Fisheries Stream Scientist's Response to CalTrout (CT) Comments to Reports Submitted to the Water Board

The Stream Scientists submitted four reports to the Water Board on August 3, 2009. These reports were:

1. Rush and Lee Vining Creeks - Instream Flow Study.

2. Radio Telemetry-Movement Study of Brown Trout in Rush Creek

3. Pool and Habitat Studies on Rush and Lee Vining Creeks

4. The Effects of Flow, Reservoir Storage and Water Temperatures on Trout in lower Rush and Lee Vining Creeks.

We appreciate the effort that CalTrout put into commenting on the reports. Mark Drew, CalTrout's Eastern Sierra Program Manager, submitted comments on October 5, 2009. CalTrout's comments included 11 general comments/questions and 13 comments specific to sections of IFS report. We will attempt to respond point-by-point to their comments. Prior to responding, we are pleased that CalTrout understood that the purpose of the IFS report was to identify flow needs, and that flow recommendations would be made later within the Synthesis Report.

Stream Scientists' Response to CalTrout General Comment #1 - desiring further explanations of the IFS results

We agree that more detailed explanations of the IFS results would be beneficial. One aspect of the study we failed to emphasize enough was that although the holding habitat criteria focused on the winter baseflow period. We should have better explained that brown trout require holding habitat throughout the entire year. Within the Synthesis Report, we will further explain the year-round use of holding habitat with more in-depth analyses of the movement study data that presents the relocation data by three size-classes of brown trout and by winter versus non-winter depths and focal point velocities. This additional level of analyses strengthens our use of the Heggenes (2002) citation during the development of our measureable habitat criteria that was criticized in the CDFG and Dr. Williams comments.

In regards to the results on page 33 where we reported that the amount of winter holding habitat increased as test flows increased in the Old Lower Mainstem. This was due to the relatively low measured flow within the Old Lower Mainstem (3-19 cfs), with the majority of the measured flow (12-62 cfs) being captured by the 10-Channel. At measured flows <12 cfs in the Old Lower Mainstem, depths <1.0 ft reduced areas of holding habitat. The response in the Old Lower Mainstem was that the amount of foraging habitat generally decreased as flows increased. This was due to focal point velocities exceeding 0.7 ft/sec encroaching into open areas of pools, thus as flows increased the widths of many individual foraging polygons decreased.

Stream Scientists' Response to CalTrout General Comment #2 – information regarding pre-1941 conditions and if these conditions can be achieved through the Restoration Program

This comment is quite similar to one made by the Mono Lake Committee, thus our response is also quite similar. However, CalTrout does raise issues specific to the termination criteria as related to pre-1941 conditions. CalTrout states that the, "termination criteria include targets for the percentage of large brown trout, specifically in Rush Creek, as well as other metrics for a healthy fishery". We contend that the termination criteria as originally set were vague, that is, there was no specific "percentage of large brown trout" stated, only a comment that Rush Creek "fairly, consistently produced trout weighing ¾ to 2 pounds". The original termination criteria also failed to define other metrics indicative of a healthy fishery, other than stating "a fishery in good condition." Order 98-05 stated that the Stream Scientists shall develop measureable criteria based on results of the annual sampling of the fish populations in Rush and Lee Vining creeks. Several years ago the Fishery Stream Scientist (Chris Hunter) submitted his recommendations of scientifically accepted, quantifiable metrics for termination criteria monitoring of the fisheries (Hunter et al. 2007). Although the metrics of density, biomass, condition factor and relative stock abundance were generally accepted; the values proposed by the Stream Scientist as being indicative of "recovery" were not generally supported.

Before discussing pre-1941 conditions, it has always been the position of the Fisheries Stream Scientists (past and current) and his sub-consultants that there was never any quantifiable data presented at past Water Board hearings to support the claim that brown trout "averaged 13-14 inches" in lower Rush Creek and that the creek "fairly consistently produced trout weighing ¾ to 2 pounds". This position is supported by language directly out of Decision-1631 and the Mono Basin EIR:

"Published and unpublished scientific information is scarce, and definitive information is unavailable to quantitatively describe historic pre-diversion fish habitats or populations."

As to pre-1941 conditions that may have supported an allegedly "big" trout population, we speculate that the following factors may have been influential:

1. Vestal springs were augmented (and possibly supported) by irrigation return flow from the extensive amounts of Rush Creek water diverted onto the Cain Ranch and the Pumice Valley area (average annual application of 30,000 acre-feet). We would not recommend restoring this practice since these historic diversions basically de-watered Rush Creek downstream of Grant Lake Reservoir. We are also concerned about experimenting with re-watering distributaries in an attempt to recharge spring flow in Rush Creek downstream of the Narrows, especially if this requires manipulating the current Parker or Walker channels. Between 2003 and 2008, Walker Creek had the highest biomass (kg/ha) of brown trout in five out of six years, including estimates greater than 300 kg/ha in four of those years (Hunter et al. 2009). Within our sample section, the single-thread, highly sinuous channel contains ample foraging and holding habitats in numerous pools with low stream velocities and extensive undercut banks.

2. Higher nutrient levels in Rush Creek below the Narrows resulting from animal waste products deposited by the thousands of sheep grazing the Cain Ranch and entire Bottomlands area. This constant input of nutrients, particularly nitrogen, probably

fueled a higher level of primary productivity than is currently occurring in Rush Creek. We would not recommend "restoring" this practice since the impacts caused to riparian vegetation and stream-bank stability would negate any "gains" in primary productivity; in fact, it could lead to excessive growth rates of filamentous algae on the stream bottom, which could cause wide fluctuations in diel dissolved oxygen concentrations.

3. The historical interviews suggest that the series of ponds created by Walt Dombromski for duck hunting were also utilized by large trout. These ponds were created off-channel and were tiered in such a way that water flowed down through the series of ponds and then returned to Rush Creek. Dick Dahlgren has proposed creating a similar series of ponds adjacent to Rush Creek to "restore" the fishery. However, since the collaborators in the Mono Basin Restoration program have agreed to focus on the recovery of the entire stream/riparian ecosystem, primarily by restoring natural processes, we do not support this type of unnatural physical manipulation of the channel or diversion of stream flow into ponds.

4. The historic record also suggests that Lahontan cutthroat, the first trout species introduced to the Mono Basin, constituted the fishery which thrived. The egg-taking stations on upper Rush Creek and Fern Creek were operated primarily to produce "black-spotted" trout eggs for export to other watersheds because of how many fish were present throughout Rush Creek and its system of lakes. For example, in 1925 the "take" of black-spotted trout eggs was 1.01 million eggs from Rush Creek and its tributaries (CDFG 1927). The black-spotted trout population appeared to increase even under heavy fishing pressure in Grant Lake as CDFG reported taking over three million eggs in 1928 (CDFG 1929). During the 1930's it appears that the Lahontan cutthroat fishery withered and possibly disappeared as indicated by the 1940-41 Fern Creek hatchery records that document the taking of rainbow and brown trout eggs and none from black-spotted trout (CDFG 1943). CDFG also reported that the overall catch of trout had increased but the catch/angler numbers had decreased (CDFG 1943). Thus, the Department recommended increased development of hatchery production maintain the quality of the fishery due to heavy fishing pressure (CDFG 1943).

To speculate if pre-1941 conditions can be achieved within the Rush Creek downstream of the Narrows, we cannot answer this question primarily because we do not have an accurate, science-based record of the pre-1941 fishery in terms of density, biomass, size composition or condition factor. However; we believe that the flow recommendations we make in the Synthesis Report will provide the Rush Creek ecosystem and the fishery a better chance of achieving a desired future condition that includes a more robust trout fishery.

<u>Stream Scientists' Response to CalTrout General Comment #3 – describe other studies and relative importance to competing the Synthesis Report</u>

You are correct in that other studies will be used in developing our flow recommendations. For quite a while we have suspected that summer water temperatures, especially in drier water-year types, were affecting the growth and condition factor of brown trout in Rush Creek. The nearly 10 years of water temperature data as analyzed by Brad Shepard indicated that thermal conditions within Rush Creek were often greater than the range of temperatures known to permit

growth. We also have limited summer water temperature data collected by Mark Drew in 2009 from above Grant Lake Reservoir that suggests that Rush Creek may be thermally impaired by upstream water management activities before reaching LADWP's facilities. The SNTEMP model supports the conclusions of Cullen and Railsback (1993) that one of the best means to provide suitable summer water temperature in lower Rush Creek is to manage Grant Lake Reservoir at higher storage levels. We will also be evaluating future conditions with the SNTEMP model such as increased shading from a more fully recovered riparian zone as well as hotter climate conditions as predicted by climate-change researchers. We may also evaluate the effects of cooler water inputs at the base of the Narrows to simulate spring inflows; this evaluation would provide information on how much flow and what input temperatures are needed to provide measureable improvements to lower Rush Creek's summer thermal regime.

Although we do not believe there are data lacking which would prevent us from making flow recommendations, we acknowledge that there are other studies and data that will be required within an adaptive management plan. Such studies include monitoring of channel conditions during winter baseflows to evaluate icing potential, conducting more comprehensive synoptic flow measurements during all seasons, establishing additional water temperature monitoring stations in Rush Creek, and evaluating primary productivity. The initiation of implanting PIT tags in September of 2009 has provided us with a jump-start to monitoring the specific growth rates and condition factors of individual brown trout.

<u>Stream Scientists' Response to CalTrout General Comment #4 – more information regarding potentially competing needs of trout habitat, BMI habitat and water temperature</u>

First of all, the SNTEMP model will not be used to "reconcile winter holding and foraging habitat and BMI habitat". The temperature model was developed specifically to evaluate summer water temperatures on Rush Creek between June 1st and September 30th. Secondly, we doubt there will be a "happy medium established" between all of the competing needs within the creeks, especially since the "fish needs" are for a non-native species that did not evolve within the Rush Creek and Lee Vining Creek watersheds nor within the eastern Sierra geographic region. We have developed a "number of good days" (NGD) evaluation as part of our strategy in developing flow recommendations. The NGD analysis allows us to set flow ranges or targets for a wide range of specific ecological processes and needs such as geomorphic processes, groundwater recharge, riparian establishment, growth and maintenance, BMI habitat, trout holding and foraging habitats, timing of fry emergence and fry margin habitat. Within our constructed water balance spreadsheets we are able to set flows and then run NGD counts to see how various flows affect this suite of ecological factors. The Synthesis Report will describe the NGD approach and we can make those spreadsheets available to the Water Board, LADWP and the stakeholders so they may run "gaming scenarios" themselves. In regards to the effects of summer water temperatures on brown trout, we will utilize a brown trout growth prediction model (Elliott and Hurley 1999) based on water temperatures to evaluate how different flow scenarios influence brown trout growth by modifying water temperature regimes.

Stream Scientists' Response to CalTrout General Comment #5 – can we extrapolate IFS results to other sections of Rush and Lee Vining creeks?

On Rush Creek we believe the reaches mapped for brown trout were extensive enough to make extrapolations to the rest of the channel from the Narrows downstream to the Mono Lake delta. Within this reach we mapped approximately 19% of the channel length and 31% of the high-quality pool habitats as identified during the 2008 pool survey (Knudson et al. 2009). Within Upper Rush Creek we would limit any extrapolations to the approximately 6,000-foot reach between the sheepherder's cabin and the Old Highway 395 Bridge. Within this reach we mapped approximately 32% of the channel, approximately 33% of the glides/runs and 75% of the pools (6 of 8 pools) identified during the 2008-09 habitat typing survey (Knudson et al 2009).

On Lee Vining Creek we believe the reaches mapped for the IFS were extensive enough to make extrapolations to the rest of the lowermost 10,000 ft of channel that was habitat typed in 2008 (Knudson et al. 2009). Within this reach we mapped approximately 30% of the mainstem channel and approximately 45% of the pool and run habitats. We also feel that the pocket pool habitat mapped within the contiguous 2,300-foot reach starting at the upper end of the A-4 side channel could be extrapolated upstream several thousand feet.

There was never a specific objective to expand the results from mapping reaches to the entire stream channels to come up with river-wide habitat area estimates. We selected large sections of each creek that contained the most abundant and highest quality habitat, and are making flow recommendations to provide suitable conditions in those reaches. If we developed habitat flow curves for other reaches, such as below Hwy 395, and those curves suggested different flow ranges were suitable, we probably still wouldn't use them in developing flow recommendations. What we're really saying is that the reaches selected for mapping were the best representation of good habitat available now, and that will increasingly be available in the future as the channels continue to recover.

Stream Scientists' Response to CalTrout General Comment #6 – predictions of future conditions under recommended flows, adaptive management and future monitoring

The Synthesis Report will include the outline of an adaptive management monitoring plan. We will develop hypotheses to test that will, in some sense, be predictions of future conditions, or future responses of the trout populations to recommended flow changes.

Stream Scientists' Response to CalTrout General Comment #7 – will we use a continuous hydrograph for SNTEMP modeling?

Within the Synthesis Report we are considering flow recommendations for the entire water-year, however many ecological processes and needs occur at or during discrete periods within the annual hydrograph. At this point in the Synthesis Report/flow recommendation process we have not adopted a continuous hydrograph approach. We have used hydrographs from the past 18 years in our analyses for the Synthesis Report.

As stated earlier, the SNTEMP model will only be used to evaluate summer water temperatures between June 1st and September 30th, thus no year-round evaluations within a continuous hydrograph are expected. The SNTEMP model uses daily average values for flow, temperature and climate inputs, thus the model performs best when predicting daily average temperatures.

Stream Scientists' Response to CalTrout General Comment #8 – request more discussion of the use of poor-quality aerial photographs and the challenges this presented

The poor quality aerial photos made it very difficult to locate specific features such as boulders, downed logs or trees. These features would be important if a primary objective of the direct habitat mapping was to accurately locate a polygon's position within the channel as well as compute its area. Our primary objective was to accurately measure polygon areas at each test flow so that amounts of habitat could be compared between the various reaches at the various test flows. We met this objective by actually measuring and plotting measurements on either aerial photographs or scaled-graph paper.

After the first day of mapping Rush Creek at 45 cfs we realized that all distances between a polygon's points must be measured and that these distances and widths must be written down. During the Rush Creek habitat mapping we still attempted to locate each polygon as accurately as possible on the aerial photographs. In many of the pool units, the manner in which the habitat area changed over the range of test flows was quite similar. As test flows increased, foraging and holding polygons generally became smaller by becoming narrower (closer to the banks) and shorter (reduced at top end by faster flows). In cases where pools gained habitat area at moderate flows, these gains were due to areas that were depth-limited at low flows "turning-on" at moderate flows; however as flows continued to increase, excessive focal point velocities caused the polygons to shrink.

As described on page 26 of the IFS report, we did not use the aerial photographs during the Lee Vining Creek IFS, but instead transcribed the polygon dimensions onto graph paper. The changes to individual polygon shapes and sizes were consistent to those just described in Rush Creek.

Stream Scientists' Response to CalTrout General Comment #9 – will we be evaluating new flow recommendations?

Yes, when Lee Vining Creek's summer flow recommendations are made we will include evaluations of changes in habitat area in the Synthesis Report. These evaluations will be based on IFS results.

Stream Scientists' Response to CalTrout General Comment #10 – outcome of rainbow trout in Rush Creek under new flow recommendations based on brown trout-generated criteria?

We expect that rainbow trout will continue to comprise a very minor component of the Rush Creek fishery. We believe that other than when CDFG was heavily stocking Rush Creek below the Narrows or when Grant Reservoir has spilled, rainbow have constituted a minor (<10%)

portion of the creek's fishery. We are not sure exactly when rainbow trout were introduced to the Rush Creek watershed, however, historical records confirm that steelhead were introduced to June Lake in 1921, that annual plantings had occurred through 1926, and the recommendation in 1927 was to continue the annual plantings (CDFG 1927). CDFG's 37th biennial report lists rainbow trout produced at Fern Creek hatchery at approximately 250,000 fish in 1940 and 35,000 fish in 1941 (CDFG 1943). Between 1940 and 1946, 35,000 trout were stocked in Rush Creek below the Narrows and approximately 14,000 of these were rainbow trout (Vestal 1954). During the "test stream" project (1947-1951) approximately 70,000 catchable rainbow trout and 19,000 sub-catchable and fingerling rainbows were stocked below the Narrows (Vestal 1954).

We have cited Kondolf et al. (1991) in several annual reports, a paper in which the authors documented spawning gravel distribution and bed mobility in seven high-gradient stream reaches in the eastern Sierras over two seasons, 1986 (a wet year) and 1987 (a dry year). During the wet year, all tracer rocks placed in spawning gravel pockets were swept away, and substantial scour, fill, and channel changes were noted throughout their study streams. The authors theorized that periodic mobility of gravels might explain why brown trout are more abundant than rainbow trout in many eastern Sierra streams where high flows occur in May and June due to snowmelt. Brown trout are fall spawners, and their fry emerge before high snowmelt flows; whereas rainbow trout are spring spawners whose eggs (or alevin) are in the gravel, and thus, more vulnerable to scour during snowmelt flows. Interestingly, these authors noted that most of their study streams looked more like typical rainbow trout streams, yet brown trout have been much more successful in these systems (Kondolf et al. 1991).

Stream Scientists' Response to CalTrout General Comment #11 – questions about condition factor, trout size classes, BMI and summer water temperatures

Our annual sampling data indicates that condition factor of brown trout is consistently higher in Lee Vining Creek than in Rush Creek. This may be due to greater food supplies and lower trout densities, but summer water temperatures in Lee Vining Creek remain within the range of "potential growth" (as defined by Raleigh 1986) for many more days than Rush Creek.

In regards to pocket pool habitat in Rush Creek, the reach between Highway 395 and the Narrows contains the longest stretches of high-gradient riffles that would contain pocket pools (Knudson et al. 2009). This reach had experienced little change in habitat composition between the 1991 Trihey habitat typing survey and our 2008 survey (Knudson et al. 2009). Our limited fish sampling in this reach suggests it is not an extremely productive reach nor does it support a higher proportion of rainbow trout. We suspect that summer temperatures are fairly poor downstream of Highway 395 until Parker and Walker creeks contribute cooler water.

We are probably never going to "optimize" summer thermal conditions in Rush Creek. Pre-1941 summer water temperatures were probably "less than optimal" in drier years. Other than managing Grant Lake Reservoir at a fuller level and accreting 5-siphons flow into Rush Creek when Grant Lake Reservoir storage is low in drier year-types, there appear to be no feasible management alternatives under LADWP's control to "maximize or optimize" summer water temperatures. As mentioned earlier, we suspect that Rush Creek may already be thermally impaired upstream of Grant Lake Reservoir prior to reaching LADWP's facilities. We do anticipate that our recommendations to increase the diversion of Lee Vining Creek flow into

Grant Lake Reservoir and setting higher minimum storage limits in Grant Lake Reservoir will improve Rush Creek's summer thermal regime. We will be recommending a monitoring plan to evaluate if these recommendations translate into either more larger brown trout or an overall fishery in better condition as defined by condition factor

Stream Scientists' Response to CalTrout Specific Comment on page 10 –

OK.

Stream Scientists' Response to CalTrout Specific Comment on page 10 –

We conducted relocations of radio-tagged fish during daylight hours only, between approximately 8AM and 5PM. Snorkel observations in conjunction with the 2002-03 pool surveys were conducted during both day and night. We contend that the observations, relocations, and habitat measurements we made for habitat criteria development were more comprehensive and relevant than those made by Smith and Aceituno (1987) for the original instream flow recommendations on Rush and Lee Vining creeks (CDFG 1991; 1993).

Stream Scientists' Response to CalTrout Specific Comment to missing citation –

OK.

Stream Scientists' Response to CalTrout Specific Comment on page 11 –

Development of flow recommendations through the Synthesis Report for Rush and Lee Vining creeks will incorporate many riparian vegetation processes and components.

Stream Scientists' Response to CalTrout Specific Comment on page 17 –

Yes, when developing pocket pool criteria for the Lee Vining Creek IFS we reduced the minimum polygon area, increased the velocity criteria and modified the depth criteria based on observations of fish presence in polygons while conducting the habitat typing survey. However, for pools and runs we used the same criteria in Lee Vining Creek as developed for Rush Creek.

Stream Scientists' Response to CalTrout Specific Comment on page 17 –

As we responded to the MLC, our research has not revealed any information that would indicate that rainbow trout were historically the dominant trout species in Lee Vining Creek. While the Lee Vining Creek channel is steeper and the water is cooler than Rush Creek, the rainbow trout are in direct competition with brown trout. Additionally, our basis for speculating that rainbow trout may not be self-sustaining in Lee Vining Creek is based on our 12+ years of annual sampling that shows rainbow trout numbers as quite variable, with numerous very poor years from which the population rebounds quickly. We also regularly capture hatchery fish in our

lower sampling sections and suspect that holdover fish from frequent stocking probably provides lower Lee Vining Creek a steady supply of adult spawners independent of naturally-produced fish reaching sexual maturity in direct competition with brown trout and suffering the effects of unfavorable snowmelt hydrographs.

Apparently, CDFG also felt that brown trout were the focal trout species in Lee Vining Creek since the title of the original instream flow study was *Instream Flow Requirements for Brown Trout in Lee Vining Creek, Mono County, California* (CDFG 1993). Page 3 of the CDFG report describes the pre-diversion fishery as primarily a brown trout fishery, as follows:

"During the period immediately prior to LADWP diversion activities, Lee Vining Creek was mostly a brown trout fishery with some rainbow trout and an occasional brook trout in the catch (Vestal 1989)."

Regardless of the Stream Scientists' opinion about rainbow trout sustainability in Lee Vining Creek, we believe that the habitat criteria utilized during the Lee Vining IFS study will benefit rainbow trout, especially the velocity criteria of 1.5 ft/sec utilized in determining pocket pool polygon areas.

Stream Scientists' Response to CalTrout Specific Comment on page 20 –

The study was completed in 2008. The rationale for selecting the mapping reaches was provided in the report. The Upper Rush reach probably had very few of the deep pools identified during the pool surveys until the Trihey pools were artificially created. The only other Rush Creek reach that has relatively low frequencies of pools is the gorge upstream of the sheepherder's cabin. We took series of panoramic photos at several locations over the range of test flows and the photos taken at higher flows revealed highly turbulent conditions in the gorge reach.

Stream Scientists' Response to CalTrout Specific Comment on page 21 –

A horizontal line at 15 cfs on the y-axis was placed the spaghetti graph of the estimated unimpaired flows for Rush Creek. In many of the drier years, the unimpaired hydrographs were close to the 15 cfs value during late summer, fall and winter months. Hasencamp (DWP 1994, pg. 2) also reported that "On a typical October day, about 17 cfs would be flowing in Rush Creek in the Grant Lake area under natural conditions".

Stream Scientists' Response to CalTrout Specific Comment on page 31 –

OK.

Stream Scientists' Response to CalTrout Specific Comment on page 33 –

We did not run any statistical tests, so the use of the term "significantly" may be inappropriate. However; in Rush Creek at 15 cfs the total area of winter holding habitat of 5,427 ft^2 is 30% of the total mapped foraging area of 18,047 ft^2. We'd contend that more than three times the

amount of foraging versus holding habitat is a significant difference. At 90 cfs, the total area of winter holding habitat was 38% of the total amount of mapped foraging, again nearly a threefold difference between holding and foraging habitat.

Stream Scientists' Response to CalTrout Specific Comment on page 38 –

Yes, more comprehensive synoptic flow measurements are needed. These are being done during the winter of 2009-2010 and should probably be conducted more frequently during various water-year types.

Stream Scientists' Response to CalTrout Specific Comment regarding inconsistent reach names-

OK

Stream Scientists' Response to CalTrout Specific Comment on page 54 –

Yes, it would.

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