BEFORE THE STATE WATER RESOURCES CONTROL BOARD
OF THE STATE OF CALIFORNIA

In the Matter of Application 30166 by the El Sur Ranch, Big Sur, CA and Amendments (as amended October 17, 2006)	Application No. 30166 REBUTTAL TESTIMONY OF DAVID H. DETTMAN

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I, David H. Dettman, provide the following written rebuttal testimony under penalty of perjury in relation to Application 30166 and the Amendments most recently dated October, 17, 2006 and detailed in Appendix C of the Draft Environmental Impact Report for Application 30166.

Population Abundance and Density:

1. Hanson concluded that the Lagoon and Lower Big Sur River provide suitable habitat for juvenile steelhead (ESR-21, paragraph 6) over late spring, summer, and early fall periods. In part, Hanson based this conclusion on studies in 2004 and 2007 to document the abundance of steelhead in the study area and provided population abundance data based on observations and counts of juvenile fish in the lower 1-mile reach. He attempted to substantiate his conclusion by asserting in paragraph 66,

"These observations [of fish abundance and densities] *are significant in showing that despite the critically low flows that occurred in the river in 2007, localized areas of depressed dissolved oxygen, effects of upstream diversions and water use, and operation of the El Sur Ranch irrigation wells, steelhead and other fish species typical of a coastal tributary fish assemblage were able to experience successful rearing within the lower river."*

2. While it may be true that some individual fish reared successfully within the lower river or moved into the ZOI following the pump tests, a conclusion about whether the "population" is "healthy", "robust" or "successful" should consider whether the population density is high enough to yield sufficient production. Sufficient production in this sense means a population comprised of large numbers of large individual juveniles.

3. **Exhibit CSPA/CBD-106** lists a summary of the abundance data collected by Hanson in 2004 and 2007, organized for the purpose of addressing the question of population density and abundance. Hanson's data for 2004 and 2007 shows a low density of steelhead in the Lagoon, averaging 0.51 fish per linear foot of channel and 280 fish total. A total of 280 fish may seem impressive, but lagoons in other coastal streams produce significantly more juvenile steelhead. For example, the nearby Carmel River lagoon yielded an estimated 3,500 juvenile steelhead in Nov 1996.

4. In the lower river Hanson found juvenile steelhead in most reaches, with average abundance ranging from 2 to 37 fish per reach. When expressed as fish population density (numbers per lineal foot), the average density ranged from 0.023 fish per lineal foot in October 2007 to 0.026 in October 2004, indicating little difference between years. More important is the scarcity of fish in these years. For comparative purposes, **Exhibit CSPA/CDB-107** illustrates the juvenile population density in the lower Big Sur and nearby Carmel River, where population surveys have been conducted systematically at reference stations since 1990. In general, population density in the lower Carmel River averaged 0.70 fish per lineal foot and ranged from 0.31 to 1.76 fish per lineal foot during the 1993 to 2010 period. By comparison in specific years, the 1994 population density in the lower Big Sur averaged 0.12 fish per foot compared to 0.33 in the lower Carmel River. In 2004 the comparison was 0.023 fish per foot in the Big Sur compared to 0.50 in the Carmel and in 2007 the comparison was 0.026 in the Big Sur versus 0.33 in the Carmel River. Although limited data is available, this comparison indicates the juvenile population levels in the Big Sur are currently about an order of magnitude lower than in the Carmel River. Juvenile population densities in this range should be characterized as critically low and are indicative of populations listed as "endangered" rather than "threatened". In summary, the critically low numbers of juvenile fish observed by Hanson in 2004 and 2007 call into question the suitability of rearing habitats in the lower Big Sur River and highlight the need to fully evaluate the effect of flow on habitat quality and quantity, before adopting final bypass flow requirements for El Sur's diversions from the lower Big Sur River.

Streamflow Impacts on Steelhead Rearing Habitats:

5. Hanson and Horton have asserted that operation of El Sur's Wells do not significantly affect water surface elevations in the Big Sur and used measurements of stage changes to estimate the effect of pumping on streamflow and habitat values. On the basis of constrained pumping scenarios, Horton estimated than pumping El Sur's wells reduced the river flow at VT-3 by 0.4 cfs, equivalent to a theoretical maximum reduction of 0.04 feet in stage height. In contrast, Hanson indirectly estimated river stage changes of up to 0.09 feet by measuring depths and calculating mean depth changes during pump tests. Based on this information it is reasonable to assume that actual changes in stage would range from 0.04 to 0.09 feet under similar test circumstances, and that the changes would vary from one location to another within the affected reach. Similarly, the effect on flow, depth and water velocity would vary depending on subtle differences in channel shape, gradient, and streambed permeability.

6. To develop a better understanding of the potential effects of stage changes on flow and habitat I contacted the USGS Field Office in Marina, California about the rating curve for the lower USGS gaging stations No. 11143010. In a phone conversation on June 8, 2011 they provided break points for their 1st rating curve at this gage; and I plotted this data on a graph, provided as **Exhibit CSPA/CBD-108**. I then constructed a log-log function for the points and simulated the effects of incremental stage changes every 0.04 feet in the flow range below 20 cfs. The simulation, listed in **Exhibit CSPA/CBD-109**, shows that incremental stage changes of 0.04 feet at the USGS gaging station yields flow reductions on the order of 45 percent within this flow range. While the simulation is an approximation, it serves to illustrate than small changes in stage elevation can cause substantial reductions in streamflow, depending on location and habitat. This finding highlights the need to fully evaluate the effect of flow on habitat quality and quantity, prior to setting final bypass flow requirements for El Sur's diversions from the lower Big Sur River.

Use of Depth Criterion in Riffles for Recommending Flows for Juvenile Rearing

Habitat:

7. Hanson used a depth criterion of 0.3 feet over 25% of the channel cross section or 10% or the contiguous channel cross section in riffles as the basis for recommending flows to maintain juvenile steelhead summer rearing habitats in the lower reach of the Big Sur River. (Paragraph 24, Exhibit ESR-21, page 15) While this depth criterion may be appropriate for recommending minimum flows for the physical passage of fish between habitat units (i.e. ability of juvenile fish to move from one pool, glide, or run to another by passing through a riffle), it is not appropriate for developing or recommending minimum flows to maintain the suitable habitat conditions in the entire stream. This is because the quality and quantity of rearing habitat in a river is a complex function of several other important factors including, water velocity, sand/silt concentrations, substrate size (cobble/boulder), stream width, degree of shading, streamside overhead cover (overhanging vegetation) and stream cover (large/small woody debris). A recommendation for all the rearing habitats in a river, based simply on water depth across riffles and without a thorough evaluation of other important factors, will result in recommendations that may be insufficient to provide suitable combinations of habitat factors in the riffles and other habitat units.

Characterization of Dissolved Oxygen and Suitability of Habitats within the Study Area:

8. Hanson characterized DO levels within the study reach as suitable for steelhead juveniles and Horton noted that DO levels were naturally depressed in the loosing reach and were only affected by pumping operations within the ZOI during a short period in 2007. They associated the “natural” decline within the upper portion of the study reach with normal summer conditions whereby streamflow percolates into in riverbed and with unusual conditions whereby El Sur pumping drew O_2 depleted water into the stream for a brief period at an isolated location.

The basis for their conclusions and characterizations can be investigated by examining DO in other streams within the region; and addressing the following questions: Are levels measured in the Study Area similar to other streams, Are levels natural and could differences be explained by diversion of surface flow from the Zone of Influence (ZOI) or areas upstream of the ZOI.

Natural Levels of Dissolved Oxygen in Coastal Streams:

9. **Figure 1** illustrates comparative levels of DO in nine streams within the Santa Lucia Region, including the Big Sur River. The Central Coast Regional Water Quality Control Board collects this data as part of the Central Coast Ambient Monitoring Program (CCAMP). During years 2001-2009, the DO in the Big Sur River at Andrew Molera Park (Site 308BSR) averaged 9.5 mg/L and ranged from 7.4 to 13.4 mg/L. Levels at the upstream site located at Pfeiffer Big Sur State Park (Site 308BSU) are similar, averaging 9.0 mg/L and ranging from 8.2 to 12.6 mg/L. These DO levels are similar to other streams in the Santa Lucia Region, except for stations located in steep reaches or steep streams. This comparative data shows that DO levels in the Big Sur River, upstream of the Study Area were similar to other stream and within levels typical of well oxygenated streams.

10. **Figure 2 and Figure** 3 illustrate instantaneous DO measurements from Site 308BSR (AMSP Footbridge) during the 2001-2009 period, including data from 2004, 2006 and 2007. Except for one measurement on June 10, 2008, all DO levels at Site 308BSR were above 7 mg/L and 80% saturation. The vast majority of measurements were above 8 mg/L; and all but three measurements were above 90% saturation. Based on this oxygenated surface flow, the habitats immediately upstream of the Study Area are highly suitable for juvenile steelhead and the biota normally associated with productive coastal California streams.

11. By comparison, instantaneous daily DO measurements at the reference Station VT-1 are similar, or higher, than Site 308BSR, ranging from 111 to 116% during the pump test period from September 5 to October 10, 2007. (**Figure 4)**

Daily Levels of Dissolved Oxygen within ESR Study Area:

12. In contrast to areas upstream of the Study Area, DO levels within the Study Area downstream of VT-1 exhibited aberrant daily patterns of DO including:

a. Compared to VT-1 and site 308BSR, DO was depressed throughout the test period from August 31 to October 10, 2007. (**Figure 5 and Figure** 6)

b. At the start of the pump test period, DO levels were significantly lower than at the reference station VT-1 and AMSP footbridge, especially at the lower stations where initial levels ranged from 42 to 50% on August 31, 2007. (**Figure 6**)
c. During the initial pump test on August 31, the DO trended downwards at all stations, declining to minims of 7.4% and 22% at stations P4LS and P4RS, respectively. (**Figure 5**)
d. At the uppermost stations, P4uLS and P5LS, the DO recovered to pre-pump test levels, but persisted below the DO at reference station VT-1 and AMSP. (**Figure 5**)
e. At the intermediate stations, P4LS and P4RS, the DO recovery was erratic, ranging from 20 to 90% and ending the test period with DO ranging from 25% AT P4LS and 60% at P4RS. (**Figure 5**)
f. At the lowermost stations, DO was exceptionally low, ranging below 40% at four stations during the initial pump test, and partially recovering to levels below saturation during the OFF pump periods. (**Figure 6**)
g. By the end of the pump tests on October 5, 2007, DO had recovered to pre-pump test levels at most stations, but not to levels associated with well oxygenated streams with daily means ranging below 70%, except at the upper most stations, P5LS and P4uLS. (**Figure 5 and Figure** 6)

13. The daily DO patterns identified in Items 1-7 above, in **Figure 5 andFigure** 6, and in Exhibits ESR-22 [Figures 59-63] & ESR-24 [Figures 52-64] are likely the combined result of intermittently pumping ESR wells and the critically-dry flow conditions during the pump test period. Assigning or separating cause and effect to flow conditions or pumping is difficult, due to the variable nature of streamflow and the limited operation of ESR wells during this period. Had ESR wells been pumped at normal rates and duration, the results would probably have been more conclusive and shown a clear impact of well operations. Regardless of this limitation, the DO levels in the reach below VT-1 did not consistently meet the water quality objectives for DO in the Big Sur River, which includes minimum DO equal to 7.0 mg/L at all times, <u>and</u> median DO saturation greater than or equal to 85%.[1] Considering these requirements and the likely linkage between pumping and DO, the operation of ESR wells should be conditioned so that water production ceases, whenever DO within the ZOI declines below the 75% saturation level.

[1] The Central Coast Regional Water Quality Control Plan includes the following Water Quality Objectives for Dissolved Oxygen in the Big Sur River: As a General Objective, median values [DO] should not fall below 85 percent saturation as a result of controllable water quality conditions; and for Coldwater Habitat and Fish Spawning, dissolved oxygen concentration shall not be reduced below 7.0 mg/l at any time.

Diurnal Dissolved Oxygen in the Study Area:

14. In well oxygenated streams the level of DO fluctuates diurnally in response to plant photosynthesis and animal/plant respiration. **Figure 7** shows the diurnal flux of DO in the Big Sur River upstream of the Study Area during five summer periods (2002, 2004-2007). Typically, DO ranges from 77 to 92 % saturation during nighttime hours, increases during morning hours to maximums ranging from 96 to 109 % at 13:00 to 14:00 hours, and gradually declines to nighttime minims by 21:00 hours. The pattern at this station is similar to other locations in coastal California streams that are well oxygenated.

15. In contrast to the natural patterns in **Figure 7**, the diurnal changes within the ESR Study Area fluctuated outside the normal natural patterns during the pump tests in 2007. **Figure 8:** Diurnal dissolved oxygen fluctuation in the Big Sur River at selected ESR monitoring stations during ESR well pump tests, September 5-7(blue), September 19-21(green), and October 1-3, 2007(red). illustrates the following abnormal patterns at selected sites in the Study Area during the September 5-7, September 19-21, and October 1-3, 2007August 31-October 3, 2007 study period:

a. During the September 5-7 period, the DO dropped to near lethal levels and partially recovered, but not to levels suitable for healthy juvenile steelhead.
b. During the September 19-21 period, the DO was generally depressed below natural saturation levels and ranged into the 40-60% saturation levels during nighttime hours. Daily peaks reached 80%, but the overall levels were not suitable for maintenance of healthy juvenile steelhead.
c. During the October 1-3 period, the daily peak DO at two sites (P4LS and P3LS) equaled or exceeded 100% saturation, but at P4LS DO rapidly declined to unnatural and unhealthy nighttime minims. At sites P4RS and P3RS the DO levels never approached full saturation, remained below 80%, and declined to extremely stressful levels of 20-30% saturation during nighttime hours.
d. Overall, the DO levels within the ZOI during pump tests were often below water quality objectives, highly stressful for fish and within ranges that could cause displacement, abnormal behavior, and/or mortality of individual juvenile steelhead.

Dissolved Oxygen Content of Pumped Water

16. WaterHorton asserted that surface flow makes up a smaller fraction of the diverted

water and only surface flow from Zones 2-4 (ZOI) contributes to water diverted by El Sur Ranch. The dissolved oxygen content in pumped water can be used to assess this assertion.

17. **Figure 9 and Figure 10** show the DO levels in well water produced from El Sur Ranch's Old and New wells during 2006 and 2007 summer operations. Notably, the DO levels during early summer are similar to levels measured in ambient river water at the upstream CCAMP monitoring site (comparison to DO fluxes shown in Figure 7 for 2006 and 2007). Further, the DO in pumped water is dissimilar to DO levels in groundwater, tested in 2004 and shown as the horizontal green band in **Figure 9 and Figure 10**. This close correspondence with river water and dissimilarity to groundwater are strong indicators that El Sur is diverting a high proportion of oxygenated surface flow from the Big Sur River and contradicts Horton's assertion about the relative contribution of surface and groundwater sources.

18. If DO in the produced water matches, or is similar, to DO levels in the river, then the fraction of surface flow is much higher than portrayed by Horton. This fraction can be assessed and tested empirically by reviewing the DO, pumping rates and estimated surface flow losses in September 2007.[2] At a maximum pumping rate of 5.02 cfs, Horton estimated that the diversion

[2] The following mass-balance equation for dilution was adapted from Washington Department of Ecology's *Guidance for Conducting Mixing Analyses*, available at: http://www.ecy.wa.gov/programs/eap/mixzone/mixzone.html Following this guidance, the concentration of DO in groundwater, surface water and pumped water at El Sur's Wells can be expressed as:

$$(DO_p * Q_p) = (DO_{gw} * Q_{gw}) + (DO_{sw} * Q_{sw})$$

and solved for DO_p,

$$DO_p = [(DO_{gw} * Q_{gw}) + (DO_{sw} * Q_{sw})]/Q_p$$

where: DO_p = *Dissolved Oxygen in pumped water;* Q_p = *Volume flow rate of pumped water in cfs;*

of surface water from within the ZOI was ~1 to 1.2 cfs, or 24% of the total pumped. (Exhibit ESR-6, Table 3.1, pdf page 34). If this percentage is accurate, then DO in pumped water would be approximately 1.74 mg/L. However, the measured DO levels in pumped water averaged 6.0 mg/L during September, thereby indicating a greater fraction of surface water was diverted. Considering that surface flow increased downstream of VT3, the only other source of surface water is from the stream, upstream of VT3. Horton estimated that the average loss in the reach from VT1 to VT3 was 3.0 cfs during September 2007 [ESR-6, Table 3-3, pdf page 96] Based on this estimate and the mass-balance equation, the expected DO concentration in pumped water equals 6.26 mg/L. This expected value is very similar to the average of DO measured in pumped water (6.0 mg/l) during September 2007.

19. Another indicator of the close linkage between surface water and El Sur Ranch's diversion is illustrated by the trend in DO concentrations during the pump test operations. In many cases, the DO concentrations trend upward following the initiation of pumping. For example, in 2006 the DO concentrations increased from 60% to ~ 85% saturation during the duration of the July 4-18 and July 20-August 7 tests. This pattern is consistent with the initial drawdown of oxygen depleted groundwater in the alluvium, followed by diversion of surface and subsurface water through the hyporheic zone, upstream of the ZOI. Interestingly, an upward trend during pumping is not always present. For example, in 2007 the DO concentrations dropped from fully saturated concentrations during July and early August to levels of ~ 60%. The cause for this abrupt decline is likely related to low flow conditions during late August and

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DO_{gw} *= Dissolved Oxygen in groundwater;* Q_{gw} *= Volume flow rate of groundwater in cfs,*

DO_{sw} *= Dissolved Oxygen in surface water;* Q_{sw} *= Volume flow rate of surface water in cfs*

September, when the DO levels in the surface water dropped to very low levels, thereby contributing to a sudden reduction DO in the hyporheic zone and the subsurface water drawn to El Sur Ranch's wells. These patterns are consistent with the DO concentrations measured by Horton and noted by Hanson, during late August and September 2007.

Summary of Dissolved Oxygen in Study Area:

20. The DO levels at the upper end of the ESR Study Area (VT-1) and upstream of the Study Area (AMSP Footbridge) were within normal levels for highly oxygenated streams along the central coast of California. Downstream of VT-1, DO was frequently lower than the objectives adopted for the Big Sur River by the Central Coast Regional Water Quality Control Board and ranged below 7 mg/L and 80% saturation, especially during 2007. At several locations daily mean DO was low enough to cause high levels of physiological stress and in possibly mortality. Diurnal fluctuations in DO indicate that the natural processes of ecosystem respiration and photosynthesis are disrupted by diversions and low streamflow conditions, which combine to reduce DO to levels not sufficient for healthy steelhead populations.

21. Differences in DO amongst monitoring sites within the ESR Study Area and the pumping of oxygenated water that matches DO in the stream is consistent with the diversion of a high proportion of streamflow. Based on the DO in pumped water, groundwater, and surface flow, the location of ESR's diversion is partially outside the described ZOI and extends upstream into the loosing reach between VT-1 and P5LS. This expansion of the ZOI is supported by observed DO levels in this reach, which are lower than natural levels at VT-1, but generally meet the objectives in the CCRWQCB Basin Plan.

Testimony on Timing of Steelhead Run and Importance of Habitat-Flow for Adults:

22. I believe Dr. Hanson testified on the timing of the adult steelhead run and characterized the movement of steelhead kelts as occurring immediately after spawning with completion of the downstream migration by April or May. Based on this testimony, I believe there may be an impression that flow for adult downstream migration is not needed later than May. While no data is available to test this presumption in the Big Sur River, historical data from Waddell Creek

in Santa Cruz County indicates that flows may be needed later than May. **Figure 11** shows a summary of the number of adult steelhead kelts migrating downstream in Waddell Creek by weekly periods. Although most kelts migrated by late-May, approximately 25% of the kelts migrated downstream later through the end of the year. Based on previous testimony by Dr. Titus and Dr. Hanson, small numbers of adult steelhead have been observed in the Big Sur River during late-spring through fall months, which leads me to form an opinion that maintaining habitats for adult steelhead in the Big Sur River during the late spring, summer and fall months is important, and the SWRCB should consider flow and habitat needs for adult kelts, when setting bypass flow requirements for ESR wells.

Equivocal Language in Scientific Testimony:

23. "In cross-examining Dr. Titus, Mr. Berliner repeated words and phrases used by Dr. Titus in his testimony such as "it is likely that" and "could result." Mr. Berliner asked Dr. Titus whether Dr. Titus had used such language in his testimony. Dr. Titus answered that he had. Mr. Berliner then asked whether Dr. Titus had "established causation." Dr. Titus answered: "No." **Is it your experience that language which is to varying degrees equivocal is in fact common to scientific expert testimony?**

24. Yes, it is quite common to have varying degrees of uncertainty expressed in expert testimony. This is especially true when examining cause and effect in natural, biological systems. In most cases, experimental tests of cause and effect are difficult to assess or test because natural variation in background conditions often confounds or obscures a true test of factors that may be manipulated. We've seen this situation in the current proceeding, where natural variation in streamflow has confounded or partially obscured tests of how pumping affects streamflow, dissolved oxygen, temperature and river stage.

CDFG vs. CSPA vs. El Sur Bypass Flows

25. "El Sur's scientists and attorneys appear to be asking the State Board to set flows that

are based on <u>proven direct causation</u> of adverse impacts to aquatic biota or their habitat, where required minimum bypass flows would allow diversions at flows greater than flows that show a <u>direct proven impact</u>."

26. **Dr. Titus was asked if he was aware of <u>any other case</u> where a minimum instream flow for steelhead had been set based on requirements for juvenile passage. Dr. Titus answered that he was not aware of such a case. Are you aware of such a case?**

27. Not any recent cases, but during the 1960's there were cases where CDFG formulated flow recommendations based primarily on passage conditions for adult steelhead. One that I'm familiar with was on the San Lorenzo River, where passage over a diversion dam was based upstream flows needed for adult steelhead. To my knowledge, none of the recent cases with flow recommendations are limited to only one life-history stage.

28. **If no direct proven impacts have been demonstrated in the past, is it still possible or even likely to have impacts caused by the applicant's minimum bypass flows?**

29. While I question the validity of asserting that no impacts have been demonstrated, it is definitely possible that applicants minimum bypass flows will cause impacts. Diversions of 5 cfs have the potential to reduce instream flows and habitat conditions within the ZOI and perhaps upstream to VT-1. These changes would affect the quantity of rearing habitat for juveniles, dissolved oxygen conditions, and the duration that the river mouth is open to the ocean and would be more likely to occur if ESR pumps are operated as proposed in the WRA to produce more water than was tested during the pump tests.

30. **If the 0.3-foot criterion has been met at a critical riffle, does this mean that there is adequate passage the <u>entire width</u> of the stream?**

31. No, the remainder of the stream width would likely be avoided by juvenile fish because it is too shallow and not suitable and this effect is size dependent, so that larger fish are more likely to avoid the remainder of the stream's width.

32. **Does the 0.3 FT depth criteria create a presumption of sufficient DO?**

33. I wouldn't presume that no DO problem existed, but I wouldn't assume that it would either. The presence of a DO problem is most related to the fraction of surface flow that is diverted within the ZOI or downstream of VT-1 and less related to a specific depth criterion. A better habitat index would probably be the fraction of riffle habitat that is exposed by pumping operations. As this fraction increases, the amount of surface water diverted downwards increases, leaving more habitats exposed. This leads to short-term die-offs of benthic algae, increases the biological oxygen demand and reduced aeration over the surface of riffle. The net effect is to create an imbalance between photosynthetic production, surface aeration, and aquatic respiration.

34. **Did Hanson and Horton address whether the 10 cfs would be protective of the lagoon?**

35. This issue was not addressed by the study design used by Hanson or Horton. A full evaluation of this impact would require assessing the frequency and duration of closures as a function of lagoon inflow over the entire diversion period, with special attention in late fall/early winter and springtime, when steelhead smolts and other fishes migrate between freshwater and the ocean.

36. **Supplementing <u>oxygenated groundwater</u> is proposed as an alternative to be used at the applicant's discretion as an alternative to minimum bypass flows. What are the problems with this method?**

37. There are a number of technical problems, including but not limited to physical and biological feasibility, cost, maintenance/operations, susceptibility to flood damage, relocation due to channel changes. This mitigation would not likely be accepted by fisheries agencies (CDFG & NMFS) because it attempts to mitigate for an impact (DO reductions) with an unnatural, highly technical fix and may not address the underlying loss of habitat quantity.

38. **Is it an easy task to create an oxygenated stream like what is being proposed?**

39. I'm not aware of any systems that have attempted to oxygenate an entire stream with injections of groundwater. There are additional concerns related to DO reductions that may not

be easily remedied, as streams that are low in DO also tend to generate excess CO_2, which is often difficult to remedy without additional aeration. Production of excessive CO_2 by dewatering would be compounded by using groundwater, which is often high in CO_2.

40. **CSPA/Dettman's <u>summer</u> flow requirements appear to be <u>only slightly higher</u> than those recommended by the applicant. Are they really so similar?**

41. No. The differences are greater than the arithmetic difference, as CSPA/Dettman's summer flow requirement is measured at the USGS gaging station in Andrew Molera State Park, at all times and does not consider losses between the gaging stations. Further, CSPA/Dettman's recommendation is based on the presumption that bypass flow is met at all times, regardless of whether a specific depth criterion is met at specified riffles. CSPA/Dettman's bypass requirement is meant to provide sufficient habitat quanity and quality, meet Basin Plan requirements for DO and maintain an open river mouth into the Pacific Ocean.

42. **Is the applicant's proposed exception to bypass flows acceptable, if ESR can demonstrate adequate fish passage at lower flows?**

43. No. This exception should not be allowed, as it does not address the potential loss of habitat quality and quantity during the low flow rearing season.

44. **CSPA and DFG's <u>winter</u> flow requirements appear to be much, much higher than those proposed by the applicant. Why such a contrast?**

45. CSPA and CDFG's winter flow requirements are based on a review of median flows and an assumption, in the absence of a PHABSIM report, that median flows will be protective. Applicant's proposal is based on minimum passage conditions at a single riffle passage transect and do not consider other flow requirements for spawning, egg incubation, smolt production and emigration.

46. **Is it possible at this point to conclusively determine what bypass flows will be protective without DFG's flow study? Why or why not?**

47. No. Any bypass flows recommended at this point in time should be considered interim

in nature and subject to change, following review of the results from CDFG's PHABSIM report. It is not possible to conclusively determine bypass flows without this work because it is designed to model the variety of habitat types within the Study Reach for several life-history phases and this is beyond the scope of any biological work done thus far on the Big Sur River.

Assessment of Diversion Impacts by ESR Consultants:

48. **Considering the following assertion by Dr. Hanson, comment on the assertion:**

> *[Shutes:] "Taking into account the natural variation in flows within the river, the effect of well operations on river flows could not be detected statistically during the critically low flows in 2007. Based on the small change in water surface elevation estimated by SGI (2008) it was concluded that a change of this magnitude would not result in a detectable adverse impact on the quality or availability of habitat for juvenile steelhead within the lower river and lagoon."*

49. My review of the pump tests and information supplied by Hanson and Horton leads me to a different conclusion and an opinion that the statistical tests were flawed by using a reference site that may have been influenced by well pumping and by limiting the duration of the pump tests to short periods that are not typical of normal pump duration and magnitude.

50. The effect of well operations on streamflow should have been tested by comparing surface flows at a nearby upstream reference site (not VT-1), but closer to the locations identified by CDFG's expert, Mr. Custis.

51. **Did Dr. Hanson establish that well operations have no effect on surface flows and the quality and quantity of summer rearing habitat?**

52. I don't agree that there is a lack of detectable adverse impact. Impacts are evident for DO in the reach below VT-1. No assessment was made on impacts to habitat area, quality and quantity, other than 0.3-foot criterion, which is insufficient for making such assessments.

Peer Review of EIR:

53. **Ms. Goldsmith told the board that the EIR could be seen as a "peer review" of the technical reports by the applicant's consultants. Do you consider the Hanson studies to be "peer reviewed" by the EIR?**

54. Only to the extent that professional fisheries biologists or other qualified experts participated in the review and comment process. My understanding is that CDFG conducted a thorough review of the project. Their comments on the EIR could be considered a peer review of the technical information that was presented in the EIR.

Health and Status of the Big Sur River:

55. **Can you comment on the "Healthy" Status of the Big Sur River? Can you comment on these different analyses of the condition of the steelhead population in the Big Sur River?**

56. Based on the evidence that I've reviewed, it appears that the steelhead population in the Big Sur River is smaller than some may have opined. In part, this may be due to the relatively short reach (~7-8 miles) of river available to anadromous adults and insufficient numbers of juvenile fish. A comparison of the population density indexes collected by Hanson in 2004 and 2007 to other nearby streams indicates that production of juvenile fish was far below other streams along the central California coastal and may not be sufficient to yield any surplus adult production.

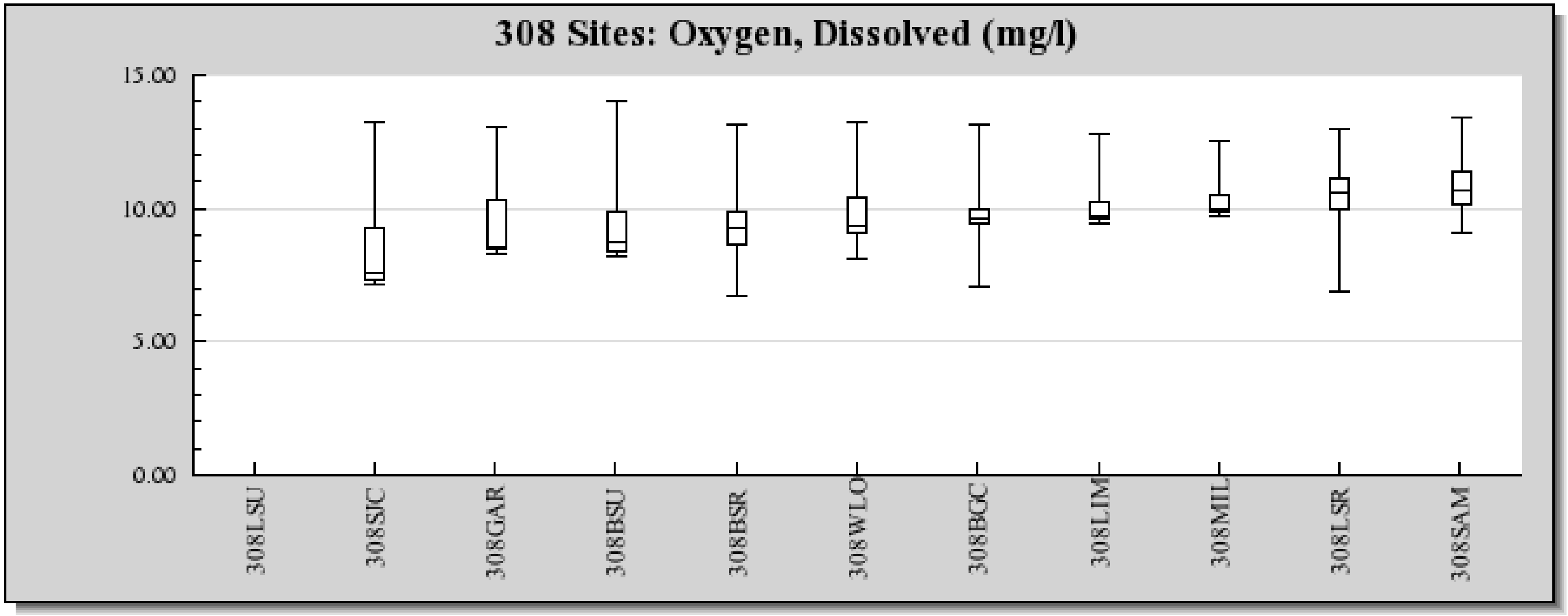

Figure 1: Dissolved oxygen (mg/L) measured at ten sites within the Santa Lucia region, extending from southernmost Salmon Creek to northernmost San Jose Creek, during the period 2001-2009. Source: Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/view_data_01.php

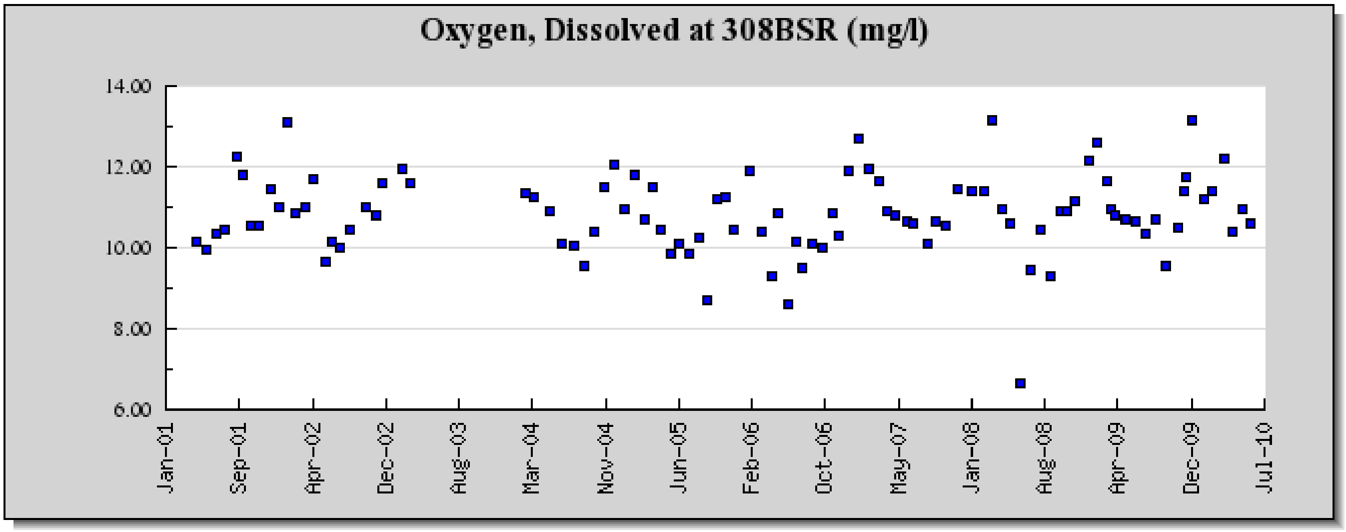

Figure 2: Dissolved oxygen (mg/L) measured at Andrew Molera State Park during the period 2001-2009. Source: Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/view_data_01.php

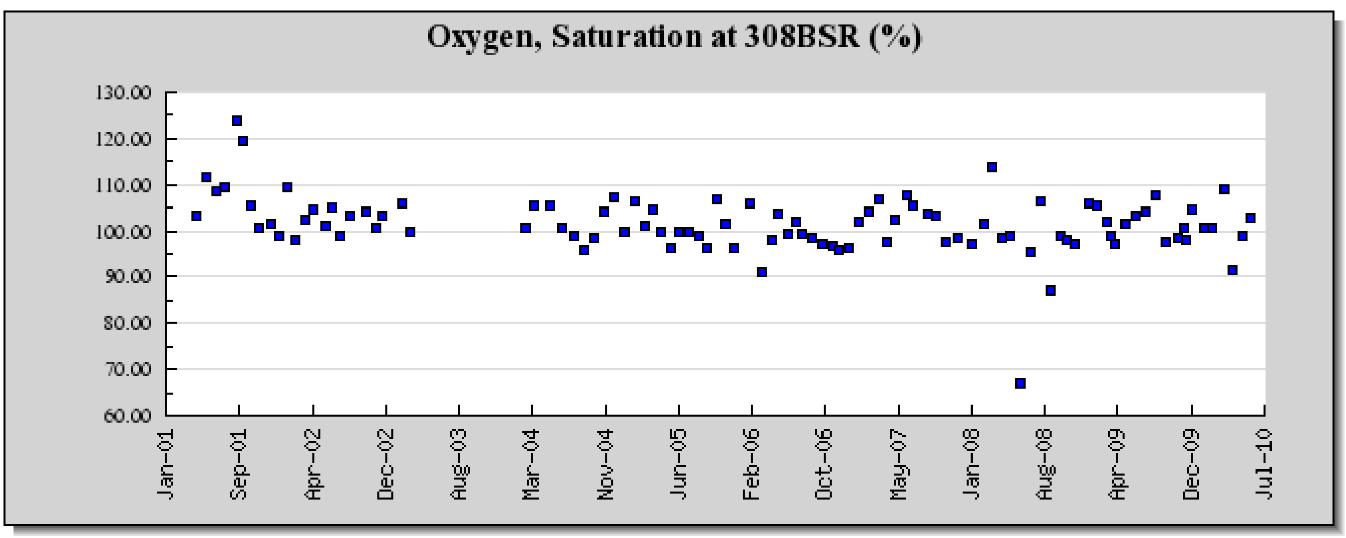

Figure 3: Dissolved oxygen (Percent Saturation) measured at Andrew Molera State Park during the period 2001-2009. Source: Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895

Aerovista Place, San Luis Obispo, CA. Website:
http://www.ccamp.info/_2010/view_data_01.php

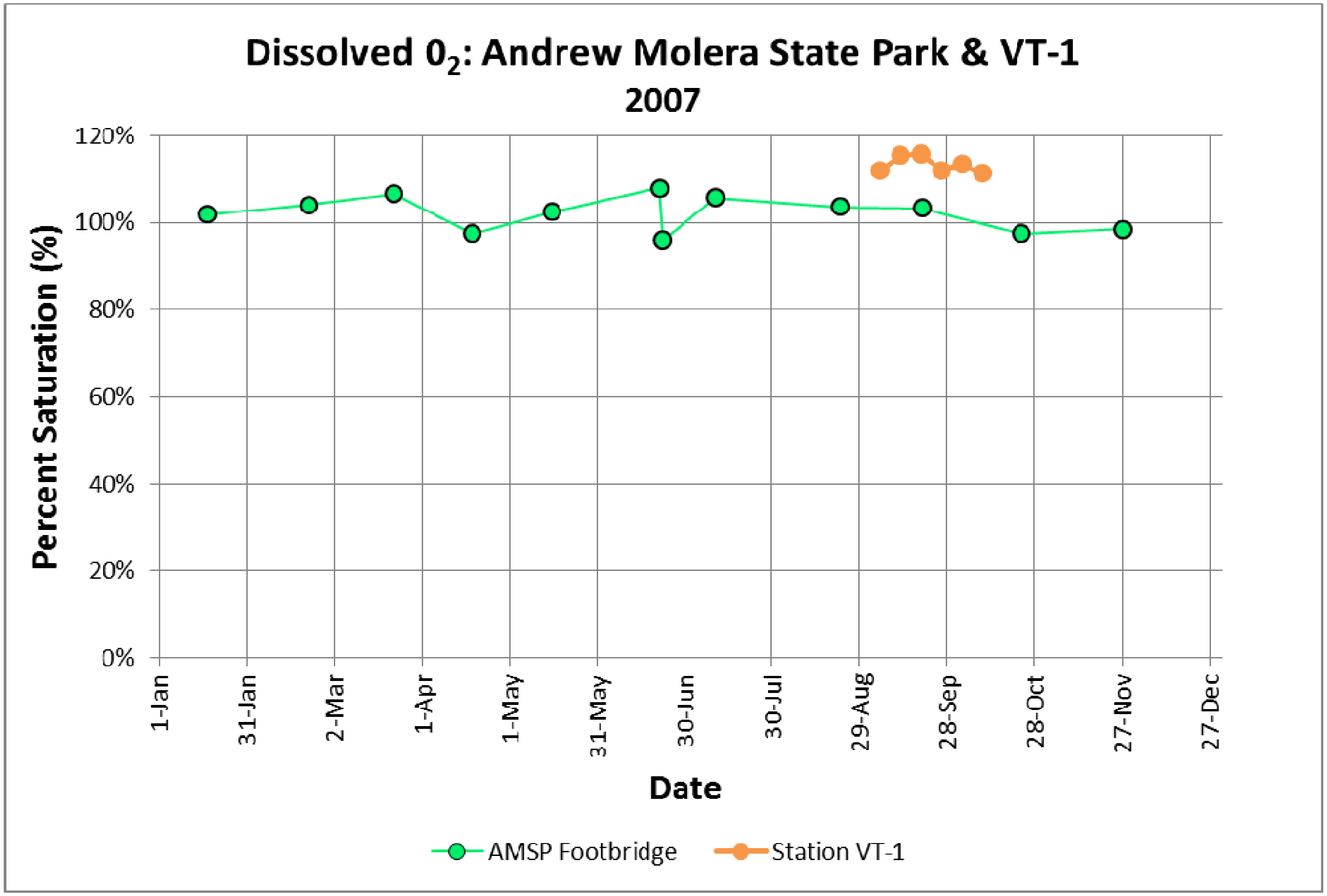

Figure 4: Instantaneous measurements of dissolved oxygen at the reference Station VT-1 and the lower footbridge located adjacent to parking lot at Andrew Molera State Park picnic grounds. Daily means at VT-1 based on three grab samples across stream channel. Instantaneous measurements at AMSP from single, morning grab sample at the lower footbridge crossing. All measurements of DO expressed in % saturation, corrected for water temperature at time of measurement and altitude (assumed sea level). Sources: VT-1 based on data supplied by ESR and listed in Copy of 071025 Piezo Temp and DO_dhdettman_06282011.xlsx. Data for AMSP Footbridge

from Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/view_data_01.php

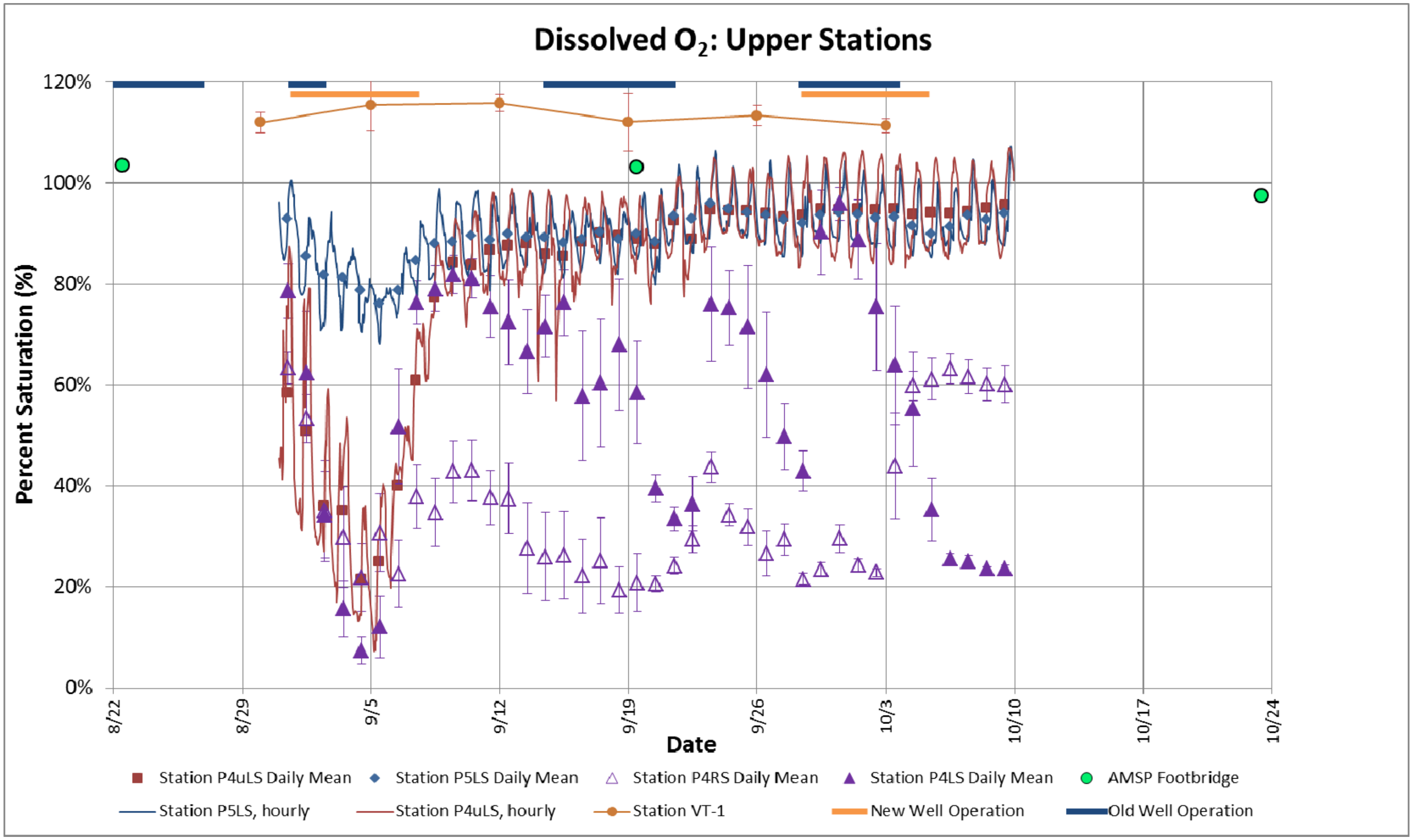

Figure 5: Mean daily dissolved oxygen levels at uppermost monitoring stations in the ESR Study Area, including Stations P4LS, P4RS, P4uLS, P5LS and reference Station VT-1 during September 2007 ESR pump tests. Daily means at P4LS, P4RS, P4uLS, and P5LS based on hourly measurements; means at VT-1 based on three grab samples across stream channel. Instantaneous measurements at AMSP from single, morning grab sample at the lower footbridge crossing located adjacent to parking lot at AMSP picnic grounds. All measurements of DO expressed in % saturation,

corrected for water temperature at time of measurement and altitude (assumed sea level). All data, except AMSP Footbridge, are based on data supplied by ESR and listed in Copy of 071025 Piezo Temp and DO_dhdettman_06282011.xlsx. Data for AMSP Footbridge from Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/view_data_01.php

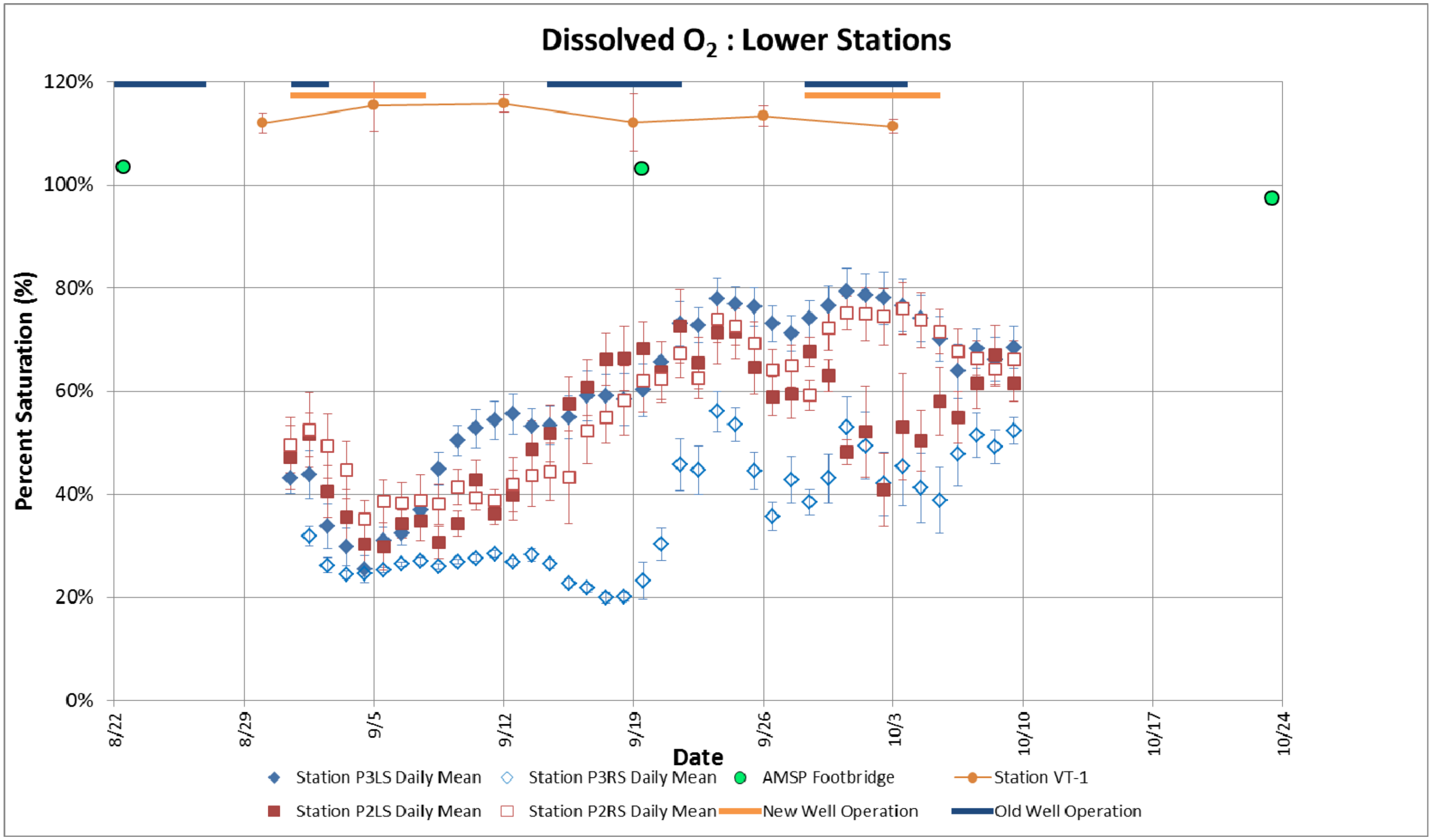

Figure 6: Mean daily dissolved oxygen levels at lower monitoring stations in the ESR Study Area, including Stations P3LS, P3RS, P2LS, P2RS and reference Station VT-1 during September 2007 ESR pump tests. Daily means at P3LS, P3RS, P2LS, and P2RS based on hourly measurements; means at VT-1 based on three grab samples across stream channel. Instantaneous measurements at AMSP from single, morning grab sample at the lower footbridge crossing located adjacent to parking lot at AMSP picnic grounds. All measurements of DO expressed in % saturation, corrected for water temperature at time of measurement and altitude (assumed sea level). All data, except AMSP Footbridge, are based on data supplied by ESR and listed in Copy of 071025 Piezo Temp and DO_dhdettman_06282011.xlsx. Data for AMSP Footbridge from Central Coast Ambient

Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/view_data_01.php

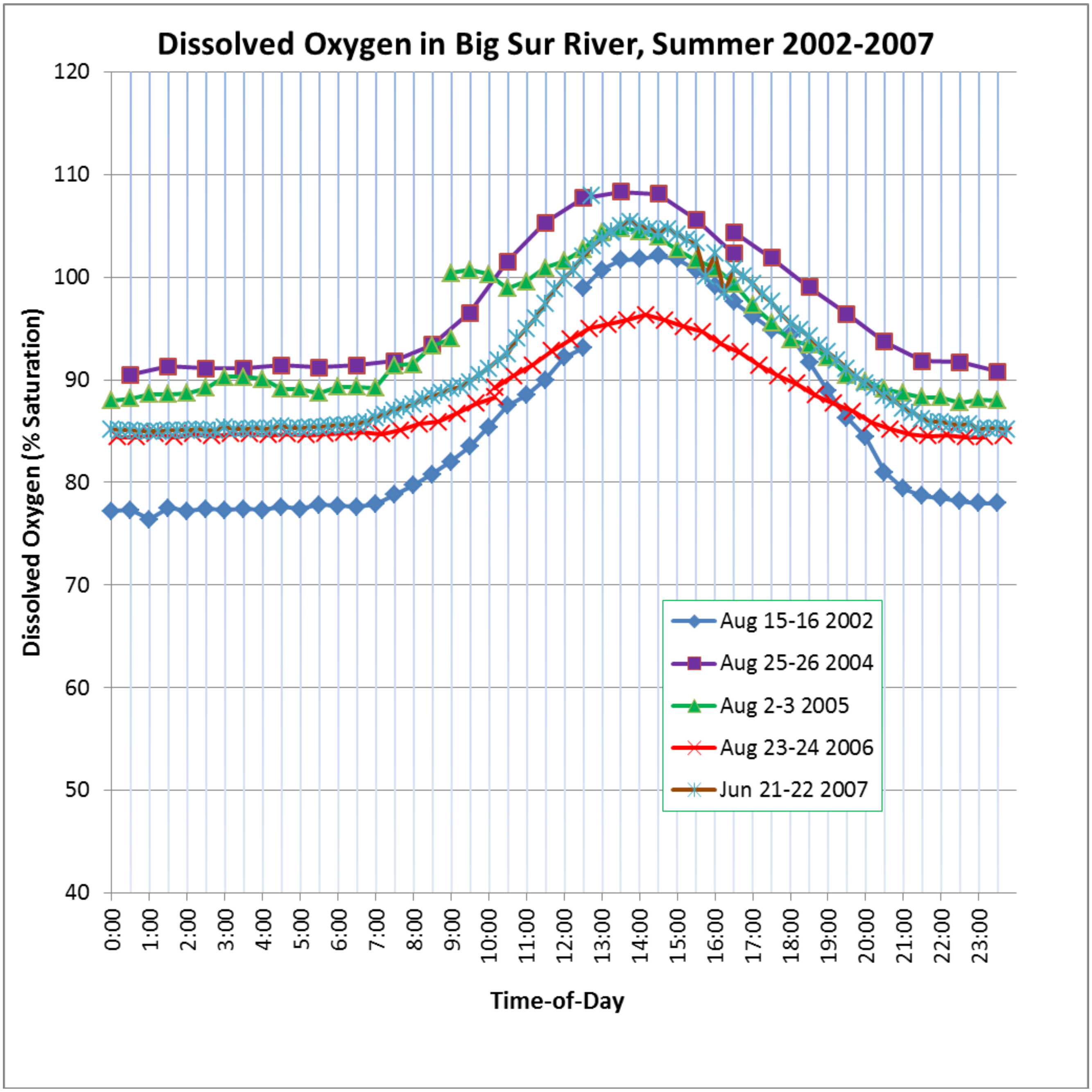

Figure 7: Diurnal fluctuation in dissolved oxygen measured upstream of Study Area during summers 2002, 2004-2007. DO was measured at the footbridge crossing adjacent to the Andrew Molera Parking Lot at Picnic Grounds, upstream of ESR Study Area. Approximate GPS location is 36.287130° N/-121.844400° W. Source: Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board, 895 Aerovista Place, San Luis Obispo, CA. Website: http://www.ccamp.info/_2010/

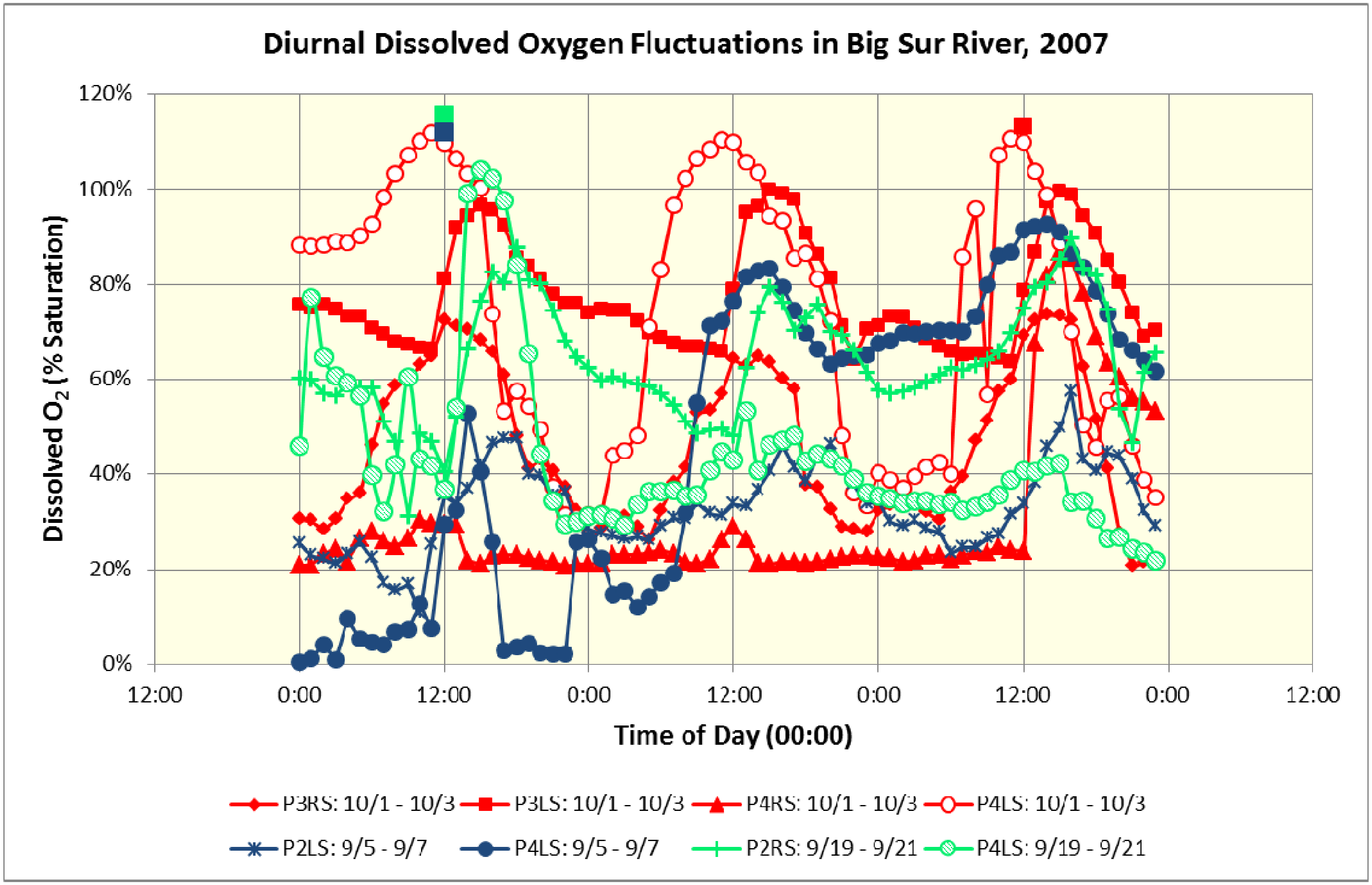

Figure 8: Diurnal dissolved oxygen fluctuation in the Big Sur River at selected ESR monitoring stations during ESR well pump tests, September 5-7(blue), September 19-21(green), and October 1-3, 2007(red). Spot measurements of DO at reference site VT-1 are plotted as green (9/19), blue (9/5) or red (10/3) squares.

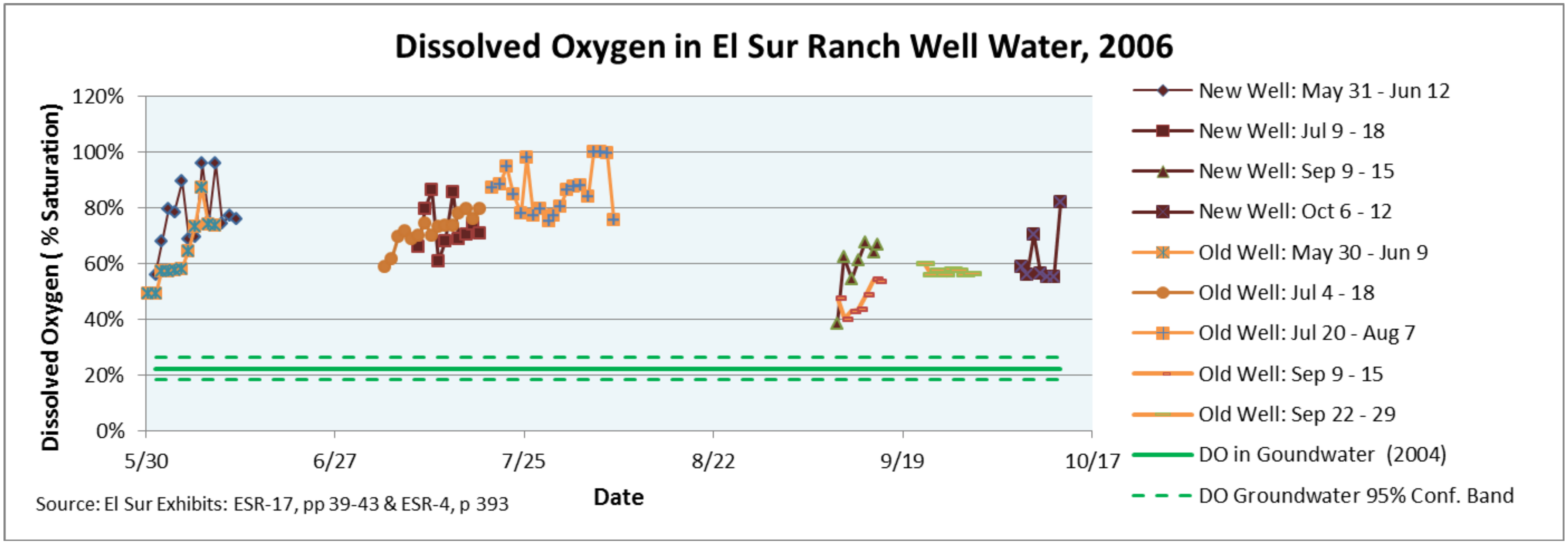

Figure 9: Dissolved oxygen levels measured in El Sur Ranch well water during late May through October 2006. For comparison, mean dissolved oxygen in groundwater is shown from measurements during 2004 season (95% confidence band for groundwater levels is shown by green dashed line).

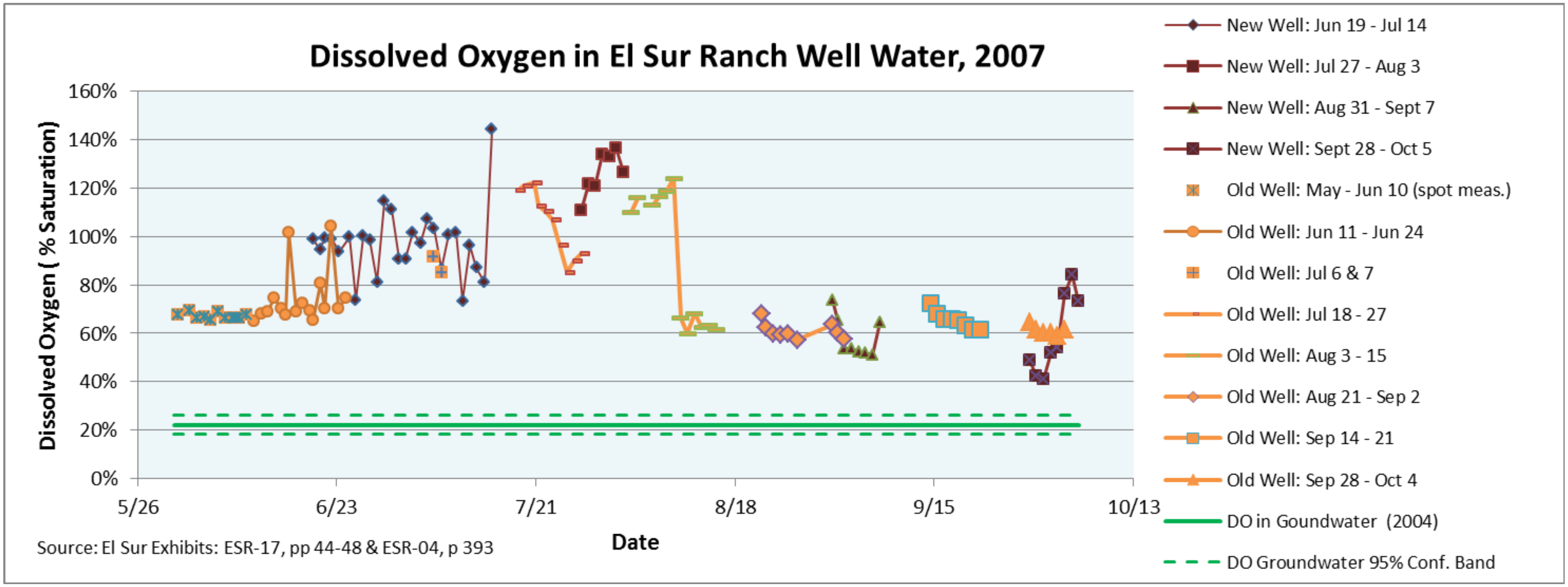

Figure 10: Dissolved oxygen levels measured in El Sur Ranch well water during late May through October 2007. For comparison, mean dissolved oxygen in groundwater is shown from measurements during 2004 season (95% confidence band for groundwater levels is shown by green dashed line).

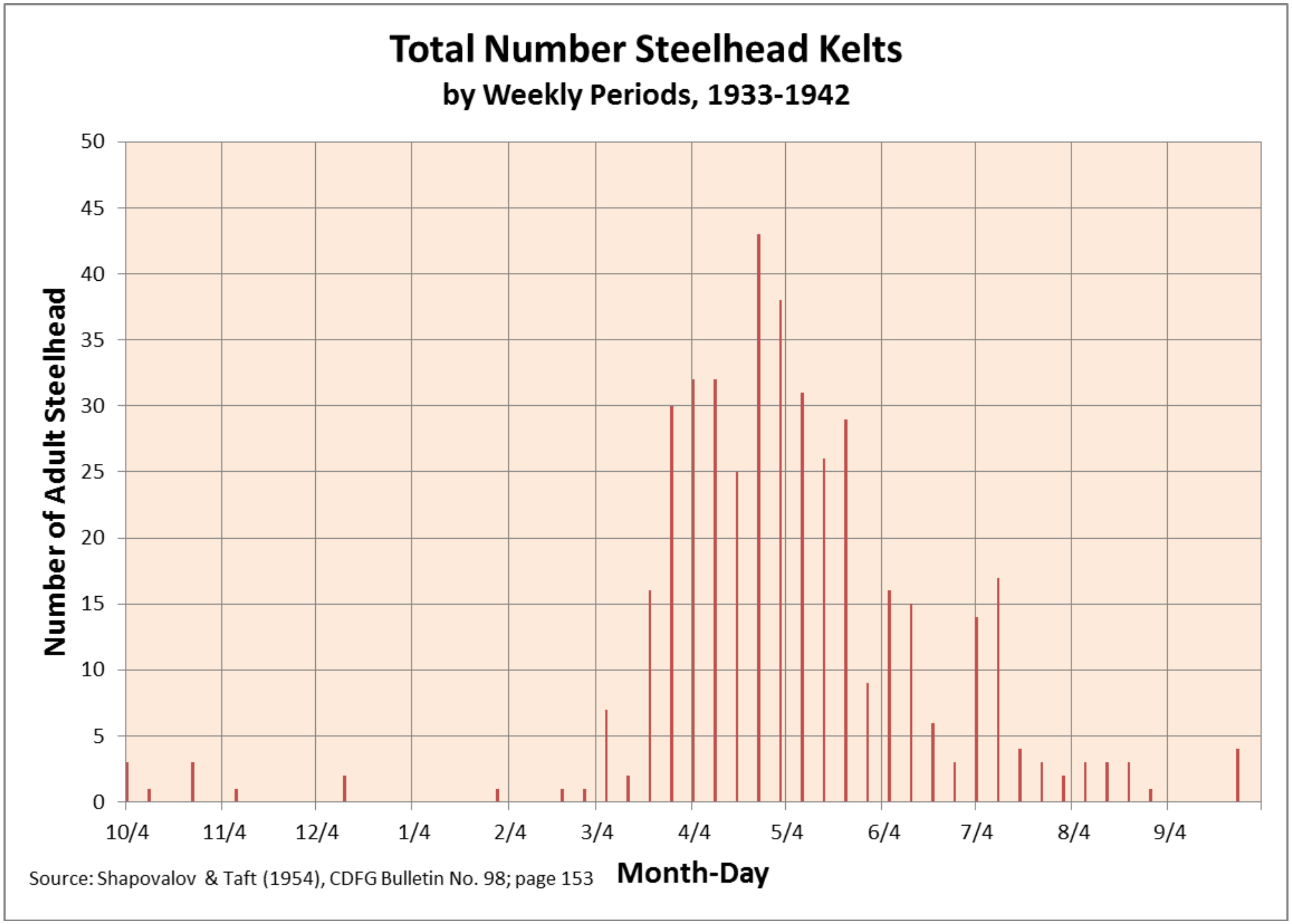

Figure 11: Number of Adult Steelhead Migrating Downstream in Waddell Creek during weekly periods, 1933-1942.