RBT.

Dense cranefly hatch on water, rocks, alders. Many 1"-2" 0+ RBT seen throughout section. There are a number of good spawning areas in this section. This would not be limiting. There are a number of areas along stream 25 yds.-75 yds. long where scour of a bend or bank collapse has left streambank void of alder or sycamore canopy. In these areas mulefat has established a 3'-6' high streamside vegetative community.

Photo 3 shows an area where the stream assumed a new channel following the 1978 floods, vacating a channel to the left of the photo that was well shaded and established. Cover no problem, but area exposed to much sunlight. Interesting trout observation in a pool 7' X 10' X 2' deep. Two male trout about 7" long were seen for 3-4 minutes in an intense fight, each continually swimming after the other in a tight circle, mouths open, attempting to bite the caudal fin and back of the other. These fish were oblivious to everything else, moving in this circular manner until they were nearly swept from the pool downstream. I have never seen trout "fight" like this for so long outside spawning season (which is February and March on Sisar Creek). Again, craneflies are very abundant, nearly covering some backwater areas of creek.

Where road crosses creek for second time a barrier probably exists for upstream fish passage, especially at low flows (Photos 4 &5). Siltation of especially pools below this crossing for 30 yds. downstream evident. Recommend stone bottom vs. shale-mudstone bottom for crossing.

Above second road crossing (stream elev. 2280') stream and riparian growth stable, old alders, bedrock walls and pools with large, well rounded boulders. Trout seen actively feeding in pools @1000 m. where East Fork enters, flow is .5 CFS, but goes underground 100 yds. upstream from confluence; appears all flow in East Fork will cease on surface this summer. Photo 6.

Summary of lower stream section: good summer holding water, abundant food, adequate cover, suitable water temps., abundant 0+ - 1+ trout (Rainbow). Each road crossing and 1 6' waterfall (see map) are potential barriers to U.S. migrating R.B.T.

Upper Section: from confluence of East and Main Fork Sisar Creek (2360') to headwaters. About ½ mile up the "East Fork" surface flow increases to .5 - 1 CFS, no fish seen, probably will go dry later in summer - fall. Main Fork Sisar flow about 3-4 CFS est. Small 0+ fish present in tail end of pool nursery areas. One hole found 5' deep X 20 feet long X 8 feet wide, dense alder and sycamore overhang with an undercut bank going back at least 3 feet Best pool on stream so far.

Barrier to U.S. migrating RBT exists 50 yards D.S. from private road crossing leading up to Howell place on East Fork. (Barrier is on Main Fork Sisar). Road crossing itself is not a barrier, but should have flat rocks vs. shale-mudstone bottom to prevent siltation of pools D.S.

Photo 7: Cascades, bedrock, small pools, dense alder canopy, narrow canyon bottom, stable stream system typical of upper section.
Photo 8: A number of old, established boulder jam pools and falls exist in upper stream section; old growth alder riparian vegetation is abundant, small trout common throughout section.
Photo 9: Upstream limit of survey "White Ledge Falls". Above here, creek smaller, ground water seepage contributes much flow, surface flow ceases short distance above White Ledge Camp. Above and below White Ledge falls stream splits into 2 channels occasionally for distances of up to .25 miles, then rejoins. Fisheries value of this area is marginal very few riffles; steep, cascading stream with little spawning area, much alder, willow, bay branches and windfalls in stream; difficult walking, very difficult fishing. White Ledge Camp is located about .25 miles upstream from White Ledge Falls. The camp was very clean and neat when I was there. A spring of .5 CFS est. flow enters Sisar Creek at White Ledge Camp, and numerous seeps and springs of "1 hose" or less enter Sisar Creek just upstream from White Ledge Camp. Sisar Creek goes underground about 100 yards upstream of White Ledge Camp. Photo 10 is very headwaters of Sisar Creek, Main Fork: Note abundance of dead craneflies nearly covering headwater spring.

Upper Stream Section Summary: The lower ½ of the upper section is suitable for RBT and has a fair abundance of fish. The upper ½ of the upper stream section is steep, heavily wooded, much debris along and instream, and split into two channels in sections. Few trout seen

here, none seen above White Ledge Falls. More bedrock in stream forming banks, cascades, and pools. Canyon tighter. More filamentous algae was evident in upper stream section. Upper stream section is stable as far as holding a year to year channel, mainly because canyon bottom is so tight.

MARK MOORE

Sespe Creek. 5 pages.

SESPE CREEK, MIDDLE SECTION

Survey of the middle section of Sespe Creek was conducted in three parts on different dates: Sespe Gorge (elevation 3,500') to Beaver Campground (elevation 3,250'), Beaver Campground to Howard Creek (elevation 3,150'), and Alder Creek (elevation 2,125') upstream to Lion Campground (elevation 3,000'). The stretch between Howard Creek and Lion Campground was not surveyed.

The broadness of the stream channel sets this section apart from the upper and lower sections. At summer flow, approximately 70% of the length is typified as large but shallow pools or glides and ripples over gravel, cobble, rubble and rocks. The majority of deep pools results where the stream abuts against or flows over bedrock formations.

Most of these pools exist in the lower ½ of this middle section, from about Timber Canyon (elevation 2,700') downstream to Alder Creek, as the Sespe convolutes extensively through the toes of the surrounding mountains. It is this lower half that harbors the abundance of large trouts in the middle section.

Sandstone is the source of streambed matrix until the Sespe Hot Springs watershed contributes granite, which comprises approximately 30%-35% of the streambed matrix thereforth. Though both the upper and lower sections have good spawning gravel, the middle section offers not only the greater amount in respect to the greater length of the middle section, but also offers the greater amount proportionally to stream length. These wide, sprawling gravel beds are quite common through the middle section and many provide excellent sites as spawning redds for trout; a point for future considerations concerning human activities that may degrade the stream.

Three instream sites of adverse impact by man were witnessed. CALTRANS conducted a stream widening at the Hwy. 33 bridge (elev. 3,425') about ½ mile below Sespe Gorge. The Hartman Ranch (elevation 3,350') did approximately a third of a mile of dozer work in channelizing and bank construction. The Hartman Ranch work was profound in producing siltation in the following 3/4 mile of Sespe Creek. The material involved in constructing the bank was primarily small cobble and a very fine, powdery textured soil which will be readily flushed away with winter flow. The third site of human activity was the Forest Service's Lions Campground's stream alteration to protect the campground. The resulting streambed was left wide and the sand, cobble and rocks dozed up against the campground's bank to serve as riprap is too small to endure a high flow, consequently, it will be flushed eventually.

A fourth site, of natural cause, was a massive slide below the old Hartman Guard Station (elevation 2,450', T.6N.,R.20W.,Sec.30). High flow will eat away a large amount of soil from this slide, for it lies in the path of main flow. During low flow, as during the survey, no siltation was contributed from the slide.

Other points concerning siltation are the 4-wheel drive vehicles operating in the streambed in the 1 mile below Beaver Campground and the motorcycle crossings between Lion Campground and Sespe Hot Springs Creek.

Though mature stands of cottonwoods line most of the middle section, the wide streambed isolates much of the summer flow from the trees' shade. Most shade over the water is derived from filamentous algae, aquatic or semi-aquatic weeds, willows, boulders and steep bedrock banks. The stretch of stream from Hartman Ranch to Howard Creek is an exception, where cottonwoods and alders crowd the narrower channel and offer approximately 60% shade over much of this stretch.

The dominant flora at the water edge was cattails, chara sp., white sweet clover, small willows, aquatic bunch grass and an unidentified grass that resembled a giant variety of St. Augustine grass, with stolons running in excess of 20 feet. This St. Augustine-like grass was not uncommon in the lower half of the middle section. It was not observed in other sections or other streams.

Aquatic insects were abundant throughout, and more so in the lower half than the upper half of the middle section. Two areas of long ripples, with thick growths of aquatic bunch grass, were heavily abundant with aquatic organisms - the richest of any points within the entire Sespe Creek. The largest of these two areas (elevation 2400') was along, sprawling ripples with bunch grass and filamentous algae providing good shade. Sticklebacks, western pond turtles and the western aquatic garter snake were common in this area that measured (est.) 100 yards x 50 yards.

Large trout ranging from 5 inches to 12 inches, as observed, were common in all pools. Smaller trout, 3-5 inches, were only observed in the Sespe within a 100 yards stretch of where a cold water tributary fed. All the tributaries that derived from a northern aspect slope (south bank tributaries) and that contributed water, were cold (below 60°F). All of these tributaries, as well as most of the north bank tributaries, held large numbers of 0+ trout. The reason(s) that the young trout in the Sespe held close to cold water tributaries isn't determined for most didn't contribute sufficient water to individually affect the Sespe's water temperature. The likely explanation is that these trout escaped to the Sespe as their tributaries' flows decreased and overcrowding in the tributaries began occurring, and then held closely in wait of increased flow so to return up the tributaries. This occurance wasn't observed for the streams entering on the north bank of Sespe, from a southern exposed aspect. An overlook possibly occurred, for all except Sespe Hot Springs and Sycamore Creek showed as harboring young trout.

Sticklebacks and Arroyo Chubs were evident throughout the middle section in abundant numbers. Bluegills were observed existing in the pools from near Alder Creek upstream to Timber Canyon. Two were examined for food preference. Caddifly larvae, grasshopper, aquatic beetle, and other unidentified organisms were found in the stomachs. The warm, slow summer flow through this section provides adequate habitat for these bluegills. Reproduction of bluegills couldn't be determined, but owing to their adaptability, the later spawning months and their ability to spawn twice in a season, the possibility of some success in reproduction is there. Though trout would dominate their favorite feeding stations at the tail of a ripple, the fact that the bluegills will consume the same organisms would make them competitors during periods of low food availability. The origin of these bluegills wasn't determined. The Rose Valley lakes, with their high production of bluegills, are definite possibilities however.

Major tributaries to the middle section of Sespe are Park Creek, Red Reef Canyon Creek, Timber Creek, Bear Canyon Creek, Lion Canyon Creek, Howard Creek and Tule Creek on the southern bank - those with drainages from a north aspect slope. Red Reef Creek was dry bedrock at the confluence, though water was in the upper portion as observed from helicopter. Sespe Hot Springs Creek, Sycamore Creek, Trout Creek, Piedra Blanca Creek and Rock Creek are tributaries on the north bank - those with drainages with a south aspect slope.

Fishing pressure is greatest in the upper half of the middle section due to its greater accessibility by the general public. The lower half does receive anglers, as well as bikers and people just interested in hiking and camping. The most frequently used access routes to the lower half is via Lion Campground, Johnston Ridge Trail, Red Reef Trail and Alder Creek Trail. Alder Creek can be entered from McDonald Peak or via the Condor Sanctuary from Dough Flat, which is the greater used of the two. Another route, though less used, is via the lower section of Sespe Creek. During most weekends, numerous automobiles can be seen at Lion Campground area where recreationist leave out for either Piedra Blanca or the lower half of Sespe's middle section.

Other fauna of interst or are readily ovserved and that associate with the middle section of Sespe are: black bears, raccoons, beavers, mule deer, great blue herons, coots, spotted owl and the pacific lampreys.

Signs of deer were present throughout the section, but predominately so in the lower half. Two sites gave indications as regularly used stream crossing points by large numbers of deer. The young white sweet clover was being heavily browsed at this time of year (Oct. 5)

Five separate beaver sites were observed, the first between Lion Canyon and Bear Canyon and the last at the confluence of Sycamore Creek. All utilized bank dwellings and cattails were favored in meager attempts at dam building. Only the first dam had any significant effect in water retention, forming a huge pool 30 yds x 80 yds x 3½ ft and only this dam had an appreciable amount of willow twigs included in construction. Great blue heron and american coots were also utilizing this pool. No beaver ditching (runs) were observed at any of the five sites. The site at Sycamore Creek confluence was disrupted by motorcyclists. The streambank where the beaver dwelled showed abuse by motorcycles in what appeared to be intentional harassment, for the streambank was bluffed and interwoven with tree roots - not a typical choice for motorcyclists.

One spotted owl was observed in a cottonwood stand in the lower half of the middle section; and existed a large, thick grove of willows that could serve as potential habitat for the Least Bell's Vireo.

Lampreys have been observed spawning as far up the Sespe as to within one mile of Lion Campground. Migration farther up the Sespe should be expected. These pacific lampreys typically do not feed upon freshwater fish. They enter the inland streams, find a suitable spawning bed of loose gravel and sand, lay their eggs and die. The dead and dying lampreys serve as food for bears, raccoons, gray foxes, bobcats, and other scavenging animals. The young remains in the streambed for two to three years feeding on organic debris, then migrates to the sea without feeding on fresh water fishes. (commonly don't)

KEN KESTNER
Wildlife Biologist

SESPE CREEK, UPPER SECTION

Survey of the Upper Sespe Creek was conducted in two parts on different dates. Don Edwards and Mark Moore, Sept. 15 from 4025' elevation to 3875' elevation and Don Edwards and Ken Kestner from 3875' elevation to Sespe Gorge 3500' elevation on Sept. 22.

The upper portion starting near Lady Bug Creek is characterized as broad channel of rubble, gravel and sand with groves of willows as the dominant vegetation. For the most part, this portion is subterranean flow. The survey was started at 4025' elevation where the channel produces pools of ¼ cfs surface flow amongst willow groves. Large trout were summering over in these isolated pools. Surface flow began continually thereafter with ½ cfs. Mature stands of cottonwood became the dominant vegetation though offering sparse canopy over the stream.

Large gravel bars offer potential spawning down to 3750 elevation where large rocks and boulders begin to form good pools with an abundance of riffles between as the stream channel narrowed with steep banks through the lower ½ of the upper section. Bedrock formed much of the south bank in this portion. This lower ½ portion receives heavy fishing pressure during the summer months and some swimming and recreation.

Just above Potrero John Creek confluence, the Sespe lost its surface flow of 3/4 cfs, and regained it where Potrero John entered. Potrero John contributed an equal amount. Silt from Potrero John Creek coated the Sespe's bottom for several hundred yards downstream. Potrero John appeared to have contributed to a thrashing effect on the Sespe Creek in this area.

Alders become apparent at the mid-portion of the upper section. The canopy of the upper section is sparse with some shade offered by steep banks and boulders. Water temperature measured 73°F at the point where it went subterranean just above Potrero John Creek.

Filamentous algae were common and bunch grass was common in segments of fast riffles. Rainbow trout were common to abundant and chubs were very abundant. No sticklebacks were observed. Two beaver sites were discovered though no dams were constructed. A road-killed ringtail cat was observed during the summer in the Sespe Gorge.

The only sulfur input was observed in the Sespe Gorge. It had no apparent effect on fish life.

Sespe Gorge is a popular site for cliff climbing.

KEN KESTNER

Bear Canyon Creek, tributary to Sespe Creek. 2 pages.

Bear Canyon Creek, as Timber Canyon Creek, best serves as a summer nursery for juvenile trout. The lower section (1/3 mile) has 53°F water with 3/4 cfs. and an abundance of large and small pools. The creek is known as a good trout fishing stream. At the time of this survey, early October, most of the larger trouts apparently have been fished out. The trout seen were a large population of fingerlings size to eight inches. Less than a half dozen 8-10" trout were observed. The canopy was dense with Alders and Cottonwoods predominating. A few dense Big-Cone and Douglas Fir existed at the upstream end of the lower section. Bedrock formed the majority of the stream bottom and pools.

Massive boulders forming barriers begin the middle section. Water is mainly subterranean with intermittent sections in the up-stream portion of the middle section. The boulders exist in a narrow canyon portion of the stream with Big-Cone Douglas Fir being the dominant shady cover. The intermittent portion above the boulders is shallow with gravel and cobbles having accumulated behind the boulder barriers. Vegetation was thickets of rose briars and young willows, with a few young alders. The west bank of this portion was steep with areas of sloughing. The east bank is a low floodplain with a mixture of thick brush.

The upper section has shallow floodplain banks with the same mixture of thick brush. Young willows close over the narrow stream (@5 ft. wide). No pools exist in the lower portion of the upper stream. Starting where the first major tributary enters from the east (elev.3350') a few pools formed by bedrock and large rocks exist. At elev. 3450 ft. the stream has a dry stretch of about 900 ft. distance where the channel narrows and large boulders clog the channel.

As with Timber Canyon Creek, this upper section would not be suitable habitat for large trout, but could serve as a good spawning and nursery area to supply wild juveniles to Sespe Creek. The ideal situation would be to provide permanent access by removing the boulder barriers, but the numbers and size of these boulders might make this alternative unfeasible. Also the quantity of debris behind these boulders would ruin the good habitat in the lower section, until one or several good flood volumes could flush it.

A practical alternative is to stock the upper section with fingerling trout. As with Timber Canyon Creek, these trouts should not obtain a large size as would be desired by fishermen, but should mature at a smaller size and be able to spawn in the upper section. After years of floods or droughts the upper section would probably require restocking.

Other than contributing wild juveniles to the Sespe Creek, trout existing in the upper section would contribute to the food source of several wildlife species, such as the bobcat, racoon, bear, kingfisher, ringtail cat and others.

The watershed burned in the 1972 Bear Fire. The south aspect slopes still have light brush while the north aspect slopes are beginning to obtain heavy chaparral brush.

Recreational use appeared heavy at the Bear Creek Camp.

KEN KESTNER

Howard Creek, tributary to Sespe Creek. 1 page.

HOWARD CREEK - July 11, 1979

Howard Creek from Sespe Creek confluence upstream to where creek goes intermittant.

Flow about 1-1.5 CFS, abundant caddis, (free crawling sand tube type), blackfly larvae, and mayflie larvae. Bottom made up of almost entirely bedrock and gravel. 0+ fish (RBT) abundant, also good numbers of trout 6"-10".

Excellent canopy of old growth alder, cottonwood, willow, dogwood, and nearstream 4' tall bunches of harding grass.

Above mile ½, (house and private land) stream very well canopied by above mentioned species, with a more normal pool - riffle configuration of gravel, sand, rocks (large and small).

Rose Valley Creek flowing ≈ .5CFS at its confluence with Howard Creek, Rose Valley Creek also loaded with 0+ trout and some 6"-10" fish. Howard Creek about .75 CFS above its confluence W. Rose Valley Creek.

Two springs comprise almost all of Howard Creek's flow above the Rose Valley Creek confluence. Above here, flow goes intermittant about 100 yards above uppermost spring. Spring temperature of both springs ≃ 60°-62°, stream temperature ≃ 67 below confluence w. Rose Valley Creek; Rose Valley Creek ≃ 69°. Howard Creek is an important spawning-rearing habitat for its own small resident trout population and also an important cool water tributary to upper Sespe Creek. Sespe Creek fish probably utilize the Cool water, abundant foods, and better cover afforded by Howard Creek during summer and fall months when many portions of upper Sespe Creek are sluggish, warmer (70°-75°) and of marginal utility as rainbow trout habitat.

Howard Creek also has lower and more stable spring water temperatures which would make it more suitable in some parts of the year as spawning habitat.

It is important that any roadcrossings or road improvements on Howard Creek be done with adequate consideration given downstream habitat/fishery impacts. (The private residence on lower Howard Creek has a washed out road crossing that may be repaired in the future. It is also important that any future work done at this point be done in such a manner so as <u>not</u> to block fish passage up and down stream, to an into Sespe Creek.

Howard Creek was scheduled to receive a fingerling plant of RBT in 1979 (by truck).

No photos taken of Howard Creek.

MARK MOORE

Lion Creek, tributary to Sespe Creek. 2 pages.

Lion Creek

Lower Section: From Sespe Creek upstream to mile 1.5, stream elevation 3175', where cement check dam forms barrier.

Photo 1: Lion Creek at its confluence w. Sespe Creek at Lions Camp.

Flow est. of Lion Creek at Sespe Confluence 2.5 CFS. Stable channel, good cover. Photo 2.

Numerous seeps on the wetted stream bottom are contributin significant amounts of sulfur-enought to exclude trout in some pools, approx. elev. 3050'. Stream runs through narrow canyon w. exposed bedrock forming good holding water - Photo 3.

Photo 4 & 5 show a significant barrier that exists approximately 1.5 miles upstream from the Lion Creek confluence with Sespe Creek. This barrier consists of a 3' high X 1½' wide cement check dam with a 2' wide apron at its base. A date is inlaid in the checkdam which reads "6-22-37" (or 31) "CO 2925." The structure was apparently built for the purpose of forming a pool behind the checkdam. There is an old and clogged exit pipe at the base of the checkdam which serves no current purpose. See Photos 4&5. This barrier needs to be removed or modified.

Summary of Lower Stream Section: Canopy medium-dense, mostly old growth alder, some willows, cottonwoods, sycamores. Streamflow 2-2.5 CFS est., abundant pools and riffles, minor sulfur problem in lowest 1 mile of stream, impact of this is lights. Streambottom mostly gravel, fairly diverse streamflow types - some cascades at head of pools, much rapid and slow flow areas. Good-Excellent spawning and nursery habitat; stream loaded with 0+ fish approx. 1" - 3" long, also many 6" - 10" trout (Rainbow); no problem catching lots of fish. Stream somewhat degraded and large fish scarcer in vicinity of Middle Lions drive in Campground. Standard trash and human waste near, along and instream. Stream silted in about 25 yds. below camp road stream crossing; should be rocked in with large flat stones or stream crossing closed off permanently. Pretty stream, provides excellent angling opportunities, serves as important spawning flood escape area for Sespe Creek Rainbow Trout. Lower stream section appears to receive moderate angling pressure but sustains healthy resident RBT population, along with limited numbers of stickleback and arroy chubs (especially in vicinity of Middle Lions Campground). Canopy and volume increase from groundwater input kept water temperature 64°, or 4° cooler than upper stream section for the entire lower stream section.

Upper Stream Section:

Surface flows approximately ½ mile above barrier reduce to approx. 1.5 CFS est. A natural barrier (low flow) exists at stream elevation 3250' (See map).

Water 68°, air 83° @ 1300. Photo 6 shows typical portion of upper stream section: slow velocity, willow lined; full of 1"-12" trout, no chubs or sticklebacks seen in upper section.

"Bunchgrass" (Phallaris sp.) and algae provide instream shade and cover along with willows in upper stream section.

From man made checkdam barrier (see map) Elev. approx. 3175' upstream to the confluence of East and West Fork Lion Creek Elev. approx. 3400'.

The upper section contained trout throughout its road, most numerous in the upper portions of the upper stream section. No sticklebacks or chubs were seen in upper stream section.

The 1/3 of the upper stream section is similar to the lower stream section, with old growth alder canopy which gradually gives way to a less canopied, boulder strewn, steeper section which comprised the mid 1/3 of the upper stream section. Flow dropped to approx. 1.5 CFS in this vicinity, and trout were less plentiful. This area appears to suffer the most flood caused instability even though canyon bottom is narrow (50 yds-75 yds. maximum). The upper 1/3 of the upper stream section was composed of a wide, gravel filled floodplain with 2-3 braids, one of which contained all base flow. Most pools were shallow, densely willow lined, long, relatively narrow and shallow (except the very head of each pool). Excellent nursery area, loaded with 0+ young of the year Rainbow Trout. Also abundant were 6"-10" trout and an occasional 12" trout.

Low gradient and open floodplain expose flow to slow, mostly shallow movement. Water temp. was 68° @1300 but obviously not seriously impacting trout population. Difficult but good trout fishing; upper section not recommended on warm-hot days!

Summary of Upper Stream Section:

Three distinct stream habitats; 1) stable old growth alder-riparian 2) steeper, boulder strewn narrow canyon, 3) wide, gravel and rubble filled floodplain w. dense willow growth along low gradient stream. Trout fishery exists for trout population throughout upper section, most fish seen and caught in upper stream section.

Streamflow splits into West and East Fork Lion Creek each with .5 CFS flow, few trout; of limited value as fish habitat or providing angler use, one trail camp exists on each fork.

MARK MOORE

Piedras Blancas Creek, tributary to Sespe Creek. 1 page.

August 1, 1979

Piedra Blanca Creek

Piedra Blanca Creek was surveyed from its headwaters to its mouth at Sespe Creek, with the exception of a portion of the Middle Section between 4400' and 5750' due to time constraints.

Lower Section: Sespe Creek confluence upstream to the confluence of the north and main forks:
Flow estimated at 1 CFS at Sespe-Piedra Blanca confluence, increasing to 2 CFS about ½ mile upstram. Rainbow Trout, arroyo chubs, and common 3 spine stickleback all present in lowest 1 mile of stream, then only rainbow trout seen. Very abundant, taking advantage of good cover provided by 10'-12' willows densely lining the creek in most places, with occasional stands of alders becoming pure alder stands for the upper ½ mile of the lower stream section. Food common, all fish appear healthy despite warm temperatures, 94° air, 69° water at 1500. North fork flow est. 1 CFS.

Middle Section: Confluence of main and north forks Piedra Blanca Creek upstream on Main Fork to stream elev. 4400' : steeper, good pools, good number of trout, flow 1 CFS up to area of intermittent flow. Perennial flow to 4150', then drops to 1/3 CFS to dry with areas of up to 1/3 CFS inbetween. Largest pool on creek section is also nearly the last, at elev. 4250'. Above here and below in some of the intermittent areas flow appears to "go under" early each summer ~~dueeeee~~ as indicated by lack of phreatophytes along creek bottom.

Upper Section: 5700' stream elev. upstream to divide between Piedra Blanca Creek and Bear Trap Creek: Only fish seen in upper stream section were at a large, well shaded bedrock pool which appeared to be in the area of 1st perennial flow (for at least a mile downstream). This was at stream elevation 5650. Above here, Piedra Blanca surfaced only in areas of bedrock; and was 1-2 hose flow at least, although, this sufficient to support intermittent stands of alders and nearly continual stands of shrubby willows and various streamside grasses. Black Bear seen along creek at elevation 5800'. Much bear sign from 3 Mile Camp (See map) upstream to Haddock Camp, flow semi-stagnant, running 1 hose in few places, little summer holding water; no trout seen. Good spring at 3 Mile Camp (100' downstream); 2 hose flow and 53° despite summer heat. Trout habitat on Piedra Blanca Creek (perennial habitat) limited to below 5750'. I recommend hiking down rather than up the trail between Pine Mountain Lodge and Twin Forks Camps. (We hiked down). The North Fork Piedra Blanca also worthy of survey when time permits.

MARK MOORE

Pine Canyon Creek, tributary to Sespe Creek. 1 page.

September 4, 1979

Pine Canyon:

Pine Canyon was surveyed from its confluence with Sespe Creek upstream to stream elevation approx. 2580'. The entire canyon surveyed was void of riparian growth along the stream and subject to extreme flooding. Limited stands of mixed age alders existed up off the stream where springs entered. A total of 13 springs fed Pine Creek, 11 from the south side and 2 from the north side of the canyon. The canyon bottom was typically "V-shaped" with occasional areas of slump terraces where sidewalls had collapsed and "melted" into side terraces. No evidence of old growth riparian vegetation along the stream was found, either in the form of stumps or debris jams. The only woody debris in the canyon bottom consisted of flood battered Big cone douglas fir trunks or occasional hard chaparral species which came down with rock/mud slides. Numerous partial and complete fish barriers (both high and low flow) were seen along entire length of stream surveyed. No trout or other fishes seen anywhere in Pine Creek.

The creek bottom ran through narrow areas (10' wide) where uplifted sedimentary rock had been eroded and through wide areas (150') of slump terracing.

Stream substrate was dominated by rough edged rocks, and fines of grey and red color. Potential trout habitat would be limited by lack of cover and suitable spawning substrate. Water temperature and food sources were not limiting. Algae was common, consisting mainly of Entermorpha sp. and another unidentified filamentous species. Dominant food source was blackfly larvae, especially abundant in fastest water. Net spinning caddis (Hydropsychid) also abundant.

Pine Creek is closed to human use due to the presence of condor roosts and other condor uses (nests). It is located along the southern boundary of the Sespe Condor Sanctuary, "hidden" from the Santa Clara Valley by Santa Paula Ridge - San Cayetano Mtn. Pine Canyon's stream parameters closely resemble those of the East Fork Santa Paula Creek. Signs of moderate human activity were seen in Pine Creek up to stream elev. 2200'. 4 "bootleg" campsites and a lightly used footpath indicated recent use. The mouth of Pine Creek needs to be posted to eliminate further human activity in area.
NOTE: A pair of S. Western pond turtles (Clemmys Marmoratta) were seen mating in Pine Creek. I have seen numerous pond turtles in the Ojai District streams but never knew when they breed. Seemed interesting as this is September.

MARK MOORE

Timber Canyon Creek, tributary to Sespe Creek. 1 page.

Timber Canyon Creek offers a few trout of catchable size, but serves predominantly as a summer nursery for juveniles, for which the habitat is best suited. The mouth of Timber Canyon at the Sespe Creek is brushy and flow is subterranean which discourages most fishermen. The Red Reef Trail crosses at the point where the upper section goes subterranean to begin the middle section. This also discourages fishermen, especially since no trail follows the lower section or middle section.

The lower section's riparian growth is of mature alders, oaks and cottonwood and one area has evidence of being utilized for back-country camping. The lower section is excellent habitat for a wide array of wildlife as well as for juvenile trout. As such, a recommendation is not to provide improvements.

The middle section is a very narrow canyon stream jammed with boulders which provide barriers against trout passage. The summer flow is subterranean. One small point has an unstable bank producing slide material.

The upper section has thick groves of mid-aged to mature alders which provides dense canopy and thicket appearance. The gradient is moderate and pools are small. No access exist except for the Red Reef Trail crossing.

The flow and velocity are low, but the habitat is suitable for spawning and summer nursery. The trout, if stocked, will not attain large size, but majority will mature probably in the seven to nine inches size and supply a breeding population which will then supply wild juvenile input to the Sespe Creek as well as food source to various wildlife species.

Management recommendations are to 1) stock the upper section with fingerlings, 2) maintain as a nursery stream, 3) not to provide improved access, 4) investigate feasibility of removing barrier boulders, and 5) restrict activities in watershed that would degradate the water quality.

KEN KESTNER

Trout Creek, tributary to Sespe Creek. 1 page.

July 26, 1979

Trout Creek

Trout Creek was surveyed from its confluence with Sespe Creek upstream to where flow went intermittent, then dry at elevation (stream elev.) 3350'.

Streamflow very low, est. .25 CFS, though sufficient in quantity to keep riffles flowing and small bedrock pools filled. Flow was rapid through the riffles but pool exchange rate probably very slow, as evidenced by dust and pollen covering surface of water. Some larger pools (10'-15' X 2' deep) had an abundance of floating mat algae, subsurface algae, and a littoral zone of cattails. Trout were generally absent in all riffle areas and limited to the pools. Larger fish were few in numbers approx. 2 per pool with lengths ranging from 6"-12"; many 0+ young of the year trout seen from 1" to 3". Seemed strange to see such small (1") trout this late in the summer. Stream very windy; many turns. Poor canopy - canyon bottom narrow, floods apparently prohibit permanent establishment of good canopy structure (of alder, cottonwood, and willow), along with bedrock composition of stream bottom and limited drainage area. One note of interest: where trout creek went underground, before reaching Sespe Creek, surface flow briefly increased during the morning, making about 50' of additional flow before the stream went underground. I would attribute this to reduced nighttime evapo-transpiration which manifested itself in the form of increased surface flow at the mouth of the creek during the morning hours. Portions of the 50' "additional flow" (that which was dry when I first arrived but became live stream in about ½ hour) were inhabited by some small trout immediately. These fish probably perished or possibly moved back upstream during the afternoon hours as the stream "shrank back" upstream.

MARK MOORE

Tule Creek, tributary to Sespe Creek. 2 pages.

.ULE CREEK June 25, 1979

Tule Creek lower section from confluence with Sespe Creek upstream to 3600' elev:

Creek flowing approximately 2CFS (EST) at its Photo 1 confluence with Sespe creek (flowing approximately 4CFS (EST)).

From the highway 33 bridge U.S. approximately 75 yards stream has been channelized by CALTRANS or landowner (probably CALTRANS to "protect" 33 bridge. Area is disturbed, little holding water.. Abundance of 1" - 10" trout evident, along w. numerous stickleback. Above channelized area stream stable, good overall trout habitat. Riparian Vegetation mostly 10' to 15' shrubby willows along creek good woody debris instream.

Air 80°, water 60° @0900

Photo 3: typical pool and vegetation in lower stream section. Pools typically small with extensive shallows - good nusury habitat. Stream in lower section has medium - slow x velocity; water moving slowly through shallows of pools, cascading into next pool or riffle and again slowing down. Trout very abundant, almost all (greater than 90%) are young of the year or yearling fish. Food is abundant, mostly 2-3 types of attached and free crawling caddis; small mayflies on and under stones, in riffles and pools; blackfly in cascades.

Sporadic complete old growth alders along stream forming most stable parts of streamflow in lower stream section, these exist in only 25-50 yards long stands and cover minor portions of overall stream. See Photo 5. (Photo 4 shows typical small trout from lower section.

9" trout killed - stomache had approximately 10% stonefly adult, 10 blackfly larvae, 20% cranefly, 60% unidentified debris (probably caddis cases). All fish fat and healthy in appearance. Stream bottom mostly small cobbles, gravel & sand. Very abundant 0+ fish. No sticklebacks seen past stream mile ½ above Sespe confluence.

Air 74°, water 58° at 1200
Air 86°, water 64° at 1400

Arroyo Chubs and sticklebacks are very abundant in Sespe creek at it: it's confluence west Tule creek, and since no barriers exist, I would assume at least some Arroyo Chub (Gila Orcuttii) also reside in Tule creek.

Summary of Lower Section:

Good - Excellent overall habitat, food abundant, 1" - 12" fish present mostly younger fish (larger fish may be selectively harvested by anglers - fair amount of angler use evidence found. Streamflow approx. 2 CFS, good cover, no problem catching a;; the 7"-9" trout one wants. Limited old riparian growth but overall fair - good canopy, stable stream channel (splits briefly but both contain good habitat with trout). Temperature suitable for food and trout. Low gradient, streamflow medium - slow. This portion of Tule creek is an important spawning tributary to upper Sespe Creek fish.

Summary of Lower Section continued:

Suitable walnut sized - pea gravel and cold incubating temps, easy access for Sespe fish.

Upper Stream Section from 3600' Elevation to 3725' Elevation:

Canyon tightens briefly at the beginning of the stream section, some bedrock formed pools (about 100 yards of the uppermost lower section runs through stable bedrock pools and riffles also). Above 3650' streamflow only about 1 CFS, canyon less stable, definite lack of riparian vegetation as if stream subject to more flooding, meandering and quicker loss of streamflow in late spring - summer. Algae more extensive in this upper section, possibly velocity dependent: plenty of food but few fish over 6" seen; mant 0+ fish seen. No sticklebacks or other non-trout seen in upper section. Flow about .5 CFS but continuous up to elevation 3725, where after 25 yards of intermittent flow all surface flow ceases. Upper Tule canyon is dry except for winter stormflows, snow runoff and brief spring runoff. Trout were seen right up to last continuous surface flow in upper section. Upper section of marginal value as sport fishery, good value as spawning-rearing area. Fresh and numerous bear tracks seen along stream in upper section.

Summary of Upper Section:

Less stable, less flow, less cover, shade and riparian vegetation but still good habitat as evidence by #5's of trout in section.

MARK MOORE

Fish Creek, tributary to Piru Creek. 1 page.

September 11, 1979

Fish Creek, Main Fork

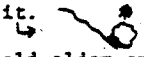
Lower Section

From the confluence of Fish Creek and Piru Creek upstream to the confluence of the Main and North Forks, Fish Creek.

Streamflow est. 2.5 CFS, algal bloom has apparently come and gone, leaving areas with dead "cotton" like algae and a mineral precipitate covering much of the granite streambottom. The lower section "snakes" back and forth a great deal, with few areas of mixed or old growth alders. Most of lower stream section shows evidence of heavy flood scour from 1969 and 1978 floods. Trout (Rainbow Trout) the only fish species seen in Fish Creek. Abundant, 20-100/pool or riffle, mostly young of the year, ranging from 1½" to 3". Each pool also typically had 1 or 2 (up to 5-6) 1 yr.+ or 2 yr.+ Rainbow Trout as well. Food sources common but not overly abundant. Most pools quite small and shallow, riffles and pools equally populated by trout. Many aquatic garter snakes (Thamnophis sp.) were also seen. Five falcons (prairie?) also seen "playing" among rocky slopes of lower section.

Middle Section

Confluence of Main and North Forks Fish Creek upstream to major fish barrier at stream elevation = 2275 on Main Fork: North Fork flow about 1 CFS. North Fork contained small pools and riffles with many 0+ trout present for the ½ mile of the North Fork examined. Main Fork regains mixed age alder canopy, medium shade, steeper gradient with slightly deeper pools, more cover, more older trout up to 13" present.

Flow in Main Fork above North Fork confluence estimated at 1.5 CFS. Some granite bedrock pools present, a more stable stream community, and narrower canyon walls typical of middle stream section. The fish barrier consists of a bedrock canyon wall with a large boulder abutted against it.  forming a 10'-12' waterfall and splash apron. The barrier has apparently been as such for some time as evidenced by an old alder growing in a crevice of the boulder. Above this barrier are many other potential low and high flow barriers so that its removal may open up only limited additional habitat upstream. Best course of action would be to stock upper Fish Creek, Main Fork, with fingerlings and allow repopulation via downstream drift of fish. Survey ended at stream elevation approximately 2350'. Fish Creek is the only spawning tributary available to trout in Piru Creek between Pyramid Lake and Agua Blanca Creek, and appears heavily used as such. Prior to stocking of Upper Fish Creek Main Fork, thought should be given to using this stream section as wild trout habitat for native trout strains above the fish barrier at 2275'. A 12" ♂ Rainbow Trout taken at the pool below the fish barrier contained 1 grasshopper, 2 leafhoppers, 2 caddis cases, 1 tenestrial beetle, 1 ant and 2 unidentified food organisms.

MARK MOORE 9/12/79

Appendix VI

NOAA Fisheries, Critical Habitat Designation for Southern Steelhead, 9/05.

http://swr.nmfs.noaa.gov/salmon.htm