Testimony of Scott B. Engblom

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Improvement District #1

Prepared for:

State Water Resources Control Board
Cachuma Project Hearing – Applications
11331 and 11332

Cachuma Member Unit Exhibit No. 228

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Introduction and Summary

I am a fishery biologist employed by the Cachuma Operation and Maintenance Board (COMB), Santa Barbara, California and have been the Project Biologist since April of 1994. I attended Humboldt State University from 1988-1993 and received my B.S. degree in Freshwater Fisheries Biology. While attending college, I worked for the Department of Fish and Game on the Trinity River Project where we installed a migrant trap and monitored Chinook salmon, coho salmon, and steelhead runs from 1989-1991. I also worked for the Department of Fish and Game from 1990-1993 on their wild trout crew. In that capacity I traveled throughout the State conducting population estimates using electrofishing and direct observation techniques on designated wild trout rivers. Since April of 1994, I have worked on the Santa Ynez River as the project biologist leading the field study effort in gathering information on southern California steelhead.

Steelhead/rainbow trout studies have been ongoing in the Santa Ynez River from 1993 to the present. Studies have focused on the seasonal timing of movement into and out of the lower watershed as well as the geographic distribution of spawning locations, rearing locations, and refuge areas within the mainstem and tributaries.

1.0 Monitoring Aspects by Season as They Relate to the Biological Opinion and Fish Management Plan

1.1 Compliance and Requirements

The Lower Santa Ynez River Fish Management Plan (FMP) was designed to increase steelhead populations in the lower Santa Ynez River watershed by utilizing both flow and non-flow measures. Flow measures will include use of Lake Cachuma water to provide additional migration access to the Santa Ynez River by releasing water during specific times of the year to facilitate passage of steelhead to the mainstem and those tributaries, which provide spawning and rearing habitat. Downstream releases are being made to help improve summer rearing conditions of steelhead/rainbow trout. Non-flow measures include projects designed to remove tributary passage barriers and impediments to migrating steelhead. These barriers/impediments decrease migration opportunities and delay upstream movement by increasing the minimum flows required for upstream adult migration. These migration delays mean that steelhead/rainbow trout must wait for the next storm event to generate sufficient flows for barrier passage. Providing additional migration opportunities by removing tributary barriers to migrating steelhead will result in an increase in steelhead/rainbow trout utilization in the tributaries and likely an overall increase in the numbers of steelhead inhabiting the lower Santa Ynez River.

A watershed-monitoring program was developed to characterize fish habitat conditions, fish resources, and steelhead in the lower Santa Ynez River watershed below Bradbury Dam. The monitoring program will occur for the life of the project, but it should be

noted that specifics might change based on yearly monitoring results. The objectives of the monitoring program as described in NOAA Fisheries September 2000 Biological Opinion (BO) on U.S. Bureau of Reclamation Operation and Management of the Cachuma Project on the Santa Ynez River in Santa Barbara County, California are to evaluate:

1) Seasonal patterns of water temperature, in both the mainstem and tributaries downstream of Bradbury Dam.
2) Diel variations in water temperature.
3) Diurnal variations in water temperature and dissolved oxygen.
4) Longitudinal gradients in water temperature downstream of Bradbury Dam.
5) Vertical stratification and evidence of cool water upwelling in selected refuge pools.
6) Water quality suitability for various fish species including steelhead.
7) Reservoir temperature and dissolved oxygen profiles (stratification, depth of anoxic conditions, etc.).
8) Lagoon physical processes including the formation of the sandbar at the mouth.
9) Migrant fish use and timing in the mainstem and tributaries.
10) Steelhead spawning and rearing in the mainstem and tributaries.
11) Steelhead habitat availability in Hilton Creek in relation to water quantity.
12) Target flow provisions in the mainstem and Hilton Creek.
13) Specific planned tributary enhancement projects.
14) Specific habitat types in the mainstem and tributaries including their distribution, quantity, quality, and persistence over time.

1.2 Migrant Trapping (January – May)

Migrant trapping is conducted between January through May to encompass the seasonal period when adult and juvenile steelhead are likely to migrate. The studies have found that even with good flows during January, the adult steelhead typically do not begin their migration into the Santa Ynez River until February. Juvenile smolts typically migrate to the ocean from February through April. The purpose of the current migrant trapping program is to monitor the number of returning adults yearly to determine what benefit the elements of the FMP are having on the returning adult population. Sites to be trapped include Salsipuedes, Hilton, and Quiota Creeks. Migrant traps are expected to be installed on the mainstem approximately 3.4 miles downstream of Bradbury Dam once the reservoir is surcharged and water is being released for upstream passage. The mainstem trap will help evaluate fish response to passage flows in the upper mainstem area.

Results of migrant trapping have been very successful in determining the timing of migration and general numbers of steelhead/rainbow trout migrating into and out of the tributary systems, namely Hilton and Salsipuedes Creeks, which is an overall reflection of when fish are migrating into the mainstem. The primary problem with trapping the tributaries is the extreme flashy flows and the high debris loads. Table 1 shows the hydrologic year type classification based on rainfall data. In Salsipuedes Creek, the

Project can effectively trap flows of 50 cubic feet per second (cfs) or less. In Hilton Creek, the Project can effectively trap flows of 20 cfs or less. When winter storms approach, the Project will remove the traps from the creek until the flows recede to a workable level. Depending on the magnitude and duration of rainfall, the Project can re-deploy traps within 12-24 hours. Larger storm events may delay trap installation up to 48-72 hours. Typical hydrograph progression from a large storm shows flows increasing frequently to several hundred cubic feet per second every 15 minutes. Once the peak hydrograph is reached, flows tend to recede rapidly except for very large magnitude storms. Hydrograph peak and duration of runoff flows are dependent upon storm magnitude, duration, and the charged state of the watershed.

Table 1. Hydrologic Year Type

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Year Type	Wet	Normal	Normal	Wet	Normal	Wet	Normal	Dry	Normal

Tributaries

Figure 1 shows the results of the Projects' upstream migrant trapping effort from 1995 to 2003. Results have varied between each year based on hydrologic conditions (wet, normal, dry rainfall patterns) and the generally low numbers of returning adults to the system. In Salsipuedes Creek, capture numbers have varied between 1 and 40 fish. Length of upstream migrants captured varied between 4 and 27 inches. In 1998 and again in 2000, trapping operations had to be suspended due to a pending NMFS scientific collection permit (1998) and a pending Biological Opinion for California red-legged frogs (2000). In both of these years, trapping did not begin until April resulting in a missed opportunity to collect upstream and downstream migration data. During the last three years, we have observed a general upward trend in our upstream migrant capture data for both Salsipuedes and Hilton Creeks.

Figure 2 shows the results of the Projects' downstream migrant trapping effort from 1995 to 2003. In Hilton Creek, with the exception of 1995 (a very wet year), downstream migrants were not captured from the creek until the Supplemental Watering System was completed. Since its completion, the Project has captured over 100 juveniles and a few adults migrating downstream. Approximately ¼ of those downstream migrating juveniles are smolts (juvenile steelhead). Future production in Hilton Creek will continue to boost the overall steelhead/rainbow trout population within the lower Santa Ynez River. Once the passage impediment is repaired in Hilton Creek it will more than double the available spawning and rearing habitat.

In Salsipuedes Creek, the majority of the downstream fish the Project has captured have been smolts migrating to the ocean to become steelhead. During two of the last three years (2001 and 2003) we have captured 140 smolts and 83 smolts respectively. Comparatively, smolt totals from 1995-2000 and 2002 were only 30 fish.

Figure 1. 1995-2003 Upstream Migrant Captures in Salsipuedes and Hilton Creeks

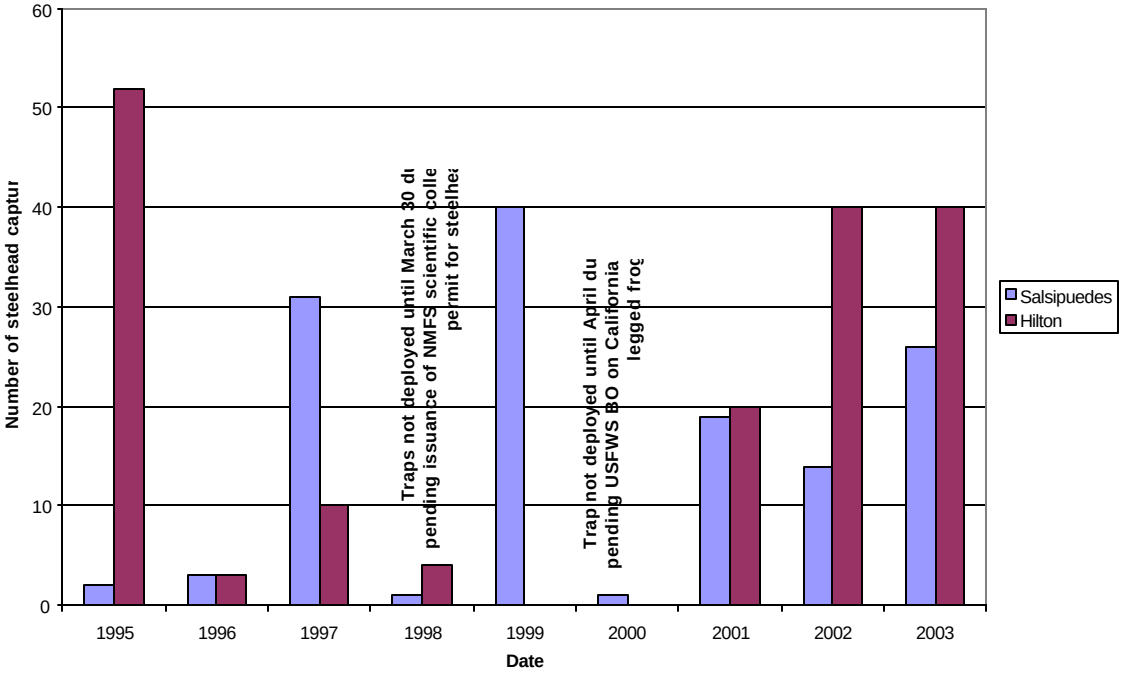
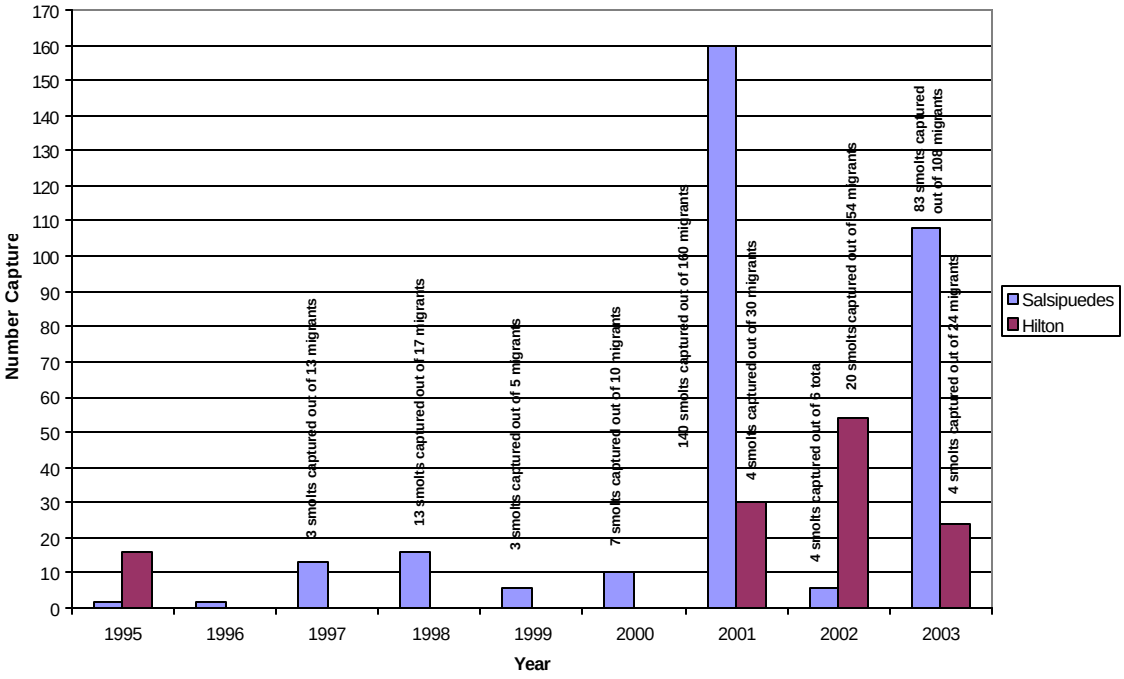


Figure 2. 1995-2003 Downstream Migrant Captures in Salsipuedes and Hilton Creeks



Mainstem

Two attempts have been made to trap the mainstem and have met with poor results. The primary problem stems from the fact that the first several storms bring high flows and large amounts of debris. This debris clogs the traps causing water pressure to build on the surface of the traps until a breach occurs which results in portions of the trap being destroyed. The project has developed another trap design that will allow easier trap deployment and removal when trapping the mainstem for evaluating steelhead/rainbow trout response to augmented storm flows (passage releases).

1.3 Redd Surveys (January-May)

Redd surveys are conducted on a biweekly basis in the mainstem and tributaries between January and May. Locations include the upper 10-13 miles of the mainstem where access is allowed, Hilton, Quiota, Nojoqui, Salsipuedes and El Jaro Creeks. Conducting these types of surveys is very useful in determining those areas spawning steelhead prefer and determining the survival of the young steelhead that are produced. Additionally, the redd surveys are used to help assess if steelhead are migrating during high flows when the migrant traps cannot be deployed in the stream due to high flows.

Table 2 shows the number of redds per year observed in each tributary sampled and the mainstem. Few redds have been observed in the mainstem during the course of studies. Part of the reason for this is that flow conditions are generally very turbid following large runoff events thus preventing observers from effectively seeing all of the areas where steelhead are likely to spawn. Snorkel surveys are used in conjunction with redd and migration surveys to determine steelhead/rainbow trout production. Redd surveys conducted in the tributaries have resulted in easier observations due to the usually rapid reduction in flows, allowing favorable observing conditions within several days to a week following a storm event. The creeks with the most redd activity include Hilton Creek, Upper Salsipuedes Creek, El Jaro Creek, and the confluence region around El Jaro and Salsipuedes Creeks. Redds have been observed in Quiota Creek, but with the exception of 1995 when larger redds were observed downstream of passage impediments, the redd excavations have been small indicating spawning resident fish of smaller sizes and not large adult steelhead. In Hilton Creek, while no redds were observed in 2000, the third driest year on record, young-of-the-year were observed in June indicating that spawning did take place. In each of the three winters the Hilton Creek Supplemental Watering System has been in operation adult steelhead/rainbow trout have used the creek to spawn and oversummer.

Table 2. 1995-2003 Documented Redd Sites in the Santa Ynez River and Tributaries

Location	1995	1996	1997	1998	1999	2000	2001	2002	2003
Mainstem	n/s	n/s	0	n/a	7	5	0	3	0
Hilton Creek	8	0	0	2	0	0	3	0	9
Quiota Creek	3	no access	no access	no access	no access	1	no access	3	
Upper Salsipuedes Creek	n/s	7	11	3	16	16	12	no access	no access
Lower Salsipuedes Creek	n/s	3	14	n/a	48	4	no access	no access	no access
El Jaro Creek	n/s	6	18	n/a	0	0	0	4*	8
San Miguelito Creek	n/s	n/s	49	1	35	n/s	n/s	n/s	n/s

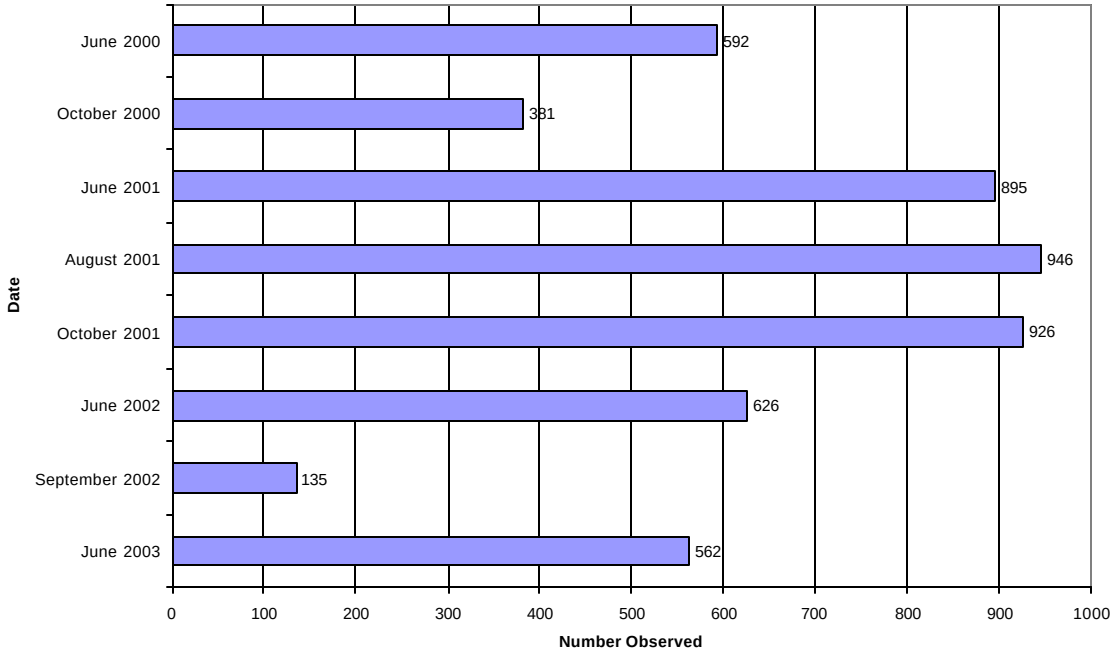
1.4 Snorkel Surveys (June, August, October)

Snorkel surveys in the mainstem and tributaries are conducted during June, August, and October to assess the success of spawning and rearing of steelhead between the spring and fall. The June survey results are used to determine the success of winter adult spawning by observing the concentration and distribution of young-of-the-year steelhead/rainbow trout. The August survey results are used to evaluate rearing conditions during the summer period and to track the growth and survival of those fish still inhabiting survey locations. The October surveys are used to determine rearing success after the summer period, and also to monitor growth and survival between June and October.

In the mainstem river, surveys are localized to those habitats that have the necessary components to successfully rear steelhead (depth, cover, cool water upwelling). Typically, every pool and deep run in the upper 10 miles of the mainstem (where access is allowed) is snorkeled. In the tributaries, habitat typing was conducted prior to snorkeling activities in each creek. Due to the size of Salsipuedes Creek (18,216 feet), habitat types were stratified (pool, riffle, and run) and snorkel sites were randomly selected to be evenly distributed throughout each study reach. All of lower Hilton Creek was sampled (1,381 feet), along with portions of Quiota (710 feet) and El Jaro Creeks (2,842 feet) where access was granted. Similarly, Upper Salsipuedes Creek was snorkeled infrequently due to questions about access. The number of observed steelhead/rainbow trout in the following graphs represents the total number of fish observed. Generally, the most numerous size categories are the smaller size classes. For example, for all creeks in the June survey, most of the fish observed were in the 0-3 inch size category indicative of young-of-the-year.

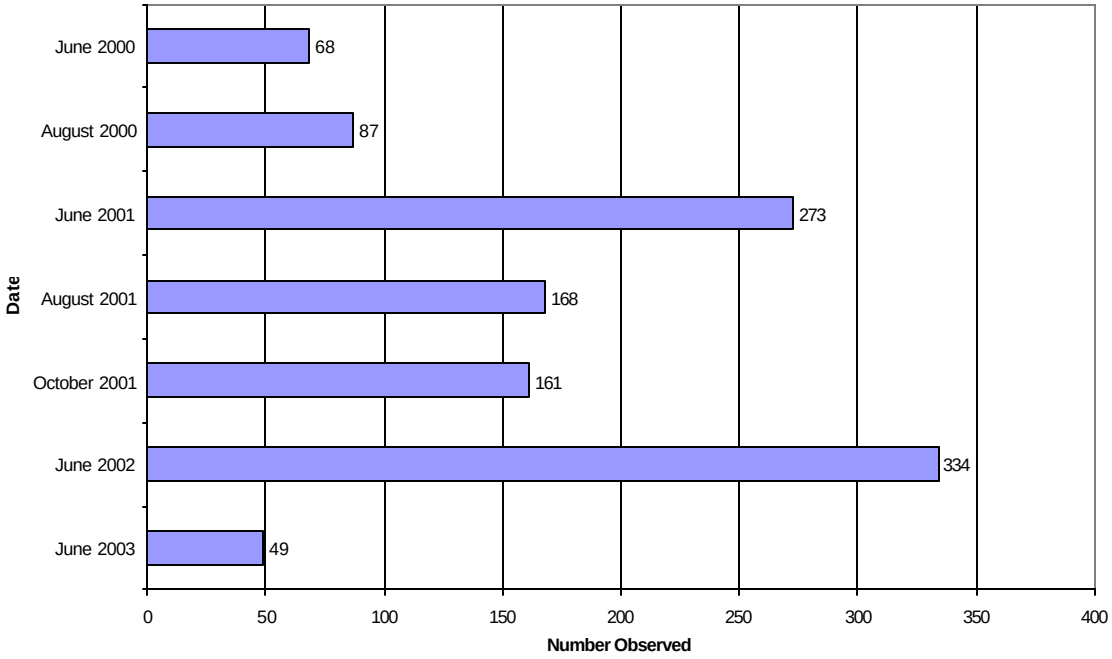
Production in Hilton Creek (Figure 3) has remained relatively constant during the June surveys with over 500 young-of-the-year observed each year. As the year progresses, there is generally a shift in the population size structure as fish move out of the creek, grow larger, or are predated upon by birds. Overall, Hilton Creek since the construction of the Supplemental Watering System has produced hundreds of young steelhead/rainbow trout each year. By the August and October surveys, many of the smaller fish have grown indicating good rearing conditions throughout the creek.

Figure 3. Hilton Creek Snorkel Survey Results 2000-2003 - 1,381' of Creek Snorkeled



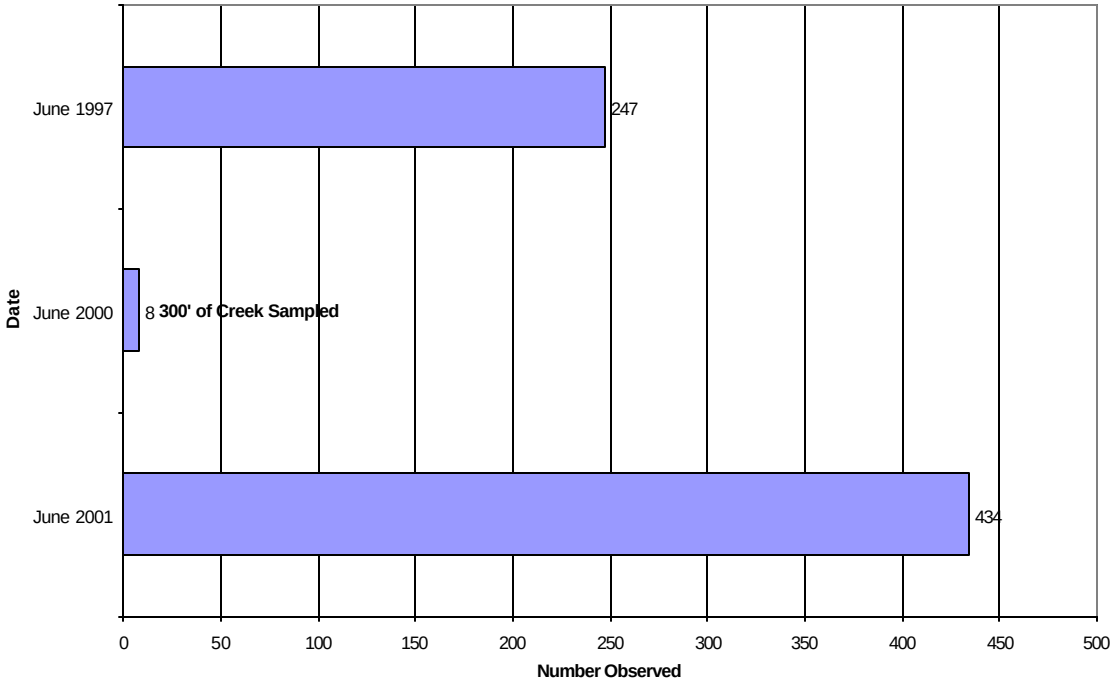
Nearly all of Quiota Creek is on private property (Figure 4) with the exception of a small section of 710 feet that is within the County of Santa Barbara right of way approximately 2 miles upstream of the confluence with the Santa Ynez River. This small region has consistently produced steelhead/rainbow trout despite the fact that there are eight road crossings that act as passage impediments. The majority of the spawning and production has been from resident fish within the creek. Once the crossings are modified to pass steelhead, this entire creek will be opened for adult steelhead migration increasing the opportunity for these adult fish to spawn within the creek and their progeny to survive to become steelhead. Generally, numbers have varied between 2000 and 2003. Unexpectedly, the largest number of fish (334) observed was during June 2002, the third driest year on record. In 2001, a wet year, 273 fish were observed in June. All other year types (2000 and 2003) fall within the "normal" rain year pattern with the small section of creek producing between 49 and 168 steelhead/rainbow trout.

Figure 4. Quiota Creek Snorkel Survey Results 2000-2003 - 710' of Creek Snorkeled



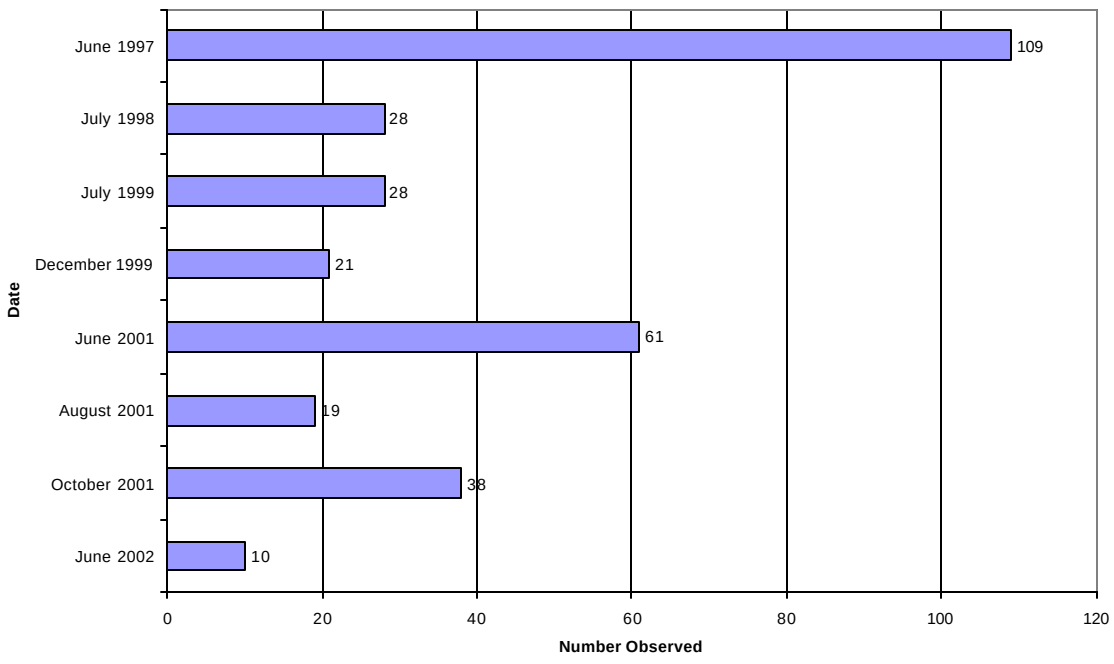
Few snorkel surveys have been conducted in Upper Salsipuedes (Figure 5) due to access issues. Snorkel surveys conducted in 1997 and 2001 documented several hundred young-of-the-year steelhead/rainbow trout. This creek has consistently produced large numbers of steelhead and during redd surveys, the Project has documented some of the largest steelhead redd constructions sites to date.

Figure 5. Upper Salsipuedes Creek Snorkel Survey Results 1997-2001 - Approximately 2,000' of Creek Snorkeled



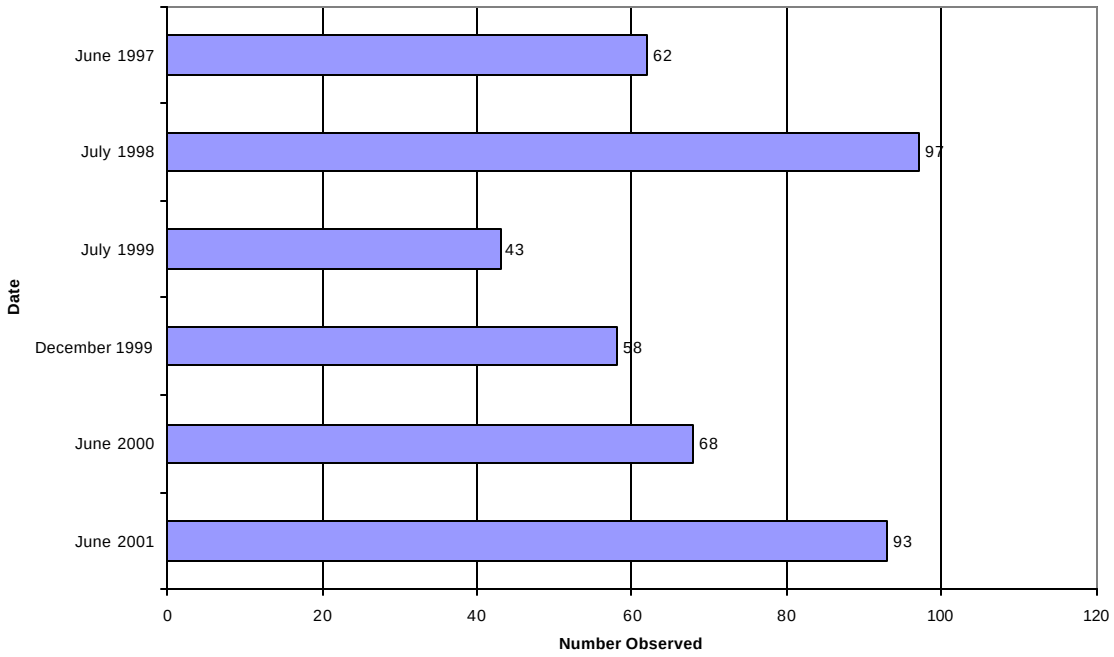
The section of El Jaro Creek sampled (Figure 6) includes those areas where access was granted. The sample area encompasses the section of creek from the confluence of Salsipuedes Creek upstream approximately 2,842 feet. Compared to other creeks, El Jaro has shown an overall decrease in fish produced. This has mainly to do with the several late storms over the years that have significantly reduced the number of steelhead/rainbow trout produced by scouring and burying redds during these late storms. In addition, pool and deeper run habitat types were filled in with sediments, eliminating their usefulness for rearing.

Figure 6. El Jaro Creek Snorkel Survey Results 1997-2002 - 2,842' of Creek Snorkeled



Lower Salsipuedes Creek was sampled regularly from 1997 through 2001 (Figure 7). For the last two years, access has been denied and no snorkel surveys have been conducted. Results from the surveys conducted indicate an overall increase in the steelhead/rainbow trout population in the creek. The majority of the steelhead/rainbow trout observed have been counted within the upper 5,000 feet of the creek where numerous pool and deep run habitats are present in addition to abundant riparian vegetation.

Figure 7. Lower Salsipuedes Creek Snorkel Surveys Results 1997-2001 - 18,216' of Creek Snorkeled



Snorkel surveys in the tributaries and mainstem of the Santa Ynez River have documented a wide range of observations. In fact, observations have been significantly different within the same year from tributary to tributary indicating different influences that affect the populations separately in each tributary. The primary reasons for the discrepancy of fish being observed include:

- Low returning adult population in the river, making steelhead/rainbow trout more susceptible to natural environmental fluctuations (lower watershed)
- Late season storm events that scour spawning locations and eliminate/limit future production (observed in Upper and Lower Salsipuedes and El Jaro Creeks)
- Insufficient passage events in both magnitude and duration to allow fish to migrate past impediments/barriers (Upper and Lower Salsipuedes Creeks, El Jaro Creek, Quiota Creek)

All of the above have contributed to affect the population by causing delays in migration and significantly reducing young-of-the-year production. The low adult population makes them more susceptible to impacts caused from migration delays and late season flow events.

1.5 Temperature monitoring network in the mainstem and tributaries throughout the year (January-December)

Optic Stowaway thermograph data loggers are deployed in several locations of the mainstem between mile 0.0 downstream to mile 24.0, and in the following tributaries: Hilton, Quiota, Nojoqui, Alamo Pintado, Salsipuedes and El Jaro Creeks. The data loggers are remote units that collect water temperature on an hourly basis 24 hours a day. The entire network is downloaded on a monthly basis to ensure the instruments are functioning properly. During the winter, some units are removed before high winter flows to save them from being damaged or destroyed.

The purpose of the thermograph network is to 1) determine the seasonal patterns of water temperature at each location, 2) determine diel variation in water temperature at each location, and 3) evaluate habitat quality and suitability for various fish species including steelhead/rainbow trout. In the tributaries, thermographs are typically deployed in run habitats. In the mainstem, thermographs are typically deployed in pools in an array form with the top thermograph approximately one foot below the surface, and the second on the bottom of the habitat. This is useful in determining the presence of cool water upwelling and the extent and duration of thermal stratification.

Results of water temperature monitoring are briefly discussed in the testimony presented by Charles Hanson and have been documented in a number of SYRTAC technical reports.

1.6 Weekly monitoring in the mainstem (May-November) to evaluate rearing conditions throughout the year (Residual Pool)

Weekly flow/habitat monitoring is conducted in the mainstem and tributaries to evaluate conditions throughout the year. Sites typically correspond to areas where steelhead/rainbow trout have been observed during snorkel surveys in order to ensure residual pool depth is being maintained.

1.7 Utilization of steelhead/rainbow trout habitat in the lower Santa Ynez River tributaries

Data collected through snorkel surveys conducted from 1997 to 2003 show a large variability in the number of steelhead/rainbow trout observed from year to year. This large fluctuation in numbers reflects the influences of seasonal variability on an already small reproducing population of fish. During years when winter conditions are favorable, typically El Nino type years, large storm events charge the watershed resulting in steady runoff that allow both upstream migration by adults returning from the ocean, and

juveniles who are migrating downstream to the ocean. Rain event timing is equally important. Even during years when there is successful migration and spawning is observed, late storm events occurring in April and May have frequently scoured and buried steelhead/rainbow trout spawning locations resulting in poor and sometimes no recruitment. Our snorkel data indicates that the carrying capacity of most tributary creeks is likely under utilized and, therefore, there is an existing opportunity for additional upstream ocean migrants to spawn and their young to rear in the tributaries downstream of Bradbury Dam.

2.0 Completed Projects

2.1 Salsipuedes Creek Fish Passage Project (Completed January 2002)

When CalTrans constructed the Highway 1 Bridge over Salsipuedes Creek it created a low flow passage barrier/impediment in the form of a concrete apron. This passage impediment has been a problem for decades to migrating steelhead during the winter migration period and during summer low flow conditions. At flows of 20 cfs and less, the concrete apron under Highway 1 acted as a complete passage barrier. Fish had to make a 5-6 foot leap onto the 20-foot long concrete apron in order to successfully negotiate past the barrier. When flows exceeded 20 cfs, steelhead were able to jump onto the concrete apron, however, doing so could potentially result in abrasion and laceration injuries to the fish. Additionally, large adult steelhead were vulnerable to poaching in the pool below the apron because of proximity to the Highway 1 Bridge where members of the general public can easily observe the fish.

During the summer, steelhead rearing below the barrier would be unable to reach cooler water located in areas just upstream. Studies have shown that adult, juvenile, and young-of-the-year steelhead that live in creeks and rivers with high summer water temperatures will seek out cool water tributaries and areas of cool water upwelling to oversummer and rear. During the summer, water temperatures in Salsipuedes Creek below the confluence with El Jaro can regularly exceed 25 C.

The solution to the problem was to create an opening in the apron by excavating three small pool habitats and bracketing them with a concrete wall at their downstream ends. Specifically, the construction activities modified the concrete structure of the apron to create a migration pathway for steelhead during low flow periods. Reinforced concrete was used to create three small pool areas in the lower portion of the structure, which create a backwater effect and reduce the height of the 5-6 foot vertical barrier to approximately 1.5 feet. The project also involved constructing additional concrete structures to redirect flow from existing structures to enhance depth of flow through the re-configured low-flow pathway. Collectively, these actions will enhance steelhead/rainbow trout migration during low flow periods by focusing the flow into a confined area and reducing the effective height over the barrier. During higher flows (greater than 20 cfs), water will cascade over the entire structure as it currently does without impediment, and fish can continue to migrate over the crest during high flows.

Success of the Salsipuedes Creek Fish Passage Enhancement Project

The Salsipuedes Creek Fish Passage Enhancement Project already is a success in its ability to allow migration by various sizes of fish under low flow conditions. In 2002, the first year of operation and the 3rd driest winter on record, a total of 13 young adult and juvenile steelhead between 5.1-15.3 inches were able to migrate through the structure when flows were less than 5.0 cfs (Figure 8). Average flows through the structure when steelhead were captured were 2.6 cfs (range 2.2-3.3 cfs) (Figure 9). Without this barrier repair, these fish would have been stranded at this location since flows did not increase above 5.0 cfs for the entire winter.

In 2003, a normal rain year, more fish moved through the system. A total of 25 upstream migrants were captured ranging in size between 3.5-27 inches. Average flow through the structure when adult and juvenile steelhead were captured was 3.7 cfs (range 2.5-11.0 cfs; Figure 10). The largest fish observed to date passing through the structure was a 27-inch female steelhead that moved through the structure when flow was 6.2 cfs. Again, the upstream migration of this large steelhead would not have been possible without the impediment being repaired.

In sum, the improvement of this structure has had positive effects on the steelhead population inhabiting the Salsipuedes Creek watershed by:

- Allowing continuous access past the barrier to optimal spawning habitats upstream.
- Eliminating the lengthy waiting period between storms for upstream migrants who are otherwise unable to pass at this location if flows decrease to less than 20 cfs.
- Reducing the likelihood of poaching since the fish are no longer trapped in the pool.
- Allowing multiple size classes of fish to move freely upstream to seek out cooler rearing locations during the summer.

Figure 8. 2002-03 Migration Results after Completion of Enhancement Project

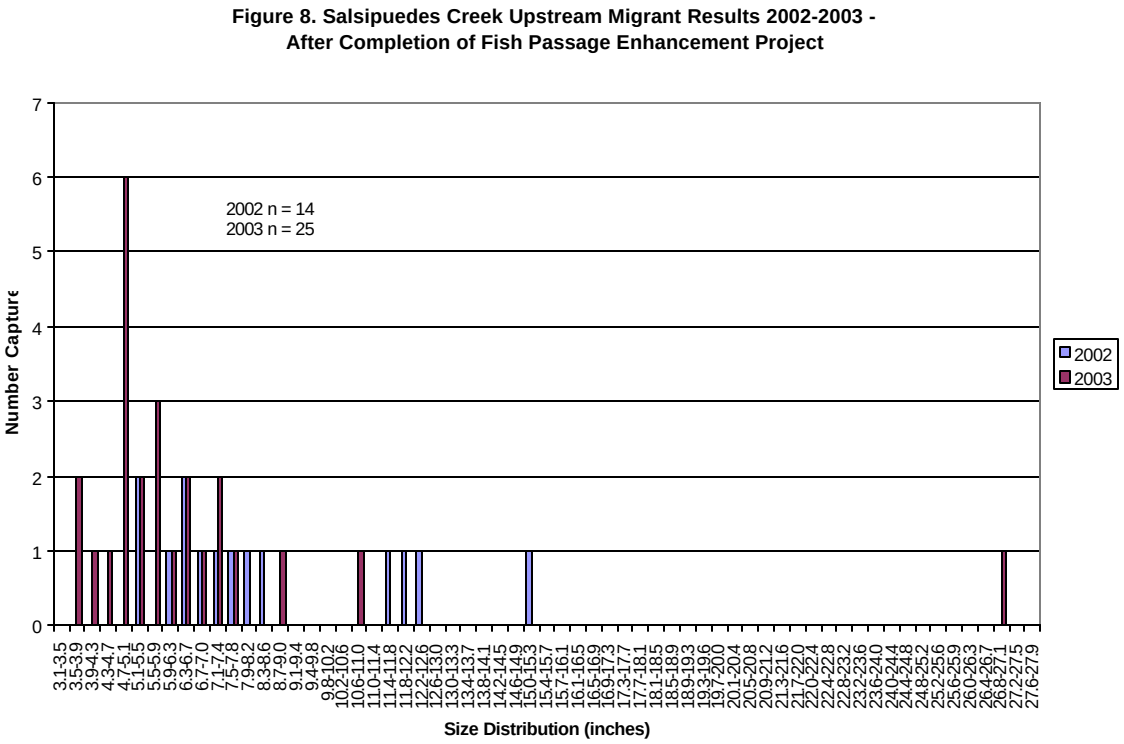


Figure 9. 2002 Upstream Migrant Captures vs. Flow

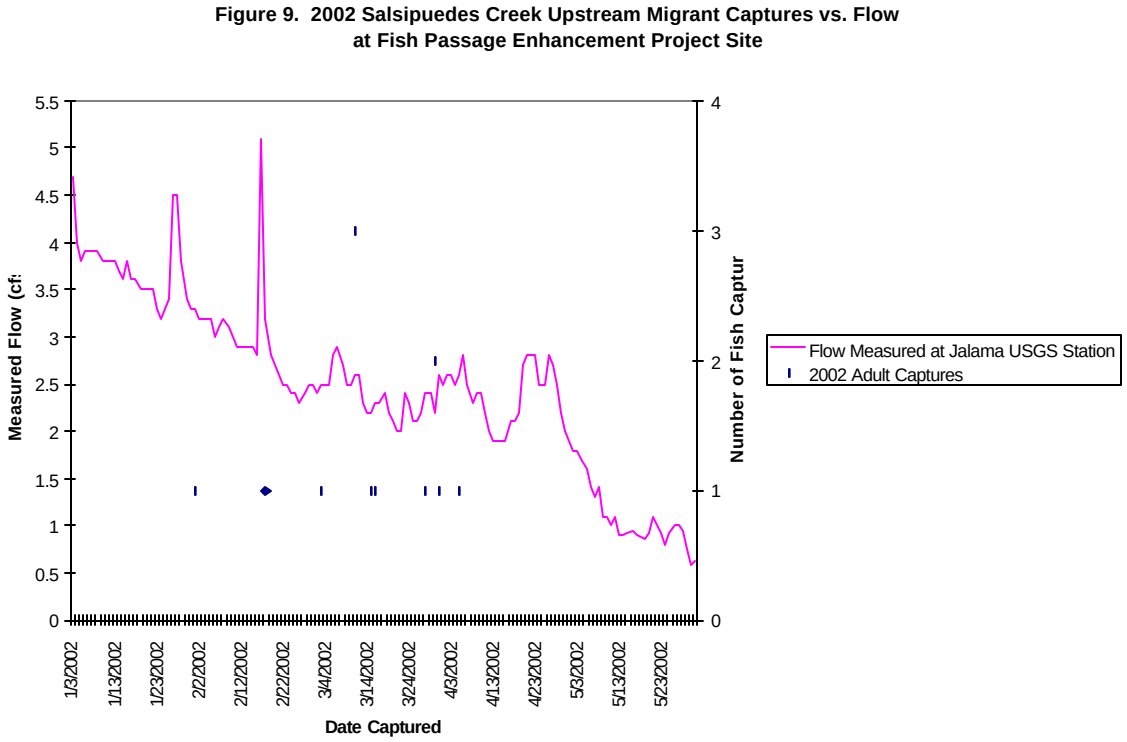
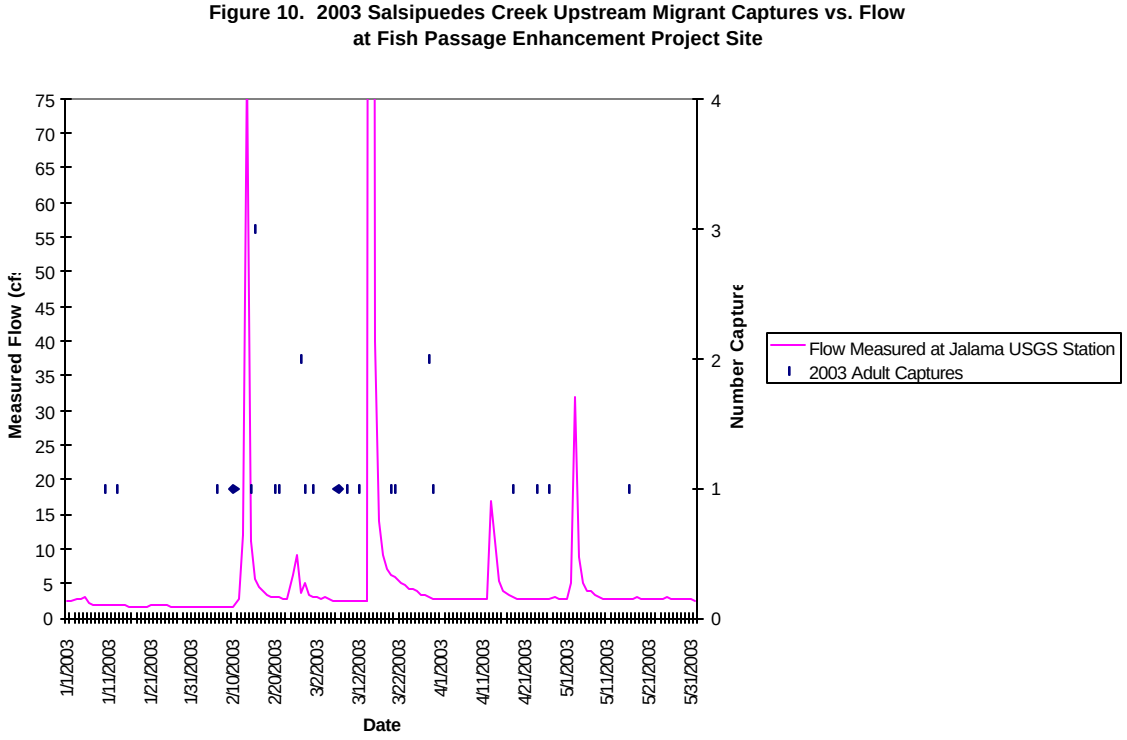


Figure 10. 2003 Upstream Migrant Captures vs. Flow



2.2 Hilton Creek Supplemental Watering System (Completed April 1999)

Hilton Creek is a small tributary that enters the mainstem immediately downstream of Bradbury Dam. The habitat within Hilton Creek has been classified as conducive to steelhead spawning and rearing, but steelhead utilization is limited by intermittent flows and several passage impediments. The watershed is estimated to be approximately 4 square miles, and approximately 2,980 feet of the creek is located on U.S. Bureau of Reclamation (Reclamation) property, including the confluence with the Santa Ynez River.

The various enhancement measures described below were designed to improve conditions in Hilton Creek and increase steelhead utilization by improving access to spawning and rearing habitats. The following are a list of actions designed to increase steelhead production and survivability in Hilton Creek:

- Augmenting streamflow through use of a supplemental watering system to release water for flow related enhancements by providing excellent year round rearing conditions for steelhead inhabiting the creek;
- Enhancing instream and riparian habitat within the existing channel of Hilton Creek at selected locations by planting willow waddles and increasing complexity in pool habitats; and
- Improving fish passage past migration impediments by lengthening the window of opportunity passage flows are available.

Supplemental Watering System

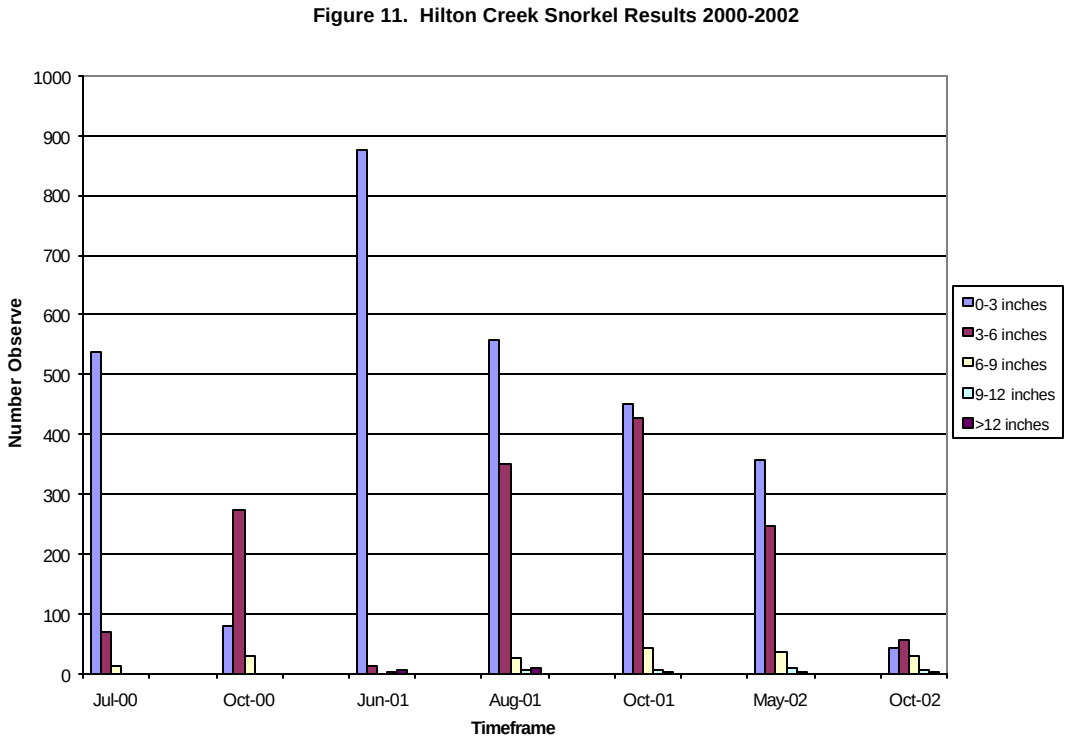
Streamflow in Hilton Creek is intermittent and the objective of the supplemental watering system is to provide a dependable year-round source of cool water to allow fish to survive the summer months until natural flow resumes in the winter. Construction of the supplemental watering system was completed in the fall of 1999, and the system is presently being used to support a steelhead population in Hilton Creek.

A pipeline extends from Lake Cachuma to Hilton Creek and is split into 3 separate release points. Two are located in Hilton Creek while the third outlets into the spilling basin. The upper release point into Hilton Creek is situated near the upper Reclamation property boundary and is seldom used at this point. The lower release point is located just upstream of a bedrock chute. This release point has successfully increased long-term steelhead/rainbow trout production and summer rearing. Since 1999, the re-watered portion of Hilton Creek has consistently produced between 400-900 young steelhead/rainbow trout each year following the spawning season. We have observed smolts migrating out in 2001, 2002, and 2003 with nearly 20 observed moving downstream in 2002.

Success of the Hilton Creek Supplemental Watering System

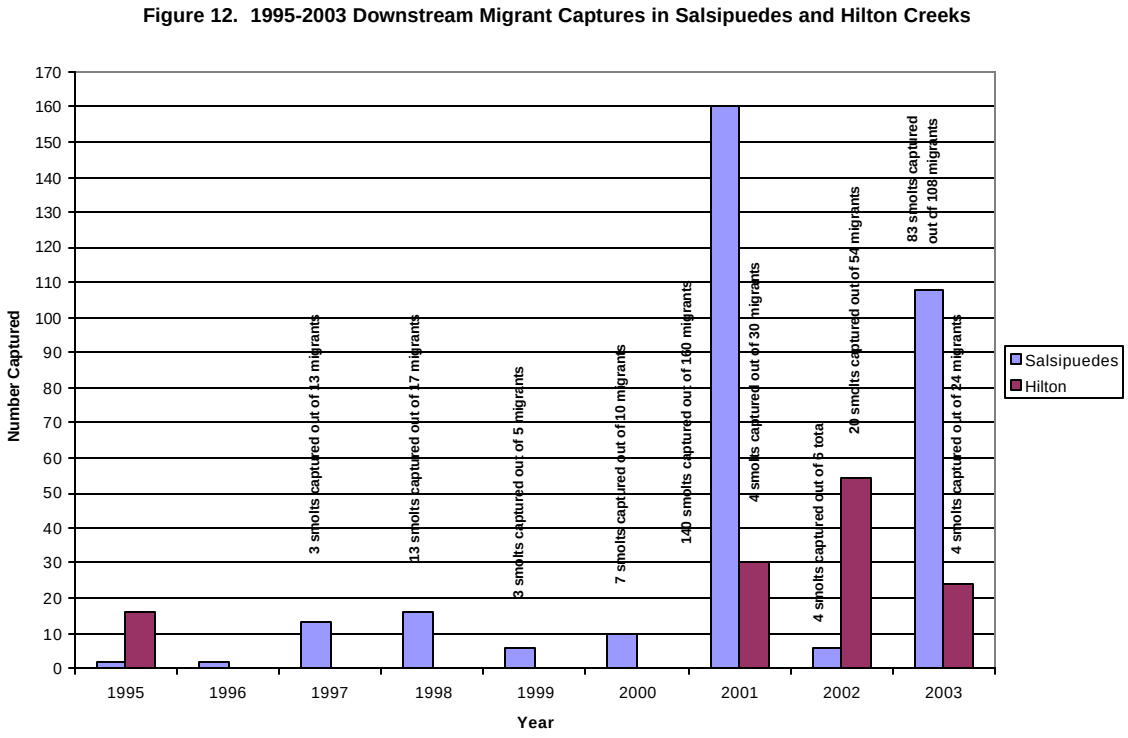
Since completion of the watering system, we have documented successful spawning and rearing from 2000 to the present. During each year, between 400-900 young steelhead have been documented rearing in the creek (Figure 11). The decrease in the numbers of rearing steelhead/rainbow trout seen in October 2002 in Figure 1 indicates the influence of bird predation on the population in Hilton Creek. With the increase in riparian vegetation and the selective placement of bird exclusion devices, this problem can be controlled and the effect on the steelhead/rainbow trout population will be eliminated.

Figure 11. Hilton Creek Snorkel Results Since Operation of Hilton Creek Watering System



Smolts have been documented moving downstream during the winter migration period (Figure 12). During each year of operation, the project has documented smolts migrating downstream to the ocean to become steelhead. While the total numbers captured to date are small, there is great potential for this system to produce significantly more smolts. The small number of smolts captured in 2002 reflects the effects of the 3rd driest year on record where limited rainfall failed to generate sufficient flows to induce a downstream smolt migration.

Figure 12. 1995-2003 Downstream Migrants in Salsipuedes and Hilton Creeks – Note Smolt Captures by Year in Hilton Creek



Riparian Vegetation Enhancement

The Hilton Creek watering system has had a substantial positive benefit to the riparian corridor downstream of the lower release point. Since 1999, there has been significant recruitment of native willow, cottonwood, sycamore and alder trees along the banks of the creek. The following pictures showcase the growth of these trees over the last several years. The benefits these trees provide are very important to the growth and survival of all age classes of steelhead and include:

- Increased cover from bird predation
- Increased shading which helps reduce thermal heating of the water during the summer
- Increased food availability (terrestrial insects falling into the water)
- Increased bank stabilization during high flow events, and
- Increased overall rearing habitat (root wads, fallen woody debris, overhanging vegetation etc.).

These trees started to grow naturally in 1999 due to the constant source of water provided by the Hilton Creek Watering System. Currently in 2003, many of these trees are over 15 feet in height. Supplemental planting has also been conducted in some of the lower sections of the creek using willow waddles and has been very successful. However, the vast majority of the new growth has been a result of natural recruitment.

3.0 Future Projects

3.1 Quiota Creek fish passage project to fix passage problems at 8 road crossings

Quiota Creek is a main tributary of the lower Santa Ynez River located about 8.4 miles downstream of Bradbury Dam. Refugio Road is a Santa Barbara County road that crosses the creek 9 times in approximately 3 miles. Eight of these crossings are in poor condition and represent passage impediments and in some cases direct barriers that limit the opportunities for steelhead spawning and rearing in the upper areas of Quiota Creek. The County of Santa Barbara is slated to repair three of the crossings with permanent bridges while the remaining five crossings will be modified by COMB to increase passage opportunities for migrating steelhead/rainbow trout. The Cachuma Operation and Maintenance Board has been very proactive in applying for grants for fish passage projects, receiving more than one million dollars in grant funding. Repairing these crossings will provide approximately 2 miles of additional habitat for steelhead to utilize. The instream habitat is considered to be of high quality and the adjacent riparian zone is well developed and comprised of mature coastal live oak, California bay laurel, California sycamore, big leaf maple and red alder.

Due to property access issues, habitat typing surveys, snorkel surveys, and migrant trapping has been limited. In 1995 access was granted briefly to conduct migrant trapping with very limited results. Since then, surveyors have focused on conducting surveys along the portions of creek that are adjacent to the road and within the county easement. Results of those surveys show that a resident population ("seed population") exists within the middle and upper reaches of Quiota Creek and also indicate that the creek is able to support steelhead/rainbow trout during long drought periods. Water temperatures within the creek during the summer are among the coolest observed in the lower watershed.

3.2 Hilton Creek Fish Passage Improvement Project

A cascade and bedrock chute is located approximately 1380 feet upstream from the confluence with the river and is a passage impediment for upstream migrating steelhead/rainbow trout. The cascade is approximately 6 feet in height with a shallow pool at the base of the cascade. The bedrock chute immediately above the cascade is about 140 feet long. Passage is possible during very brief windows of opportunity, but is extremely difficult during high velocity flows due to the lack of deeper pool habitat and resting sites.

Since it is unknown whether the impediment is due to the height of the cascade or the high-flow velocity in the bedrock chute, the project concentrates on modifying the hydraulic conditions at both of these impediments. Specifically, the project focuses on improving passage upstream of the plunge pool since adult steelhead/rainbow trout have been observed in the pool habitat.

The project design involves creating a backwater effect in the plunge pool by constructing two cast in place concrete channel obstructions (roughness elements) which will increase the depth of the pool during higher flow events, modifying the streambed near the crest of the cascade thereby slightly reducing the jump height and allowing a resting pool at the top of the cascade, and creating five cast in place concrete elements in the bedrock chute area upstream to slow down water velocities and create resting places for steelhead/rainbow trout that are moving through the region.

Once this project is constructed it will more than double the available rearing and spawning habitat within the Hilton Creek watershed, increasing the likelihood of increased smolt production the following years.

3.3 Jalama Bridge Fish Passage Project on Salsipuedes Creek

Jalama Road Bridge is a county owned facility that crosses Salsipuedes Creek approximately 2.5 miles upstream of the confluence with the Santa Ynez River. Prior to 2001, this section was not an impediment to migrating steelhead/rainbow trout. However, a large magnitude storm event in March of 2001 removed portions of bedrock that acted to create a backwater effect allowing steelhead to successfully negotiate the barrier. With the section of bedrock missing, there is now a fish passage impediment at this location. The repair at this location is nearly identical to the Salsipuedes Creek Fish Passage Project at Highway 1 (1/4 mile downstream) that was completed in January of 2002.

This fish passage impediment is important to repair for the southern California steelhead inhabiting in the lower Santa Ynez River. Once repaired, this impediment will open up miles of additional spawning and rearing habitat and will provide steelhead/rainbow trout access to cool water areas directly upstream during the summer months.

3.4 El Jaro Creek sediment control projects/demonstration projects

The demonstration projects are located along El Jaro Creek, a tributary to Salsipuedes Creek. The El Jaro Creek watershed is characterized by rolling hills of oak savanna and Mediterranean annual grasses. Lands in the Salsipuedes/El Jaro watershed are mainly in private ownership. Existing land uses include cattle ranching and dry farming techniques.

The demonstration projects involve: 1) the removal of an undersized culvert and stabilization of the stream channel and adjacent streambanks within the small ephemeral drainage; 2) stabilization of an exposed side draw located 100 feet downstream of the existing culvert; and, 3) stabilization of an eroding streambank along El Jaro Creek.

An additional component is a workshop discussion with landowners regarding non-point source pollution associated with streambanks and upland soil erosion in the watershed. The focus of the discussion will be on management actions property owners can take to reduce soil erosion on their properties. A follow-up public workshop will provide details for the technical implementation of the demonstration projects and present methods for monitoring the project success in terms of water quality and instream habitat restoration.

Culvert Removal Project

The culvert at this particular site is a relict of the former Highway 1 alignment and is undersized for the drainage resulting in storm water runoff that passes over the former roadbed, scouring a gully downstream of the culvert. The repair involves removing the undersized culvert and stabilizing the culvert area to prevent the release of sediment captured upslope of the culvert, and stopping the headcut migration in the gully upslope of the culvert.

Sidedraw Stabilization Project

Immediately downstream of the culvert project, flows within the same drainage have eroded a near-vertical streambank situated along a bend in the drainage. Geoweb or gabion baskets filled with rock will be used to stabilize the embankment that will also help save several large, mature oak trees.

El Jaro Creek Floodplain Enhancement Project

The floodplain enhancement project is located immediately downstream of the above referenced sidedraw stabilization. The purpose of the project is to reduce the amount of silt input into the creek, stabilize the bank to prevent future bank failures, and enhance the floodplain around the project area by planting native riparian vegetation. The project entails constructing a hard toe against an unstable hillside using 4-5 ton boulders. The boulders will be placed in such a way that the top of the rocks is consistent with the bankful elevation. The area behind the boulders will be backfilled with native soil

obtained from an existing slump along the bank. Native vegetation will be planted behind the toe to further stabilize the streambank and prevent further sediment inputs to the stream at this location.

Once these projects are complete, two public workshops will be held with local landowners to discuss non-point source pollution associated with streambank and upland soil erosion in the Salsipuedes/El Jaro Creek watershed. The focus of the workshops will be on positive management actions property owners can take to reduce soil erosion on their properties. A follow-up workshop will provide details for the technical implementation of the demonstration projects and methods for monitoring the project success in terms of water quality and instream habitat restoration.

4.0 Public Outreach

There has been statewide interest in our projects. This has resulted in a number of speaking opportunities at various biological seminars during 2002 and 2003. The Cachuma Operation and Maintenance Board also has a website that is updated regularly to provide information to the general public on study activities and basin projects.

5.0 Conclusion

Since the adoption of NOAA Fisheries Biological Opinion for the Cachuma Project in September 2000, COMB has successfully improved spawning and rearing conditions within the lower Santa Ynez River and its tributaries by the creation of new habitat in Hilton Creek and by implementation of the Fish Passage Enhancement Project on Salsipuedes Creek. Monitoring efforts now show smolt migration out of Hilton Creek; something that would not be possible without the new Supplemental Watering System funded and constructed by the Cachuma Member Units. In addition, with only that portion of the Hilton Creek on Bureau of Reclamation property receiving supplemental water, hundreds of steelhead/rainbow trout are now being naturally produced each year. Moreover, through the efforts of the Cachuma Member Units, adult steelhead/rainbow trout are now freely migrating up to, and juvenile smolts migrating down from, the upper reaches of Salsipuedes Creek whereas, before, migration to habitats within the upper reaches of the creek was highly limited to non-existent. The next projects to be constructed include fish passage enhancement projects on Hilton, Quiota, and Salsipuedes Creeks. These projects- like those already accomplished-will significantly improve adult steelhead/rainbow trout access to all of these creeks and boost the overall steelhead/rainbow trout population within the lower watershed.