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Written Testimony of Thomas P. Keegan
October 14, 2003

Skills, Knowledge, and Expertise

I am a fisheries biologist and aquatic/estuarine ecologist with over 24 years of experience working with salmonids in rivers and streams throughout the Pacific Northwest, and northern and southern California. Specific to southern California, I have conducted research on steelhead (and other special-status fish species) issues on the Santa Ynez River, Santa Clara River, Malibu Creek, San Mateo Creek, Cayucos Creek, and numerous small coastal creeks and estuaries. I have special expertise in evaluation of water project impacts (i.e., dams, diversions, and alterations to streamflows and other physical habitats) to special-status fish species, in particular, steelhead, winter-run and spring-run Chinook salmon, and coho salmon, including their early life history, instream habitat requirements, and estuarine behavior. I have authored or co-authored hundreds of EA, EIS, EIR documents, Biological Assessments, Technical Reports, and other research papers regarding impact assessments to steelhead, Chinook and coho salmon, sierran trout, and other special-status fish species.

Specific Areas of Expertise: Relative to the Santa Ynez River System

I was a member of the Santa Ynez River Technical Advisory Committee (SYRTAC) at its inception for about 2 years, on behalf of the Cachuma Conservation Release Board. I assisted in the development of the initial study design and supervised (and conducted) initial sampling efforts in the Santa Ynez River basin for collecting data on the steelhead population and aquatic habitat. I assisted in initial surveys to determine use of steelhead in tributaries to the Santa Ynez. I conducted sampling efforts and habitat evaluations downstream of Bradbury Dam, including the mainstem, tributaries, and lagoon, and performed site visits throughout the basin upstream of Bradbury Dam. I also assisted in the preparation of the first annual data report to the Santa Ynez River Consensus Committee.

Education and Training

I have a B.S. degree in Fisheries Science from Humboldt State University (1979). My resume is attached to this statement.

Membership in Professional Societies

I am a member of the American Fisheries Society (AFS) and The American Institute of Fishery Research Biologists (AIFRB). I am currently the Director of the Northern California District of the AIFRB (since 2001), and am certified by that organization as a professional fishery research biologist. In August 2003, I was elected by the AIFRB National Board of Directors to be the Chairman of National Membership.

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Basis for my Opinion

My expert opinion put forth in this statement comes from over 24 years experience as a fisheries biologist and ecologist; my first hand experience with southern California steelhead and habitat assessment, including the Santa Ynez River steelhead population; and my review of pertinent environmental documents and data that have been produced for this project.

I have studied steelhead and steelhead habitat conditions in the Santa Ynez River basin, including the mainstem and tributaries both above and below Bradbury Dam, and the lagoon. I have first hand knowledge of habitat and water quality conditions in the river system and lagoon. I participated in the Santa Ynez River Technical Advisory Committee from its inception for about 2 years. I have also conducted upstream passage studies of steelhead and salmon, both in the Pacific Northwest and in northern and southern California. My studies with steelhead in Northern California and Southern California include assessment of flow requirements at critical life stages, including upstream passage and spawning of adults, downstream passage and instream rearing of juveniles, and rearing of smolt steelhead in the lagoon setting.

My opinion is also formed from my review of many of the environmental documents that have been produced for this project. I have reviewed the *NMFS Biological Opinion* (2000) [Staff Ex. 9], the *Biological Assessment* (1999) for the current project [Staff Ex. 10], the *Cachuma Project Contract Renewal EIS/EIR* (1995) [Staff Ex. 5], and the *Entrix Revised Fish Resources Technical Report* (1995) [Ex. CT 35]. I reviewed data and several documents produced by the SYRTAC, including the *Habitat Analysis for the Santa Ynez River* (i.e., top-width analysis) [Ex. CT 36] and the *Adult Steelhead Passage Flow Analysis (1999)* [Ex. CT 39]. I also reviewed the Draft *Santa Ynez Instream Flow Need Study* (IFIM) by DWR (1989) [Ex. CT 37]. I also reviewed the *Lower Santa Ynez River Fish Management Plan (2000)* [Ex. DOI-1f] including the *Upper Basin Actions for the Protection and Enhancement of Southern Steelhead in the Santa Ynez River (Appendix E),* and the *Flow-Related Fish Enhancement in the Santa Ynez River (Appendix B).* I have recently reviewed the SWRCB *Draft Environmental Impact Report for consideration of modifications to the U.S. Bureau of Reclamation's Water Right Permits 11308 and 11310* (2003) [Staff Ex. 10]. I have also reviewed the work by Shapovalov and Taft (1954), Dr. Jennifer Nielsen (*Molecular Genetic Population Structure in Steelhead/Rainbow Trout from the Santa Ynez River,* 1998) and Dr. Jerry Smith (California State University, San Jose), regarding assessment of lagoon habitat for steelhead rearing in central and southern California river systems.

Introduction

The Santa Ynez steelhead population is considered to be a remnant run. Historically numbering in the thousands, less than 100 fish currently make up the annual escapement. The cause for the collapse of the Santa Ynez steelhead fishery is largely due to construction of Bradbury Dam, but has been further exacerbated by the manner in which the Cachuma Project was and is operated. Based on my review of the project-related data and reports identified under the Basis for my Opinion, current operations (DEIR Alternative 2 with interim flows) have not resulted in improved conditions to the

steelhead population. However, I believe there is an opportunity to improve the current status of the fishery. I therefore urge the SWRCB to consider modifications to the water rights permits that will allow for improvements to the fishery. The Bureau of Reclamation (BOR) should not only adhere to project operations as required in the NMFS Biological Opinion (including the 14 Reasonable and Prudent Measures), but BOR should also implement the three Conservation Recommendations. Even so, these actions should be considered as a starting point for restoration of the Santa Ynez steelhead population. I believe that flow augmentation, over that proposed for all of the alternatives in the DEIR including alternative 2, alternate 3 series, and alternate 4 series, will be necessary to achieve restoration of the Santa Ynez steelhead population.

More study is necessary on effects of proposed flows, including water rights releases and fish flows, on critical life stages, adult upstream migration through the mainstem, juvenile downstream outmigration in the mainstem, and lagoon conditions. In addition, there needs to be a better evaluation of the current conditions resulting from implementation of Alternative 2 with interim flows.

The Santa Ynez River historically supported a very large run of steelhead that has been substantially impacted by the construction of Bradbury Dam, and further reduced by operation of the Cachuma Project. Construction of Bradbury Dam has resulted in a migratory barrier for steelhead and other species (e.g., Pacific lamprey) to reach the most important (qualitative and quantitative) spawning grounds in the Santa Ynez basin, interruption of downstream sediment movement, and reduction of downstream movement of suitably sized spawning gravels for steelhead and other species. Together with the operation of the Cachuma Project, the natural hydrology has been severely and adversely affected, with disastrous results on the native aquatic and riparian resources of the Santa Ynez River. In addition, the lagoon no longer functions as a necessary and integral part of the system for steelhead rearing, or for other freshwater, estuarine, and marine species.

Good condition

Using Dr. Peter Moyle's definition of "good condition", of which I agree for the Santa Ynez River, there are 3 levels to be concerned with: individual, population, and community. The individual level implies healthy individual fish, free from disease, with good growth and the ability to respond appropriately to stimuli (e.g., avoid predators and unsuitable water quality conditions). The population level is made up of healthy fish, with multiple age classes (evidence of successful reproduction and recruitment) and a viable population size (such that it will not go extinct from random factors or unusual events, such as drought). Viable population size can be implied from presence of extensive good quality habitat for all life stages. Community level means that a dynamic assemblage species is present, dominated by co-evolved species.

In my opinion, based on review of project documents and first hand knowledge of the project and habitat conditions in the Santa Ynez River, the Santa Ynez River steelhead population is not currently in good condition below Bradbury Dam, nor will it likely achieve that status under any of the DEIR alternatives. The Santa Ynez steelhead population does not meet the criteria for good condition. Their general absence from

habitats in and below the Alisal Reach is indicative of unsuitable conditions. Steelhead that are present in the mainstem below Bradbury Dam are not abundant in multiple age classes, and extensive good quality habitat is not currently present for all life stages. Finally, the current fish species assemblage downstream of Bradbury Dam is dominated by non-native species.

Upstream passage of adult steelhead

The ability of adult steelhead to pass unimpeded from the ocean to upstream spawning grounds is a basic requirement for a successful steelhead restoration. Suitable conditions for upstream passage of adult steelhead include sufficient flow and depth of water, good water quality conditions, and the presence of deep pool resting habitat. The *Adult Steelhead Passage Flow Analysis (1999)* report, conducted by the SYRTAC using the "Thompson criteria", presents a cursory evaluation (study based on a small sample size) of passage that concludes a target flow of 30 cfs is adequate to achieve upstream passage for adult steelhead throughout the Santa Ynez River, with the exception of the Lompoc 1 transect where flows in excess of 100 cfs would be required to meet the full Thompson criteria. These evaluations are based on an assessment of identified "critical riffles" between Lompoc and just upstream of Refugio Road. Passage was also evaluated by NMFS and reported in the B.O., using criteria of 8 ft of contiguous wetted channel at 0.5 ft. of depth (BOR 1999). That analysis concluded that flows of 30 cfs at Lompoc (37 miles downstream), 15 cfs at Cargasachi (24 miles downstream), and 25 cfs at Alisal Bridge (10 miles downstream) are considered by NMFS biologists and hydraulic engineers as "close to the minimums at which passage is possible, not water depth and width that produce good migration habitat" (NMFS Biological Opinion).

The SYRTAC adult steelhead passage flow evaluation states that successful upstream passage would have occurred between 62 and 83 percent of the 75 year record under unimpaired flows (without the Cachuma Project), and from 50 to 83 percent (one day events) with the project. Although it is difficult to precisely compare passage conditions between project and no project condition, it appears that 'with-project' passage is reduced by 12 percent from 'no-project' passage. However, this percentage is higher for multiple-day passage conditions, which are generally necessary for unimpeded upstream passage. Upstream migration rates generally range from 8 to 31 miles per day for adult salmonids (Groot and Margolis 1991, as referenced in the Biological Opinion), indicating that adult steelhead would have required from about 1.5 to 6 days to ascend to the location of Bradbury Dam with suitable passage flows.

NMFS's evaluation indicates that during normal water years and normal project operations, successful passage (providing at least 14 days of passage per year) would occur in only 38 percent of years, increasing to 63 percent with proposed project supplemental migration flows (as determined using minimal, not good passage criteria). Alternative 3A2 in the Cachuma EIS/EIR presents flow strategy that would achieve successful passage in all but 17 years out of the 75-year record, or 84 percent of the entire record. Passage flows provided under Alternative 3A2 represent a pronounced increase over the project flows identified in the DEIR, which can only be considered as being adequate to sustain the current population.

Juvenile rearing and downstream passage of smolt steelhead

Currently, under the pre-surcharge Biological Opinion operations (Alternative 2 in the DEIR) conditions in the Santa Ynez River mainstem are not suitable for steelhead rearing. Historically, the portion of mainstem downstream from Bradbury Dam was primarily used as a corridor for upstream and downstream passage, but also provided limited rearing habitat for downstream migrating juvenile steelhead upstream from Solvang. Indications are that suitable habitat existed in the channel, with suitable riparian conditions to afford adequate water quality (including water temperature), cover, and prey items for young steelhead to rear. Removal of riparian resources for flood control and other construction activities, along with the absence of suitable flow conditions from the current project, have degraded mainstem rearing habitat. Limited rearing conditions do exist within 8 miles downstream of Bradbury Dam (including the Refugio Reach). Below the Refugio Reach, water temperatures and adequate surface flows are not adequate to continually allow for suitable rearing and production of steelhead.

Alternative 3A2 in the Cachuma Project Contract Renewal EIR/EIS (1995) would provide sufficient flow releases to improve downstream rearing conditions into the Alisal Reach, and likely below the Alisal Reach, through increased flow through the riffles and glides, thereby improving quantity (e.g., improvements in velocity and depth) and quality (e.g., increased prey drift) of shallow rearing habitat, while improving pool habitat conditions (e.g., flow input to pool and through-pool flow). Current project operations (Alternative 2) and the other alternatives in the DEIR do not provide flows necessary to improve degraded steelhead habitat downstream of Bradbury Dam as described above, and will not significantly improve juvenile rearing.

The SWRCB DEIR provides scoring criteria for steelhead habitat under different instream flow regimes (Table 4-41, Page 4-99). The underlining basis for the SWRCB DEIR criteria scoring is the NMFS Biological Opinion and the top-width based habitat vs. flow relationship.

TABLE 4-41
SCORING CRITERIA FOR STEELHEAD HABITAT

Life Stage	Flow Location	Months Considered	Scores ← better					worst →
			(5)	(4)	(3)	(2)	(1)	(0)
Passage	Alisal Rd.	January - April	≥ 14 days*	11 to 14 days	7 to 10 days	4 to 6 days	1 to 3 days	0 days
Spawning	Hwy 154	February - May	> 30 cfs	> 15 to ≤ 30 cfs	> 10 to ≤ 15 cfs	>5 to ≤ 10 cfs	>2.5 to ≤ 5 cfs	≤ 2.5 cfs
Fry Rearing	Hwy 154	April - August	> 10 cfs	≥ 5 to < 10 cfs	≥ 2.5 to < 5 cfs	≥1.5 to < 2.5 cfs	>0 to < 1.5 cfs	0 cfs
Juvenile Rearing	Hwy 154	January - December	≥ 10 cfs	≥ 5 to < 10 cfs	≥ 2.5 to 5 cfs	≥1.5 to < 2.5 cfs	>0 to < 1.5 cfs	0 cfs

* A 'passage day" is defined as a flow ≥ 25 cfs at the Alisal Road Bridge

The BORs Cachuma Project Contract Renewal EIS/EIR also provides scoring criteria for steelhead habitat (Table 6.4-1 Page 6.4-54). The underlining basis for Reclamation's criteria scoring is the Department of Water Resources IFIM (IFG-4 model). There is a discrepancy between scoring standards that is not readily understandable.

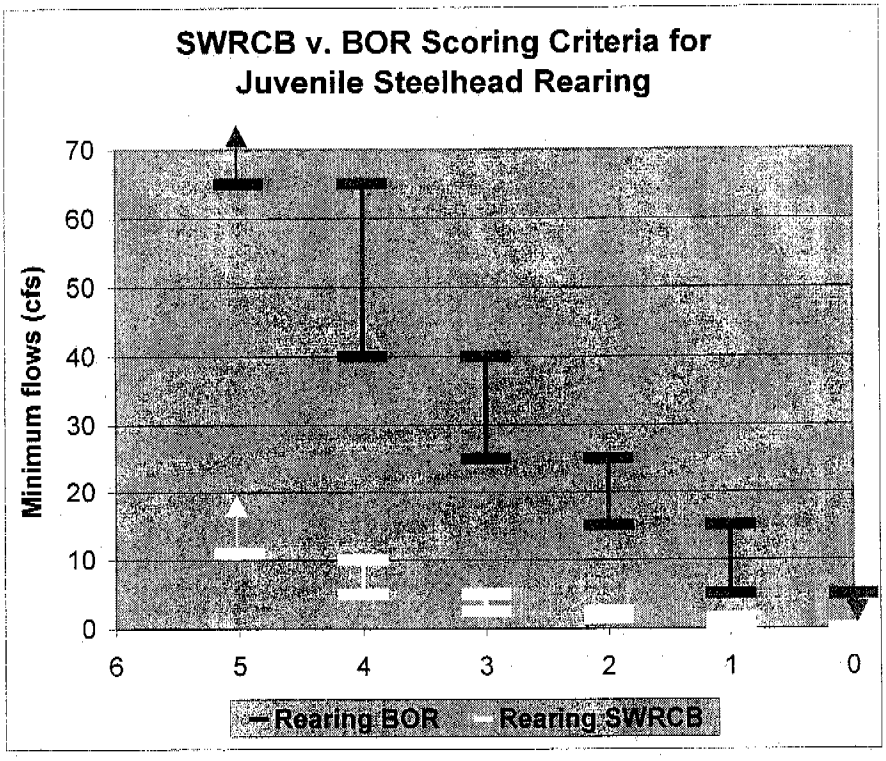
TABLE 6.4-1
SCORING CRITERIA BY LIFESTAGE FOR STEELHEAD IN THE SANTA YNEZ RIVER, ABOVE REGUGIO ROAD

Life Stage	Scores ← better					worst →
	(5)	(4)	(3)	(2)	(1)	(0)
Passage	> 25 cfs*					≤ 25 cfs
Spawning	>70 cfs	≤70 and ≥ 45 cfs	<45 and ≥ 35 cfs	<35 and ≥ 25 cfs	<25 and ≥20 cfs	< 20 cfs
Fry Rearing	<160 and ≥ 50 cfs	>160 cfs <50 and ≥ 30 cfs	<30 and ≥20 cfs	<20 and ≥ 10 cfs	<10 and ≥1 cfs	<1 cfs
Juvenile Rearing	≥65 cfs	<65 and ≥ 40 cfs	<40 and ≥ 25 cfs	<25 and ≥ 15 cfs	<15 and ≥5 cfs	<5 cfs

* Passage is defined as a flow > 25 cfs at the Floradale Bridge Feb. to April.

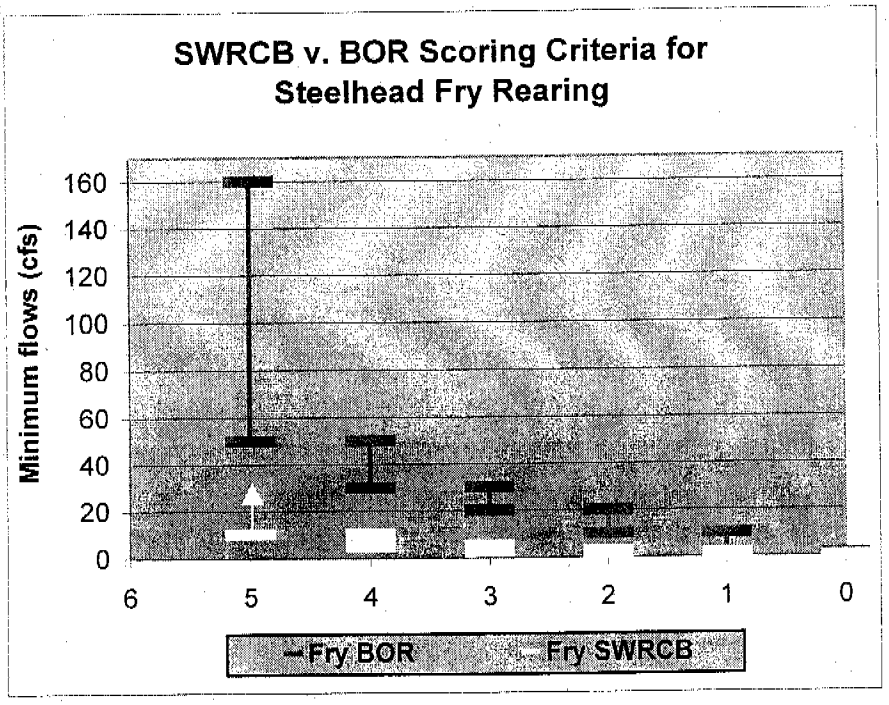
For example, the highest score (a value of 5) obtainable for juvenile rearing under BORs criteria results from flows greater than or equal to 65 cfs. However, under SWRCB criteria, the highest score is obtainable for flows greater than only 10 cfs (See Figure 1).

Figure 1.



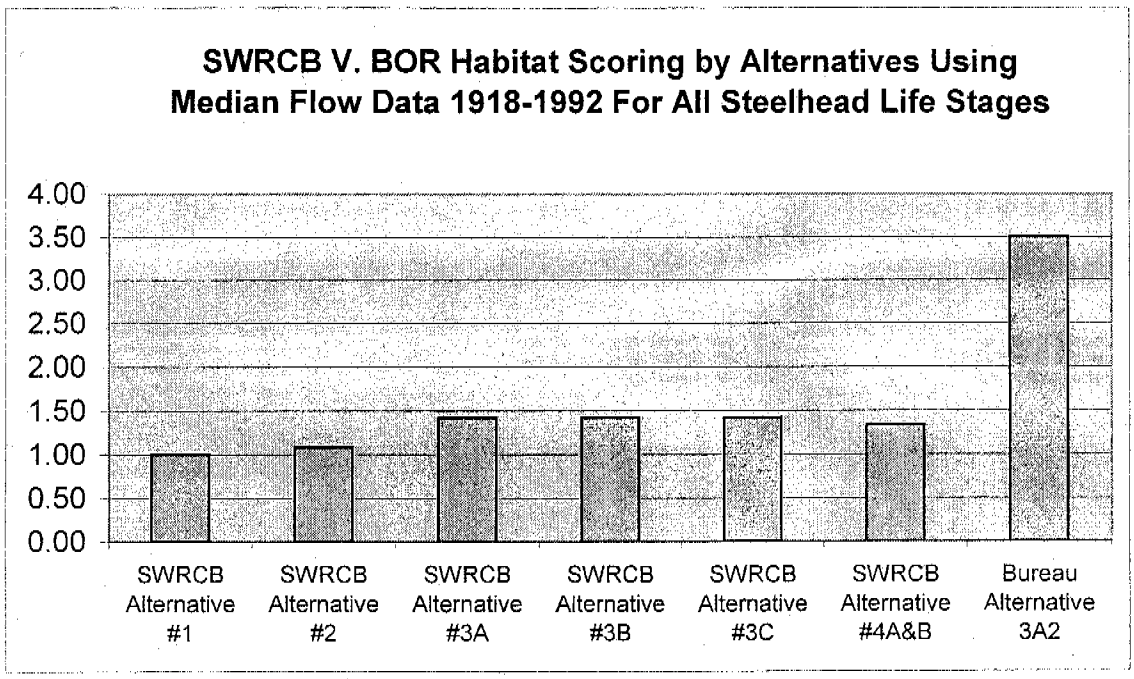
Likewise for fry rearing, the highest BOR score is for flows greater than or equal to 50 cfs and less than 160 cfs, while under SWRCB DEIR, the highest score is for flows again greater than only 10 cfs (See Figure 2).

Figure 2.



The result of the SWRCB DEIR revised criteria are similar scores among alternatives 3A, 3B, 3C, 4A-B for adult migration (Table 4-42), spawning (Table 4-43), fry rearing (Table 4-44), and juvenile rearing, (Table 4-45). In all cases, alternative 2 has a lower score than the other alternatives, but not as low as Alternative 1 (historic) scores. However, if the mean monthly flows that are scored using the top-width based approach in the SWRCB DEIR are scored against the IFIM based criteria presented in the BOR EIS/EIR, the scores among all alternatives other than 3A2 are relatively similar, with historic operations (alternative 1) and current operations (alternative 2) having somewhat lower values, alternatives 3A, 3B, 3C, 4A-B being similar to each other, and 3A2 having substantially (two-fold) higher values than the rest (See Figure 3).

Figure 3.



Top-width based model vs. IFIM for evaluating juvenile rearing habitat

The use of the top-width method can be useful for evaluating changes in overall habitat associated with changes in stream flow for specific channel configurations and habitat types (runs and pools), but is not generally appropriate for determining the amount of usable habitat (i.e., cannot assess whether suitability criteria are being met). The SYRTAC *Habitat Analysis for the Santa Ynez River (1999)* report presented a set of assumptions (associated with the absolute and relative change in top-width from one flow to the next) pertaining to the use of this method and interpretation of the results. These "assumptions" provide a framework for evaluating the data collected during this study; however, many of these assumptions are misleading and may only apply to specific channel morphologies and habitat types (runs and deeper pools), and are generally not appropriate for determining changes in usable habitat in riffles, glides, and possibly shallow pools. To determine changes in actual usable habitat (for all life stages), data on key habitat parameters and characteristics (e.g., depths and velocities across the channel, substrate composition and structure, water temperature, etc.) is essential.

The following assumptions and analyses presented in the SYRTAC (1999) report are discussed relative to their usefulness in evaluating changes in habitat with increasing river flows as compared to data obtained from the IFIM conducted by the Department of Water Resources (DWR 1989).

- The greater the top-width the greater the amount of habitat.

This statement may or may not be true depending on channel morphology, type of habitat, substrate composition, and bank gradient. An increase in wetted perimeter may not directly result in an increase in useable habitat. Water velocities, depths, and substrate composition across the channel are also key suitability components in describing habitat, and neither of these parameters is taken into account relative to increases in flow. In low gradient stream reaches with low gradient banks (riffles, glides, and some shallow pools), initial increases in flow typically result in substantial lateral spreading with minimal increases in water depth and velocity. The net result is a significant increase in the width to depth ratio relative to minor increases in flow. With increasing flows, width to depth ratios generally decrease as lateral spreading diminishes and depths increase. During initial flow increases, newly created margin habitat is usually very shallow (several inches or less) with very slow velocities, and is highly susceptible to potentially significant daily increases in water temperature and potential degradation of other water quality parameters. Consequently, in these types of habitats, the top-width method substantially over-estimates the amount of habitat gained with increases in flow (especially initial flow increases).

The IFIM provides incremental data (depth, velocity, substrate, etc.) across the stream, which allows for an evaluation of changes in useable steelhead habitat with changes in flow based on life stage criteria. The additional data collection associated with the IFIM is critical in assessing the actual benefits of increased flows on steelhead habitat.

- Large changes in top-width indicates a large change in the amount of potential living space available to steelhead

The problems with this assumption are similar to those stated above. The use of the top-width method does not provide sufficient data to evaluate this issue. As stated above, a lateral increase in wetted perimeter does not necessarily indicate an increase in living space for steelhead. Additional margin habitat established via increased flows may or may not contain habitat characteristics appropriate for steelhead life stages. In some habitat types (runs and pools), this assumption may adequately describe habitat changes with increasing flow. Runs and pools do not typically experience large changes in top-width with incremental flow increases. Large changes in top-width are normally associated with stream habitats that are typically wide and shallow or have low bank gradients that allow for extensive lateral spreading with increasing flow. However, this large increase in top-width is not commensurate with increases in depth, and as a result does not contribute to an increase in usable habitat. Using the top-width method, significant lateral spreading associated with small increases in flow in these types of habitats translates directly to a net increase in steelhead habitat. However, depth measurements along these newly created margin habitats would likely indicate that much of the increased habitat is not suitable (usable) for any steelhead lifestage, with the possible exception of fry given otherwise suitable water temperature and flow velocity.

The IFIM methodology provides the necessary depth and velocity data (along with temperature data) within this newly created margin habitat, which along with temperature data, is necessary for evaluation of the net increase in usable habitat for specific life stages.

- Top-width is used as an index of the amount of habitat available in the past.

The use of top-width as an index of the amount of habitat available in the past is wrought with the same problems mentioned above. The use of the top-width method for evaluating habitat changes does not take into account critical depth and velocity measurements that contribute to the overall evaluation of usable habitat for steelhead. Additionally, changes in the Santa Ynez River channel over time are not taken into account using top-width as an index of available habitat in the past. In any event, the index would be of limited use in evaluating availability of habitat in the past, since depth and velocity measurements do not exist for past habitat.

- A higher width to depth ratio denotes better quality habitat.

This assumption may be true for some stream habitats and life stages; however, as stated earlier, this assumption does not apply to all habitats. A higher width to depth ratio in main channel pools, runs, and some glides and riffles, may not create better quality habitat unless other habitat characteristics are also present. Appropriate substrate composition (including distribution and structure), water velocities, and temperatures, are also necessary to provide suitable habitat for specific life stages. An assessment of habitat quality requires additional data than just top-width and maximum depth. Habitat suitability is also based on other data including; depths and velocities within the habitat, substrate composition and structure, and water quality data including temperature.

Using the top-width method, the determination of appropriate flow releases for maximizing available habitat (greatest habitat improvement) is based on the largest percent increase in top-width between successive flows. The greatest increase in top-width occurred at very low flows (1.5 to 5 cfs) in riffles, glides, and shallow pools in the Refugio and Alisal reaches, and between 10 and 15 cfs in the upper reach above Highway 154. However, as stated earlier, these predicted flow releases are not based on actual increases in usable steelhead habitat (which should include depths and velocities across the habitat), but simply on newly created aquatic habitat regardless of water depth, velocity, and water quality parameters.

The use of an IFIM approach for evaluating availability of usable habitat for steelhead trout provides critical habitat data that can be compared with life stage specific habitat criteria. These data provide most of the required information to evaluate changes in all stream habitat types associated with changes in flow. The IFIM conducted by the DWR (1989) provides these data for selected representative transects within each of the three reaches. The number and placement of transects in each reach is designed to provide sufficient data to evaluate changes in the types and relative abundance of habitats available within each reach at various flow levels. The placement of transects evaluated

during the DWR IFIM study appear to be adequate for assessing overall changes in other similar habitats within each reach, but the number of transects in representative habitats relative to actual proportion of habitats within each reach could have been improved. In particular, only three transects were established in the San Lucas site. Nevertheless, the data generated through the IFIM provides substantially greater refinement of habitat characteristics associated with incremental flow increases, than does the top-width method.

Entrix (1995) recalibrated the DWR model to better reflect proportionality of habitats within a given reach. It is difficult to compare the DWR IFIM results with the Entrix recalibrated model results. The original data were presented in four groups: one mile below Bradbury Dam, two miles below Bradbury Dam, three miles below Bradbury Dam, and Bradbury Dam to Buellton as a single reach. The Weighted Useable Area (WUA) are presented in different units between the two analyses: cumulative area is calculated in the DWR analysis, while sq. ft. of WUA per 1000 ft. of stream is calculated in the Entrix analysis. The original analyses looked at habitat quality vs. flow, based on existing substrate conditions and with improved substrate conditions. The recalibrated model combines the data into two reaches (Bradbury Dam to Refugio Road, and Refugio Road to Highway 101), and primarily analyzed habitat quality vs. flow for existing substrate conditions. Ideal substrate conditions were also evaluated for fry and spawning lifestages only above Refugio Road.

Both analyses show large improvements in habitat with both 'improved' (DWR) and 'ideal' (Entrix) substrates at much lower flows than occur with existing substrates. Also, the DWR analysis shows virtually no spawning habitat at 50 cfs (upper three miles) as compared to the recalibrated model, which shows habitat available at 50 cfs. These results underscore the need for improvements to the stream channel and substrate that have been adversely affected by construction of Bradbury Dam.

Lifestage-specific habitat and flow requirements

Adult migration and spawning

Alternative 3A2 provides for minimum streamflows of 48 cfs from 15 February through 14 April for steelhead spawning, as measured at San Lucas and Alisal bridges, *including drought years*. Modifications could be made to these migration flow requirements consistent with juvenile steelhead needs during drought years (e.g., reduce migration flows towards juvenile rearing flows).

The 48 cfs flow was based on scenario 1 in the draft IFIM report (DWR 1989) for constant habitat flow requirements (from Bradbury Dam to Buellton) for steelhead spawning with improved substrates, relative to optimum flow (100 cfs) with existing substrates. The recalibrated Entrix IFIM analyses for the Refugio Road to Bradbury Dam reach for existing substrates showed that flows in the range of 50 cfs provided some increase in spawning habitat, with continual improvement up to about 80 cfs. Additional small increases in spawning habitat did not occur until flows reached about 120 cfs.

Fry and juvenile rearing
Alternative 3A2 provides for minimum flows of 20 cfs from 15 April through 1 June, an increase of 25 cfs for a week to provide for emigration, and a gradual decrease to 10 cfs by 30 June.

The 20 cfs flow was also based on scenario 1 in the draft IFIM report (DWR 1989), but included necessary improvements to substrate. Otherwise, the DWR IFIM report showed that 48 cfs provided about 60 to 70% of available juvenile rearing habitat, and about 90% of fry habitat. The recalibrated Entrix IFIM showed that 48 cfs provided approximately 60% of available juvenile habitat and about 80-90% of available fry habitat.

Interim Mainstem Rearing Target Flows
The interim mainstem rearing target flows for the current DEIR Alternative 2, are based on results of the top width analysis, and generally range from 1.5 cfs (<120,000 af lake storage, no spill) to 5 cfs (>120,000 af lake storage, spill>20,000). Per the *Habitat Analysis for the Santa Ynez River (1999)* report, the greatest increase in stream top width (and therefore, according to that report, rearing habitat) occurred from 1.5 to 5 cfs. This analysis is based on faulty assumptions and an incomplete assessment of useable steelhead habitat at various flows. Stream top width is not necessarily a surrogate for habitat quantity, and certainly not for habitat quality.

In addition, the long-term mainstem rearing target flows (2.5 to 10 cfs under the same conditions as above) are not acceptable, based on the same rationale as stated above. Alternative 3A2 provides for 20 cfs rearing target flows, which appears to have its origin in the DWR IFIM Scenario 1 with corresponding improved substrate (With existing substrate, less than half of the available rearing habitat is provided).

Effects of Order No. WR 89-18 on juvenile steelhead rearing
Water rights releases under Order No. WR 89-18 should occur over a more continuous nature, with suitable ramping, than occur under present operations (i.e., 'pulsed' high flow release), to maximize public trust protection WR 89-19 flows can be used in tandem with other releases to afford further protection to instream rearing fish. Currently, dry river conditions are necessary to trigger these releases, which is not conducive to improving mainstem rearing habitat. In addition, high flow pulse releases during the summer months can adversely affect juvenile steelhead and their food resources through downstream displacement into unsuitable habitats. Displaced steelhead are also more vulnerable to predation. In addition, temporary turbid water conditions are created which may affect the steelhead ability to feed.

Lagoon rearing of smolt steelhead
Given the overall habitat degradation that has occurred in the Santa Ynez River, it is critical to restore suitable conditions for smolt steelhead rearing in the lagoon. Studies conducted by Dr. Jerry Smith in smaller central and southern California drainages indicate that lagoons are essential for production of the majority of steelhead smolts than are produced in the remaining watershed. In particular, spring and summer inflows are most important in determining depth, temperature, salinity, and dissolved oxygen

concentrations in the lagoon, all of which are essential components of habitat. For steelhead, it is important to maintain overall freshwater conditions, especially in light of removal of access to upstream rearing habitat and degraded lower river rearing habitat. In particular, sufficient inflows should be provided to minimize stratification layers. Dense marine water is unsuitable for steelhead rearing because of unsuitably low dissolved oxygen concentrations and warm water temperatures that occur, especially in the lower marine layer. A freshwater lens overlaying the marine layer exacerbates unsuitable conditions in the lower marine layer. Unstratified freshwater conditions result in greater amount of suitable habitat and higher quality habitat. Steelhead that include a lagoon rearing phase have been shown to have greater survivability during ocean phase and are more likely to return as adults. Steelhead that are forced to leave the Santa Ynez River during first year of life have lower survivability than those fish which are allowed to remain at least one year in freshwater.

The alternatives in the SWRCB DEIR do not meet suitable flow conditions to allow for improvement to lagoon habitat. Alternative 3A2 (Cachuma Project Contract Renewal EIR/EIS, 1995) scored highest among the other alternatives in its ability to improve lagoon habitat with providing sufficient inflow to the lagoon to improve steelhead rearing conditions.

More studies of inflow and lagoon water quality condition interactions are necessary to quantify available steelhead rearing habitat.

Predator control and removal of exotics

The presence of predators and other exotic fishes that are present in the Santa Ynez River (e.g., largemouth and smallmouth bass, bullhead) is a major concern. There are current projects in southern California (e.g., San Mateo Creek and Santa Margarita Creek) underway that are examining potential removal techniques for exotics. I recognize that this sometimes seems to be an impossible dilemma, but not enough attention has been brought to this subject. Continued strategic removal programs may result in bringing a level of control to the exotic species. The *Lower Santa Ynez River Fish Management Plan* determined that it is feasible to remove warm water species from below Bradbury Dam. A more integrated approach is possible with the use of both passive (fyke nets, fish traps) and active (beach seine, electrofishing, seining, diver-operated devices). Such a plan should be developed

Availability of habitat upstream of Bradbury Dam

I reiterate NMFS Conservation Recommendation (and CDFG Steelhead Restoration and Management Plan) that a study should be designed and implemented to determine effective passage for steelhead at Bradbury Dam, including upstream passage, downstream smolt trapping facility, and screening of the Tecolote Tunnel and other water intakes. It is clear that construction of Bradbury dam has had the most important adverse impact on Santa Ynez steelhead populations by blocking the most important (quality and quantity) spawning and rearing habitat in the Santa Ynez basin. About 150 miles of habitat is no longer accessible to steelhead due to construction of Bradbury Dam, and operation of the Cachuma Project. US Forest Service habitat mapping activities show

that the mainstem and tributaries contain suitably sized substrates (gravel and cobble), and habitats for spawning and rearing. Instream cover is also relatively abundant.

The Hilton Creek improvements (flow augmentation and channel development), 11 passage barrier projects, the suite of flow releases and other proposed measures cannot mitigate for the loss of habitat and the ability of the above-dam population to emigrate to the ocean, brought about by construction and operation of the Cachuma Project. The project must include actions that will directly result in restoration of the Santa Ynez steelhead population. Remnant populations of rainbow trout above Bradbury Dam provide a genetic bridge to Santa Ynez steelhead and must be protected. To achieve restoration of steelhead, genetic information in those populations should be made available to current runs of steelhead below Bradbury Dam. It is worth considering that a connection should be made between the anadromous steelhead below Bradbury Dam and the remnant landlocked population that exists upstream. Therefore, more intensive study that has currently been conducted (e.g., *Upper Basin Actions for the Protection and Enhancement of Southern Steelhead in the Santa Ynez River, Upper Basin Workgroup)* are necessary to determine the feasibility of restoring passage for steelhead upstream of Bradbury Dam.

Adaptive management

Adaptive Management is the key to providing the ability for restoration of the Santz Ynez steelhead population. However, it is not enough to simply establish an Adaptive Management Committee (AMC) that will review data as they become available and make decisions. It is paramount to set measurable target objective goals for steelhead restoration (e.g., adult population size, juvenile production, age structure percentage, juvenile biomass per acre or stream width, and useable weighted habitat for each lifestage). This approach is becoming standard language in Federal Energy Regulatory Commission (FERC) mediated collaborative Settlement Agreements, dealing with effects of hydroelectric power generation activities on aquatic and terrestrial resources in California streams (e.g., Pacific Gas & Electric's Mokelumne and Rock Creek-Cresta projects, and El Dorado Irrigation District's El Dorado Project on the S.F. American River).

There is no mention of target adaptive management objectives in the SWRCB DEIR (nor in the Lower Santa Ynez River Management Plan or the Bureau of Reclamation's Biological Assessment). The SWRCB, California Department of Fish and Game, Bureau of Reclamation, and other agencies were involved, at least with review, of the adaptive management plan for the Battle Creek DEIR (Appendix D). That plan concludes that the purpose of adaptive management is to design studies and management programs that can be adapted to uncertain circumstances, with a well planned document anticipating as many circumstances as possible before designing monitoring and data assessment approaches. Eleven objectives were identified pertaining to the adaptive management of steelhead and salmon populations, passage, and habitat. I recommend the inclusion of such an adaptive management plan as a Term and Condition for the current water rights modifications that includes measurable target objectives for such elements as population

size, trends in productivity, population substructure, population diversity, and carrying capacity, as are presented in the Battle Creek DEIR Adaptive Management Plan.

Major Conclusions

In sum:

1. Permits 11308 and 11310 should be modified as described below to protect public trust resources, in particular, the Santa Ynez steelhead population.
2. None of the alternatives identified in the SWRCB DEIR are capable of maintaining steelhead in "good condition" as defined by Dr. Peter Moyle, or achieving a level of steelhead population restoration.
3. Streamflows provided under Alternative 3A2, along with the protections afforded under the Terms and Conditions of the NMFS Biological Opinion (with the exception of the flow schedules where they conflict with alternative 3A2, e.g., interim and long term flow recommendations), and the Conservation Recommendations, would likely result in maintaining Santa Ynez steelhead in "good condition" as defined by Dr. Peter Moyle, and result in the restoration of steelhead runs.
4. Further, establishment of non-flow related improvements such as stream channel and spawning substrate improvements as stated in the DWR IFIM flow recommendations (as discussed on pages 4, 5, 19, 21, 22, 23, 24, 27 and 28 in the DWR IFIM report), used as basis for 3A2 spawning and migration flows and juvenile rearing flows, are necessary components for restoration of the Santa Ynez steelhead population.
5. Habitat improvements below Bradbury dam cannot mitigate for the loss of habitat above the dam, or the ability of the above-dam population to emigrate to the ocean.

I recommend the following:

1. Streamflows provided under the 3A2 Alternative, as well as the SWRCB's draft EIR alternatives, have been developed from predictive models. However, only through direct observations following the implementation of the modeled flows can there be adequate assurance the predicted result has occurred. The SWRCB has recognized the use and importance of adaptive management protocols. In the *Battle Creek Salmon and Steelhead Restoration Project Draft Environmental Impact Statement/Environmental Impact Report*, natural resource management through adaptive processes that include measurable target objectives have been established. Unfortunately, no such discernable management with measurable target objectives currently exists within any Santa Ynez River plan, Biological Assessment, Biological Opinion, or the draft SWRCB EIR for the Board to judge if and when public trust resources are progressing towards success. I recommend that the SWRCB require that Permits 11308 and 11310 contain an adaptive management plan similar to that put forth for the *Battle Creek Salmon and Steelhead Restoration*

Project Draft Environmental Impact Statement/Environmental Impact Report with measurable target objectives, and a schedule to achieve the target objective.

2. Implementation of flow measures identified in alternative 3A2 of the Cachuma Contract Renewal EIR (as modified for dry years).
3. For whatever flow schedule the SWRCB orders, focused study of each lifestage for which flows are being provided, including systematic and suitable seasonal monitoring, should be required. This includes, but is not limited to adult upstream migrant passage flows, spawning and egg incubation flows, juvenile emigration flows, and juvenile rearing flows.
4. Implementation of juvenile steelhead rearing habitat studies and juvenile steelhead monitoring in the lagoon.
5. Comprehensive fish passage studies should be conducted.