D.W. ALLEY & Associates aquatic biology

Soquel Lagoon Monitoring Report- 2013

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Abundance of gulls on the beach. 23 November 2013.

Abundance of gulls bathing in the lagoon. 23 November 2013.

SOQUEL CREEK LAGOON MONITORING REPORT, 2013

ACKNOWLEDGMENTS

Ed Morrison and the Capitola Public Works Department did well in creating and maintaining the lagoon in 2013. We appreciated that Matt Kotila, as heavy equipment operator, and Ed Morrison, as Contracting Supervisor, teamed to daily observe the lagoon and adjust to its needs. Every year is different, and we are grateful for their attentiveness. The series of small rains in the fall were successfully passed through the flume by skilled personnel until a larger storm came in February 2014, requiring facilitated breaching.

Regarding the Begonia Festival, the organizers and volunteers effectively dismantled the floats and removed flowers by boat after the Begonia Festival. We thank Nels and Susan Westman again for the loan of their boat for fish censusing. The lagoon inhabitants (wildlife and humans alike) benefitted greatly from Ed Morrison's daily attention to managing the flume inlet as streamflow lessened greatly through the summer We greatly appreciated the close monitoring of weather conditions, rainfall patterns and lagoon level by Steve Jesberg, Public Works Director, as he teamed with his staff.

We were grateful to the volunteers who assisted in the annual fish censusing at the lagoon. There were local residents and a good turnout of UCSC and Cabrillo College student volunteers. The students received valuable field experience. Ned Spencer of Friends of Soquel Creek lent a much-appreciated hand. Biologist, Josie Moss, again provided her positive energy, along with Debie Chirco-MacDonald from Coastal Watershed Council. The regulars, Chad Steiner and Walter Heady, rounded out the fish-crew. Chad brought his daughter, Autumn, who helped us in seining and identifying the fish.

Volunteers are greatly appreciated and always very welcome on typically the first two Sunday mornings in October. Seining usually ends by 1:00 pm, in time for other afternoon activities.

More anchovies were captured than could be swollowed by satiated pelicans or scavanged by gulls. This was a summer/fall season that brought unusually high abundance of marine life to the Monterey Bay to feast upon anchovies, the likes we have not seen before.
23 November 2013.

REPORT SUMMARY

Sandbar Construction. No negative impacts to steelhead were detected during sandbar construction in 2013. Sandbar construction and creation of a freshwater lagoon of maximal depth represented habitat enhancement. Sandbar construction was done prior to Memorial Day weekend in May 2013. Sandbar construction has been permitted by the California Department of Fish and Game (1600-2003-0357-3), the Army Corps of Engineers (25714-0S) and under the National Marine Sanctuary Permit MBNMS-2004-033-A1.

Winter storms had been few after December 2012, during a largely dry winter, and streamflow had declined steadily to 3 cfs on 20 May at the Soquel Village USGS gage, the day that sandbar construction activities began. Kelp and seagrass were prominent throughout the lower estuary, downstream of the railroad trestle. The estuary appeared to have been scoured out during two large December stormflows with peak flows in the 5,000 to 7,000 cfs range, with the bed at least 1−2 feet lower than previous years. The estuary was too deep to wade and rake decomposing kelp from the estuary except within approximately 60 feet upstream of the flume inlet. Kelp and seagrass formed a thick layer on the estuary bottom because there had been no spring storms capable of periodically moving vegetative material out of the estuary. As a result, the estuary bottom was soft with decomposing vegetative ooze. The thalweg of the lower lagoon below Stockton Bridge appeared wide and centered. The typical lateral channel across the beach did not form in 2013. The Creek cut through the sandbar adjacent to the flume and widened at its mouth. Residual estuary depth at low tide prevented good access to the lower lagoon, and insufficient streamflow (less than 3 cfs) was present to assist in moving vegetative material out once it was raked off the bottom. Approximately 20−25% of the decaying plant material was raked from Reach 1 below Stockton Avenue Bridge during 4 days of raking and 3 artificial openings of the sandbar. In normal years, 70−90% of the plant material is raked out below Stockton Bridge. During the 20−23 May construction activities and daily openings of the sandbar, at the minimum daily estuary water surface elevation, the estuary extended from bulkhead to bulkhead in width up to almost the Shadowbrook Restaurant. An estimated 70 percent of the estuary from the beach upstream to the railroad trestle was more than 3 feet in depth at the minimum daily water surface elevation. No tidewater gobies (*Eucyclogobius newberryi*), steelhead (*Oncorhynchus mykiss*) or other species were found in the outlet channel through the beach on May 20. The channel was fast and shallow. No fish rescue and relocation was necessary prior to sandbar closure. No fish were stranded during estuary fluctuations because there were no estuary sidepools. A remnant of a redwood trunk with rootwad was present upstream of the railroad trestle, across from the Noble Gulch confluence.

The entire estuary reach was surveyed for steelhead spawning redds, including the glide above estuary influence. No steelhead redds were found. As required in the permit, a fisheries biologist was present during all sandbar construction activities that could affect fish habitat in the lagoon/estuary. This was year 23 of our monitoring and activities associated with sandbar construction. Annual monitoring reports for the first 22 years are available at the City (**Alley 1991-2013**). As stated in the Soquel Lagoon Management and Enhancement Plan (**1990**) and the 2004 Soquel Creek Lagoon Management and Enhancement Plan Update (**2004**), all instream removal of kelp, sea grass and other organic debris was to be accomplished without the use of heavy equipment in the stream channel except within 25 feet of the flume.

The sandbar was closed for the season on 23 May. Plywood had been positioned under the flume pilings and perpendicular to underflow to successfully reduce seepage under the flume during the summer lagoon phase. City staff and Morrison cabled drift wood under the Stockton Bridge to provide cover for tidewater goby and steelhead. The raft also provided valuable roosting area for native waterfowl during the lagoon phase.

The flume outlet was closed to steelhead passage during sandbar construction and until the lagoon filled sufficiently to allow water into the adult passage portal, and smolts had no access to the ocean nightly (5 nights; 20 May – 24 May). With only 2−3 cfs inflow to the lagoon, the lagoon could not reach the flume inlet after a night of filling. Two days of filling were required for the water surface to reach the flume elevation. The lagoon was completely full by 28 May. With the apparent absence of salmonids in the estuary during the sandbar construction period, it appeared that most smolt out-migration was over prior to sandbar construction in 2013. The 5-night break in steelhead smolt access to the Bay during sandbar construction and lagoon filling likely had little impact upon smolt out-migration in 2013.

Sandbar Breaching. Ed Morrison and Public Works staff did an excellent job of maintaining the productive lagoon for juvenile steelhead as long as possible in fall and winter of 2013/2014, in the absence of sustaining stormflow. Staff manipulated inlet boards before 3 small fall/winter storms and re-enforced the berm around the lagoon periphery to maintain the sandbar and minimize tidal overwash. The shroud was placed over the flume inlet when necessary to draw saltwater out of the lagoon after tidal overwash. Finally, when the 7−9 February storm brought stormflow in excess of the flume's capacity, sandbar breaching was facilitated at 0829 hr on 8 February with the biologist present. The lagoon water surface elevation was increasing 1 inch per 5 minutes when the breach was initiated and was within 5 inches of the piling bolt that indicated flood stage. The water surface was 14 inches above the flume when breaching was initiated. After the breach, the water surface rose from 5 inches to within 3 inches of the lowest piling bolt, coinciding with the freeboard before the lagoon bulkhead would be overtopped. The USGS stream gage reading at Soquel Village was 54 cubic feet per second (cfs) at 0830 hr, with the flume capacity estimated at 30 cfs. By 0945 hr, the estuary water surface had dropped to approximately 40 inches below the piling bolt and about 18 inches below the top of the flume. Light rain continued through 9 February, with streamflow reaching a maximum of about 125 cfs by 0400 hr on 9 February.

Stream Inflow to the Lagoon. Stream inflow was considerably below the median and the lowest since the drought of 1987-92 and 1994. It was insufficient to prevent water temperatures to potentially rise to stressful levels when the management goal of maintaining early morning minimum temperature below 20°C near the bottom was not met for 47% of the monitoring period until 13 October. Baseflow at the time of sandbar closure was approximately 2−3 cfs (compared to 10 cfs in 2012 and 25 cfs in 2011) (**Table 10**). 2013 had the lowest baseflow on 1 June of the past 23 years of monitoring. By 1 September, prior to any fall rainfall, 2013 streamflow had declined to only 0.4 cfs at the Soquel Village USGS gage, compared to 1.8 cfs in 2012 and 5.8 cfs in 2011. The 1 September 2013 baseflow of 0.4 cfs at the gage was third lowest in the last 23 years, just above those in 1992 and 1994. Since streamflow is lost between the gage and the lagoon, streamflow was merely a trickle (0.1 cfs or less) as it entered the lagoon later in September.

Water Temperature. Lagoon water temperature was within the tolerance range of steelhead in 2013, as evidenced by the fifth highest and above average steelhead population (1,681 steelhead) measured in 21 years of estimates. The warmest water temperature was detected in the deepest part of the lagoon below the trestle during the first 10 days after sandbar closure due to a temporary saline layer there. Lagoon water temperatures through the lagoon phase were the warmest in the last 5 years, likely because of low stream inflow and despite a deeper lagoon and good management of the flume inlet (**Figures 2, 3a−3e**). As in past years, no stratification or lagoon thermocline was detected in 2013 by the data loggers, except for the first 10 days after sandbar closure in the deep area near the trestle. A warm, stagnant saline layer approximately 1.5 feet thick existed there until early June (**Figures 4a−4l)**. Flume inlet shrouds were installed to draw saltwater off the bottom, and no water temperature stratification was detected at any of the 4, two-week monitoring stations on 8 June or afterwards **(6a-1 and 6a-2**). Lagoon water temperature was sometimes slightly warmer near the bottom than near the surface, as seasonal maxima and minima of temperatures and 7-day rolling averages indicated (**Table 4**). Lagoon water temperature was warmer near the surface than near the bottom in the heart of the dry summer season, as indicated by the maximum water temperatures and maximum 7-day rolling averages at each location (**Table 4**).

As in past years, lagoon water temperatures in 2013 closely reflected those of the stream inflow and were elevated above stream inflow temperature typically 3−4 °C at dawn and 2−3 °C in the afternoon (**Figures 3g−h; 4a-l; 5a-b**). In 2013 from 30 May to 15 September, the maximum and minimum 7-day rolling average temperatures were 4.7°C and 3.2°C cooler, respectively, in the stream than near the lagoon bottom near the trestle. The average 7-day rolling average of 17.0°C in the stream was 3.7°C less than the average 7-day rolling average of 20.7°C at 0.5 feet for the lagoon bottom. We see from comparisons of the 7-day rolling average for 2013 and 2012 near the bottom that it fluctuated more in 2013 and was generally at least 2°C warmer than in 2012 and about 3°C warmer than in 2011 (higher stream inflow) for July through mid-September. In fact, 2013 consistently had the warmest 7-day rolling averages heretofore recorded.

In 2013, the lagoon steelhead management goal of maintaining early morning minimum temperature below 20°C near the bottom was not met on 63 of 135 days (47%), including 33 consecutive days from 15 August to 16 September (**Figure 4a**). The coho management goal of keeping maximum water temperatures below 20ºC (68ºF) near the bottom in the presence of steelhead was NOT met until mid-September except for a few days in June and early August (11 days during the 2 months), totaling 73% of the days NOT being met (99 of 135 days) of the lagoon period in 2013. At the creek site near Nob Hill in 2013, the stream management goal was met for steelhead of *no more than 4 hours a day at greater than 20ºC (68ºF)* was met except for 1 day (**0.7%**) (**Figure 5a**). The Soquel Creek water temperature goal for coho salmon in stream habitat is to have an average weekly temperature (7-day rolling average) of 16.7º C (62º F) or cooler. In 2013, the management goal was not met on 83 of 135 days (65%) (**Figure 5a**).

In 2013, *water temperatures near the lagoon bottom in the early morning* were rated "good" at all 4 monitoring stations during the 2 monitorings in June and from late September onward until sandbar breaching in February (**Tables 2 and 3**). However, early morning ratings of "poor" (21.5−23°C) or "fair" (20−21.5°C) occurred throughout July and August up to 1 September,

except for a "good" (<20°C) rating at Noble Gulch on 3 August (**Table 3**). The warmest afternoon water temperature recorded in 2013 near the bottom during two-week monitoring was 23.5°C on 1 September (**Figure 3h**).

Aquatic Vegetation. In 2013 at the time of sandbar construction, only approximately 20-25% of the decomposing kelp and seagrass had been raked out of the lower lagoon, and the lagoon bottom was soft with a thick layer of detritus. Therefore, there were more nutrients available for plant growth in 2013 than previous years. Thicknesses of bottom algae and pondweed (with attached algae) were much greater in all reaches in 2013 compared to 2010−2012, with similar coverage (**Tables 5-8**). Evidence of nutrient inputs from Noble Gulch in 2013 was expressed by recurrent thick planktonic algae and sporadically high levels of surface algae nearby, though bottom algae was not thicker than at other sites as had been the case in past years.

Bottom algae thickness in the 2013 lagoon was more than in 2010−2012 and somewhat similar to that in 2009. In 2013, bottom algae thickness in Reaches 1−3 and at the mouth of Noble Gulch averaged 2.0 ft, 1.1 ft, 1.2 ft and 1.2 ft, respectively (**Table 5**). Pondweed was first detected in early August, it being initially most prominent in Reaches 1 and 2 in September and then later reaching 20−25% coverage and 3−5 ft thickness in all three reaches by late September.

Surface algae in 2013 varied between 0 and 7% in Reach 1, 0 and 5% in Reach 2, 0 and 10% in Reach 3 and 0 and 30% at the mouth of Noble Gulch (**Table 5**). Surface algae in the vicinity of Noble Gulch seemed to be sporadically high. Surface algae abundance here seemed unrelated to Soquel Creek stream inflow to the lagoon when comparing different years. Surface algae coverage was somewhat correlated with bottom algal thickness throughout the lagoon because 2009 and 2013 had relatively high bottom algae thickness in Reaches 1−2 and correspondingly high surface algae coverage there.

Oxygen Concentration. Oxygen concentration was lowest at dawn, or soon after, because oxygen was depleted by cell respiration overnight before plant photosynthesis could begin producing oxygen with the light. Near dawn is the time when oxygen concentrations are most importantly measured and rated. In 2013, the average oxygen level remained "good" (greater than 7 mg/l at dawn) for steelhead *near the bottom* at all 4 stations during the 18 two-week monitorings (**Table 2; Figure 6a-1**). However, oxygen concentration was "poor" at Stockton Bridge (Site 2) on the first monitoring due to the saline layer on along the bottom (**Tables 2 and 3, Figure 6a-1 and Appendix A**). In addition, oxygen concentration at the mouth of Noble Gulch (Site 4) was "poor" during 4 monitorings and "fair" on 1 monitoring. In 2013, oxygen levels at the mouth of Noble Gulch were sporadically lower than in at least the past 5 years (and the only year with it in the "poor" range), including the low flow years of 2007−2009 (**Alley 2008−2013**). This "poor" rating then improved through the day into the "good" range once photosynthesis began, except at Stockton Bridge when the saline layer was present (**Figure 6a-2**). At the flume (Site 1) the oxygen concentration was "fair" in the fall on 2 monitorings, as it was at Stockton Bridge on one monitoring. Ed Morrison and Public Works staff did an excellent job of managing lagoon water level after small storms to maintain light penetration to photosynthesizing plant life to produce oxygen.

Salinity Monitoring. In 2013, saline conditions were only detected a short time after sandbar closure (30 May and 8 June) in the deeper lagoon area along the wall at Venetian Court and at Stockton Bridge (**Appendix A**). Warm water was also detected from data loggers in a 1.5 ft (0.5 m) layer along the bottom in the deepest part of the lagoon, downstream of the railroad trestle until 4 June. This indicated that saltwater was also present there. Saline conditions resulted from a small amount of saltwater being trapped in the lagoon at the time of sandbar closure on 23 May, which created a stagnant layer along the lagoon bottom that heated up. A shroud was installed on the sandbar inlet on 30 May to pull saltwater off the bottom and out through the flume. No salinity was detected on 22 June. Despite limited lagoon outflow in 2013, saltwater was not periodically flushed back into the flume on certain high tides. A freshwater lagoon was maintained from mid-June until 29 December when tidal overwash occurred. At that time, the shroud was installed on the flume inlet and only slight salinity was detected at Stockton Bridge on 4 January. The estuary phase began on 8 February.

Begonia Festival Observations and Water Quality Findings. No negative impacts to fish were detected during the Begonia Festival. Water temperatures near the bottom were the season's highest since the saline layer dissipated in the first 10 days of sandbar closure. Water temperature increased to between 23 and 23.5°C near the bottom in the afternoon (**Figure 3h**) and was likely stressful to steelhead. Lagoon water surface elevation was excellent and was maintained relatively high at 2.61−2.62 (**Figure 2**). Morning oxygen levels were in the "good" range at the 3 lower sites and "fair" at the mouth of Noble Gulch (**Figure 6a-1**). In conformance with the permit requirements from the California Department of Fish and Game, no floats were set up to be propelled by waders. All floats were electric motor-powered. Thus, the lagoon bottom was undisturbed. No fish mortality was observed. Oxygen concentrations in the afternoon near the bottom following the nautical parade were high and supersaturated, ranging between 11.44 at Noble Gulch at 1500 hr and 13.91 mg/l at the flume at 1610 hr. The secchi depth (water clarity) was to the lagoon bottom after the float procession. Flower petals were collected by Begonia Festival staff and volunteers the following week, and there were minimal petals left by the parade of floats.

Fish Sampling. Our steelhead population estimate based on mark and recapture for fall 2013 was 1,681 compared to 220 in 2012 and 678 in 2011 (**Table 11; Figure 23**) (methods in **Ricker 1971**). This was the fifth highest estimate in 21 years and slightly above the average of 1,599. On 13 October 2013, 10 tidewater gobies were captured with a smaller seine, along with threespine stickleback without mortality. Tidewater gobies were last captured in 2008 and 2009 after other dry winters. Other species captured with the large seine on both days combined were 12 prickly sculpin, 25 staghorn sculpins, 2 adult Sacramento suckers and 1 juvenile Sacramento sucker. There may have been few yearlings in the 2013 lagoon due to the two 4,800+ cfs stormflows in December 2012 that may have flushed many yearlings out of the drainage and then given the remaining yearlings clear water to feed effectively in spring with the absence of stormflow and growth rates sufficient to allow emigration without staying another summer (**Figure 24**). Yearlings were scarce in the watershed's stream sampling sites in 2013 (**Alley 2014**). Size histograms for other years of sampling back to 1998 may be found in **Figures 12−22**.

Pollution Sources and Solutions. No negative impacts to fish were detected from pollution

sources in 2013. The lagoon near the beach was closed to human contact due to bacterial levels above the maximum acceptable level. The gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria. They forage through the human refuge left on the beach. They bathe and defecate in the lagoon. They roost and defecate on the buildings surrounding the lagoon. The gull population in summer/fall 2013 was the largest observed in 23 years of monitoring. There was an abundance of anchovies in the Monterey Bay, attracting hundreds of brown pelicans and other marine life. Reducing the gull population at Soquel Creek Lagoon would be a major step in reducing pollution. By minimizing the summer stream inflow from Noble Gulch, nutrients and bacteria entering the lagoon would be reduced.

The historical lagoon had large tule beds prior to construction of the bulkheads after the 1955 flood. Tules are commonly used in managed wetlands to remove nutrients and other pollutants from wastewater effluent. Re-establishment of tule marsh in Soquel Lagoon would reduce nutrient pollution and may reduce bacterial counts. Tule re-establishment would also provide fish habitat in Soquel Lagoon.

New and Continuing Recommendations and Those Not Yet Fully Implemented

1. Continue to maintain and repair the flume as necessary. Repair the flume at a time that does not obstruct fish passage or require lowering of the lagoon water level.

2. Take special care to pack sand under the flume, between the pilings, during final sandbar closure in order to prevent seepage under the flume after closure. Continue to add plywood cutoff sheets between the pilings and perpendicular to underflow to maintain sand under the flume and to reduce water seepage and sink holes from forming.

3. Prior to sandbar breaching in the fall, notch the sandbar across the beach, minimizing the gradient of the notch to slow the evacuation of water through the beach and to minimize beach erosion. The purpose is to maximize the residual estuary depth after the emergency breach.

4. Continue to maintain an outer berm near the surf and an inner berm near the lagoon margin with a wide notch in between. The notch in the sandbar should be cut slightly lower than the piling bolt. Continue to make the notch at least 30 feet wide across the beach. The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation.

5. When breaching must be facilitated to prevent flooding, notch the inner berm first, allowing the notch across the beach to fill with water. Then notch the outer berm to finish the sandbar breach, if necessary. If possible, allow the streamflow and tidal action to "naturally" breach the outer berm.

6. Seek volunteers to re-establish tules in the alcoves under the railroad trestle and near the Golino property. When this becomes successful, approach the restaurants to allow tule plantings in Margaritaville Cove. This will provide additional cover for steelhead and

tidewater gobies against predators and may reduce dissolved nutrients and bacteria in the lagoon.

7. Seek funding to secure large woody material to the lagoon bottom with anchor boulders and cabling to bedrock in appropriate locations on the east bank under the railroad trestle or upstream adjacent to the Golino property. This large woody material will provide additional cover and scour deeper habitat to protect juvenile steelhead from predators. Continue to retain large woody material that naturally enters the lagoon.

8. Allow a clear path from under the bridge to the beach at Venetian Courts to enable seining for juvenile steelhead during fall censusing.

9. Make sure the flume is completely open to the Bay before the work-day has ended during all sandbar construction activities. This includes during sandbar re-construction activities late in the smolt out-migration period. Do not use manhole cover spacers to flush sand out of the flume during darkness when the entire outflow from the lagoon must exit through the flume and there is a chance that smolts are still exiting.

10. If stranded fish are detected as a result of sandbar closure or flume clearing, alert the monitoring biologist to discuss the appropriate relocation method for fish, and have the biologist capture and relocate the fish with assistance from Public Works staff. The biologist should be present during all sandbar closure and flume clearing activities when fish may be present (not when the flume is being cleared the week prior to sandbar construction and streamflow is still flowing through the beach). If the biologist is unavailable during emergency cases, have experienced Public Works staff and Morrison relocate fish to the main body of the estuary or lagoon near the pilings and boulders adjacent to the restaurants, where cover and good water depth are available.

11. Closing the sandbar in late May is better than mid-June or later because streamflow is sufficient to rapidly fill the lagoon in most years, and the juvenile steelhead most likely to be present in the lagoon in May are out-migrating smolts. Late May is prior to down-migration of most YOY steelhead from spawning sites above the lagoon. Small steelhead fry remain in the vicinity of spawning sites before moving down into the lagoon.

12. The management solution for minimizing the time required for sandbar construction is for the City to remain flexible on timing of the work. If rain is in the forecast within two days after the intended starting date for sandbar construction, Public Works should postpone construction until clear weather is forecasted. If 4-5 working days are set aside to construct the sandbar, the sandbar construction may be delayed as late as 4-5 days before the Memorial Day weekend and may still satisfy the tradition of lagoon formation before then.

13. Continue to rake as much kelp and sea grass out of the lagoon as possible before final closure, from the Stockton Avenue Bridge downstream, including plant material trapped under the restaurants and in depressions around the bridge piers. Discontinue raking if juvenile steelhead are observed near the water surface. It is best to minimize time

required to stockpile sand, rake out the decomposing organic material and prepare the flume inlet for fish passage. This will minimize the number of instances of artificial fluctuation of lagoon water level. Sufficient City staff should be assigned to be ready to enter the estuary at the earliest opportunity each day and quickly rake out decomposing kelp and to clear the sand-filled flume.

14. Dispose of kelp in the Bay rather than bury it in the sandbar. Disperse it up and down the beach. Continue to include this in the Fish and Game permit for sandbar construction. County Environmental Health approved of this method so long as kelp is spread over a wide area (**J. Ricker, personal communication cited in the original 1990 Soquel Creek Lagoon Management and Enhancement Plan**).

15. During sandbar construction, continue to close the lagoon each day before the incoming tide can wash salt water and kelp into the lagoon. Re-open the sandbar and unplug the flume, if necessary, each morning to facilitate kelp and sea grass removal.

16. Continue to search under the Stockton Avenue Bridge and in Reaches 2 and 3 for stranded fish to rescue as the lagoon drains each day during sandbar construction and raking. It is best to minimize the number of days to construct the sandbar and rake out the decomposing organic material. This will minimize the artificial fluctuation of lagoon water level. Having a maximum number of personnel to rake decomposing organic material into the bay and to clear the flume of sand will minimize the days needed to prepare the lagoon for the summer.

17. Maintain an underwater portal in the flume intake for out-migration of adult steelhead until June 15, while maintaining a notched top plank for out-migrating smolts until 1 July. However, in dry years such as 2007−2009 and 2013, when stream inflow is insufficient to both fill an underwater portal and allow lagoon filling, opt for a larger notch in the top plank to accommodate adult kelts and smolts in place of the underwater portal for kelts.

18. Maintain the 1-foot high baffle inside the flume until July 1 for safe entrance of out-migrating steelhead smolts into the flume inlet before they enter the Monterey Bay.

19. Place a 4-inch by 4-inch plank in the base of the flume outlet to maintain adequate flume depth, if necessary.

20. Continue to cover the visquine around the flume inlet with manually shoveled sand instead of tractor shoveled sand. This will prevent the tractor from displacing the visquine. Clear visquine is preferable to black. Key the visquine into the lagoon margin to encourage its retention when the sandbar breaches in the fall.

21. Retrieve visquine from around the flume inlet before or immediately after the fall sandbar breach, if possible.

22. Require that Margaritaville staff not wash the patio and adjacent walkway (containing refuse dumpsters) off into the lagoon.

23. During sandbar construction, continue to lash floating logs together under the bridge to create fish cover if they are present and time allows.

24. Restrict the number/weight of float participants allowed on each floats to a safe level.

25. Continue to disallow wading to propel floats during the Begonia Festival's parade.

26. Recommend to the Begonia Festival organizers that floats be safely maneuvered downstream of Stockton Avenue, with a water marshal present to direct floats around buoys in a circular direction along the periphery of the lagoon after they clear the bridge.

27. Support the ban on alcohol consumption by float participants and rowdy behavior on their floats.

28. Continue to use wedges or plywood on the flume inlet boards to prevent their dislodgment from vandals and back-flushing from the tide, especially in the fall when the beach becomes eroded.

29. If sufficient turbidity occurs after the first small storms of the season to prevent light from penetrating to the bottom of the intact lagoon for more than one day, continue to reduce lagoon depth temporarily to insure that light reaches the bottom. This will prevent death of aquatic vegetation and increased biological oxygen demand, with the associated loss of oxygen production that would have occurred from photosynthesis. Thus, anoxic conditions will be prevented. When the lagoon clears up, re-establish the maximum lagoon depth.

30. If the sandbar is in place after November 15, maintain an opening in the flume inlet during early, small stormflows to allow early spawning adults to pass through the flume from the Bay.

31. Continue to use gull-proof lids on refuse cans on the beach and around the lagoon. Use enough refuse containers to satisfy the demand for refuse disposal.

32. Look into installing gull sweeps on restaurant roofs. The stringing of wire above roofs as observed over the Paradise Grill Restaurant should continue and be expanded to other restaurants to successfully prevent gull roosting there.

33. Look into screening the railroad trestle to discourage roosting and nesting by rock doves.

34. As stated in previous reports, if the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, notify Tiedemann Nursery and the Fish and Game Department so that direct water pumping from the stream may be reduced or discontinued until flow returns. Loss of surface flow should be prevented.

35. During daily artificial breaching during sandbar construction, continue to maintain water

depth in the estuary such that no isolated pools and backwaters form at the margins to strand fish. Blocking of the sandbar may be required to maintain sufficient depth. Check the estuary margins to prevent stranding of fish.

36. As stated in the Management Plan (**1990**), make sure that parking lots and streets draining into the lagoon are cleaned before the rainy season. This will reduce the pollutants entering the lagoon during the first storm of the season that are lethal to fish. Street sweepers with water and suction may be necessary. In addition, roadwork such as repaving and application of fresh petrochemicals should be done in the early summer to allow sufficient time for penetration and drying before the rainy season.

37. Just as the first storm of the fall season begins, remove boards from each side of the flume if a small storm is anticipated. The number of boards removed will be dictated by the anticipated size of the storm. Remove two boards from either side if a large storm is anticipated. Clear the exit to the flume by removing the plate from one side of the exit. After the stormflow subsides, replace the cover until the next storm.

38. As stated in the 1993 monitoring report, management options to delay sandbar breaching include installation of a perimeter fence around the flume inlet to collect algae. Replace the boards after the stormflow subsides, removing them for each succeeding storm until the sandbar is eventually breached during later, larger storms usually occurring after Thanksgiving. There is now a grated opening on top of the flume inlet.

39. After the first storm of the season with the sandbar still intact, lower the lagoon level to a point where light may penetrate to the lagoon bottom. In doing so, the plant life in the lagoon may continue to photosynthesize and is kept viable. Thus, vegetation mortality and stressfully low oxygen levels are prevented until the water clarity is re-established. Re-install boards to increase lagoon depth after the lagoon clears up.

40. Continue to notify the California Department of Fish and Game 12 hours before the possibility of a sandbar breach and immediately after the breach occurs.

41. If the sandbar breaches early in the rainy season, followed by a period of 2−4 weeks of a reformed sandbar that prevents water exchange with the ocean, attempt to pull the decomposing kelp out of the stagnating lagoon. Open the flume and encourage streamflow out with the shroud installed.

42. If a stagnant, kelp-filled lagoon forms in fall after an early breach and a dry period, do not empty the lagoon by breaching the sandbar. Instead, use the flume and shrouds to pull saltwater out. Breaching of the lagoon will increase the opportunity for more kelp to enter and probably will not empty the entire lagoon anyway. Fish passage need not be maintained through the flume because it should be discouraged until sufficient stormflows develop to provide passage up the Creek. If adult salmonids enter too early, they will become stranded and unable to migrate upstream because of insufficient streamflow.

43. The City should encourage and influence planners, architects and property owners through the permit process to maximize water percolation and to filter out and collect surface runoff pollutants from new and existing development in the City and upstream.

44. The City should request from the flood control district that sediment and grease traps be installed, inspected and cleaned on drains leading into lower Soquel Creek.

45. The City should continue to fund activities to remove Arundo from lagoon-side residences and other non-native plants in the riparian corridor between Highway 1 and the lagoon.

46. Continue to census the juvenile steelhead in the fall to monitor the use of the lagoon as an important nursery area under varying management scenarios and restoration efforts.

47.

LAGOON AND ESTUARY FORMATION

Fishery Rescue Actions Required Prior to Construction Activities

20 May 2013. No fish relocation was necessary prior to sandbar construction. The Creek cut through the beach adjacent to the flume at 3 cubic feet per second (cfs), with a widening mouth. The flume had been cleared of sand the previous week. The water surface elevation of the estuary was below the entrance to the flume. No tidewater gobies (*Eucyclogobius newberryi*) or steelhead (*Oncorhynchus mykiss*) or other species were observed in the outlet channel on May 20. The channel was fast and shallow. No fish rescue and relocation were necessary prior to sandbar closure. No auxiliary channel was needed this day. The bull-dozer was used to narrow the Creek outlet, focus streamflow and to cause the outlet channel to cut more deeply through the beach to gently drain a short, shallow, lateral finger that was present on the restaurant-side of the beach. No fish were observed in this finger before or during its draining. After the creekmouth near the surf was narrowed, the channel developed a bend away from the flume and then back towards it near its outlet.

As required in the permit, a fishery biologist was present during all activities that could affect the fish habitat in the lagoon/estuary during sandbar construction. This was our twenty-third year of monitoring and assisting in activities associated with sandbar construction at Soquel Creek Lagoon. Annual monitoring reports for the first 22 years are available at the City (**Alley 1991-2012**). As stated in the Soquel Lagoon Management and Enhancement Plan (**1990**) and 2004 Soquel Creek Lagoon Management and Enhancement Plan Update (**2004**), all instream removal of kelp, sea grass and other organic debris was to be accomplished without the use of heavy equipment in the stream channel except within 25 feet of the flume. The bulldozer/tractor could traverse the area adjacent to the flume.

Monitoring of Flume Maintenance and Sandbar Construction

20 May 2013. The fishery biologist, Alley, arrived at 0600 hr. Sand grading on the beach began this day. Unlike most years, Soquel Creek was flowing straight out to the Monterey Bay adjacent to the flume, with a widening mouth. There was no lateral channel across the beach. The flume had been cleared of sand the previous week by Public Works staff, with adequate screening of the intake hose for water pumped into the flume. The weir inside the flume was still intact. On 20 May, no auxiliary channel was necessary adjacent to the flume. The water surface elevation of the estuary was below the flume entrance, which was fully boarded up. The flume exit was closed to help keep sand out of the flume. After the high tide at 0715 hr (3.3 feet), the bull-dozer was used to narrow the Creek outlet, focus streamflow and to cause the outlet channel to cut more deeply through the beach. This allowed the short, shallow, lateral finger that was present on the restaurant side of the beach to drain slowly. No fish rescue was necessary. The estuary drained at a rate of approximately 1 foot per hour down approximately 2 feet. A large swell was present. Three city staff, Ed Morrison and the biologist raked kelp and seagrass from 0830 to 1120 hr. One YOY staghorn sculpin (*Leptocottus armatus*) was observed swimming near the surface during raking. The biologist went upstream at 1020 hr to check for fish stranding in side pools. The estuary width extended from bulkhead to bulkhead in width to nearly the

Shadowbrook Restaurant. An estimated 70 percent of the estuary upstream to the railroad trestle was more than 3 feet in depth. No side pools were found. The estuary had steep, smooth sides and a deeper cut thalweg than usual. There was no spawning habitat observed within the tidal influence of the estuary, with one very wide, gradual hydraulic control observed. A spawning glide was observed immediately upstream of the estuary's tidal influence where no spawning redds were observed. Only threespine sticklebacks (*Gasterosteus aculeatus*) were observed on the walk upstream. A black-crowned night heron and mallards were observed. Base supports of the bulkhead wall were exposed. Low tide (1.3 feet) occurred at 1333 hr. The large swell required sandbar closure at 1615 hr and the biologist left at 1630 hr.

21 May 2013. The biologist arrived at 0645 hr. The equipment operator (Kotila) was grading sand toward the concrete wall along the beach, where he had created a shallow pool. No fish were observed in this pool. The sandbar remained closed. The lagoon water surface elevation had not reached the flume inlet, which was fully boarded up. The flume exit was closed to help keep sand out of the flume. But there was a large gap behind the steel plate on one side. The biologist walked the periphery of the lagoon up to Noble Gulch (1015−1040 hr), looking for any coho salmon juveniles. No salmonids were observed. The sandbar was opened at 1130 hr. The outlet channel was adjacent to the flume. Raking began at 1130 hr with 8 city staff, Ed Morrison and the biologist. Raking continued until 1430 hr. The lagoon drained gradually at approximately one foot per hour. The biologist surveyed upstream in the estuary from 1330 to 1430 hr, looking for stranded fish. The estuary extended from bulkhead to bulkhead in width up to almost the Shadowbrook Restaurant. An estimated 70 percent of the estuary upstream to the railroad trestle was more than 3 feet in depth. No side pools or stranded fish were observed. Only sticklebacks were observed in the estuary. Also observed were two yearling deer, adult mallards and 5 ducklings. The extent of upstream tidal influence in the estuary was at N36.97845; W121.95676.

The sandbar was closed at 1445 hr. The biologist left at 1500 hr, by which time the entire beach was covered with fresh sand between the channel next to the flume and east to the jetty.

22 May 2013. The fishery biologist arrived at 0800 hr. The sandbar was still closed, and the lagoon water surface elevation had not reached the flume inlet. The sandbar was opened at 1235 hr. Raking began soon after with 8 city staff, Ed Morrison and the biologist. Raking continued until 1530 hr for the 8 city staff. The biologist had surveyed upstream in the estuary for stranded fish (1405−1448 hr). None were found. Morrison and Alley continued to rake until 1605 hr. The biologist left at 1620 hr. The sandbar was closed shortly thereafter by Kotilla at 1640 hr.

23 May 2013. The fishery biologist arrived at 0845 hr. The sand berm remained in place across the creekmouth. The lagoon water surface elevation was still below the flume inlet, which was boarded up. City staff had portals removed from the flume ceiling and were pumping water into the flume in an attempt to flush sand from the flume. The pump intake pipe was properly screened, and the pump was contained within a tray. Water was being pumped from a pool on the bayside of the sand dam that kept the sandbar closed. The metal plate on one flume exit was removed. Water flowed out of the flume outlet that had been pumped in, indicating that the flume was not completely plugged with sand that had entered during high tide. The metal plate was then re-installed. Kotilla opened the sandbar at 1220 hr. Again, 8 city staff, Ed Morrison and the biologist began raking at 1255 hr. This continued until 1450 hr. Sidewalk grates were sealed

with aluminum flashing to prevent trash and cigarettes from entering the lagoon from the Esplanade. The flume inlet preparation was completed by 1545 hr, assisted by the biologist. Clear visquine was secured around the flume inlet with sandbags. Visquine sheets were keyed into the lagoon bottom with a trench. The visquine was covered with a layer of sand by 1545 hr. The biologist focused on getting the flume prepared and saw no need to survey upstream for stranded fish because no side pools had existed the 3 previous days. The sandbar was closed for the season at 1550 hr, with only approximately 20−25% of the kelp and seagrass having been removed from the lower lagoon up to the Stockton Bridge. The biologist left at 1630 hr.

24 May 2013. The biologist arrived at the lagoon at 1205 hr. The portal was installed in the flume inlet, though the water had not reached the flume inlet after 20 hours of filling at streamflow of approximately 3 cfs.

25 May 2013. The lagoon water surface level was part way into the fish passage portal in the morning.

26 May 2013. The lagoon water surface level was approximately 4 inches from top of flume, having completely filled the adult passage portal.

27 May 2013. The lagoon water surface level was approximately 2-3 inches from the top of the flume.

28 May 2013. The fishery biologist arrived at the lagoon in early afternoon to measure for salinity in the lagoon. The lagoon was full to within an inch of the top of the flume at gage height 2.44, with the adult portal in place. Saltwater was detected under the Stockton Bridge and along the Venetian Court wall to a maximum of 6.8 ppt and a water temperature of 24.3 C at the bottom (18 C at the surface). Oxygen levels were supersaturated from 1.25 meters from the surface down to 2.25 meters in the Venetian Court depression.

30 May 2013. Temperature probes were launched in the lagoon and upstream. A shroud was placed over the flume inlet to help draw heavier saltwater off the bottom and through the flume.

Effect of Sandbar Construction on Tidewater Gobies in 2013

It was likely that most tidewater gobies, if they were present, used habitat upstream of the construction area, where there was less tidal fluctuation and salinity. Tidewater gobies were detected in small numbers in the fall between the flume inlet and the Esplanade restaurants after a relatively dry rainfall season. Slow, artificial water level fluctuations were created during sandbar construction activities. Three sandbar breaches were required during sandbar preparation, with 3 breaches allowed by the permit without regulatory consultation. The 3 breaches closely mimicked normal tidal fluctuations of the estuary. The estuary remained deeper than usual during breaching due to winter scour without much subsequent filling, making it impossible to wade more than 30-50 feet upstream of the flume to rake decomposing plant material. Even at low tide, the estuary remained ponded with 60-70% of the estuary being greater than 3 feet deep up to the railroad trestle at its lowest draining.

With each lowering of the water in the estuary during sandbar construction, tidewater gobies

would have to retreat to deeper water in the upper estuary as water surface receded in the upper estuary. A well defined, bathtub-like margin existed in the upper estuary in 2013, allowing easy retreat to deeper water. No isolated side pools were found.

The channel in lower Soquel Creek lacks sheltered backwaters for gobies to escape high water velocity during high stormflows, and the population that have re-occurred during the dry years of 2008, 2009 and now 2013 may be transitory.

Effect of Sandbar Construction on Steelhead in 2013

No juvenile steelhead or coho salmon were detected in the outlet channel before it was covered over in May. No salmonids were observed along the margin of the lower lagoon prior to each daily sandbar opening. The flume outlet was closed to steelhead passage during the period of sandbar construction and until the lagoon filled sufficiently to allow water into the adult passage portal, and smolts had no access to the ocean nightly (5 nights; 20 May – 24 May). With only 2-3 cfs inflow to the lagoon, the lagoon could not even reach the flume inlet after a night of filling. It took 2 days of lagoon filling for lagoon water surface to reach the flume. The lagoon was completely full by 28 May. With the apparent absence of salmonids in the estuary in 2013 during the sandbar construction period, it appeared that most of the smolt out-migration was over prior to sandbar construction. The 5-night break in steelhead smolt access to the Bay during sandbar construction and lagoon filling likely had little impact on smolt out-migration.

The seasonal effect of removing organic material and constructing the sandbar is to create good summer rearing habitat for steelhead and tidewater goby. Compared to allowing natural lagoon formation, a lagoon is created with cooler, deeper, freshwater conditions, with reduced potential for eutrophication and associated increased biological oxygen demand from plant decomposition and nighttime respiration by live algae. Kelp and sea grass removal and sandbar closure create better fish habitat for tidewater goby and steelhead than if the sandbar was allowed to close naturally. Natural sandbar formation would allow considerable kelp and sea grass to become trapped in the lagoon to decompose. Under natural sandbar conditions, a much shallower lagoon would have formed with much more saltwater trapped to create an unmixed, anoxic lagoon bottom, which would collect heat and raise lagoon water temperature. The naturally formed sandbar would be lower in stature, allowing more tidal overwash of saltwater during especially high tides. Increased tidal overwash would further elevate water temperature, making the lagoon less hospitable for steelhead.

Recommendations for Lagoon Preparation and Sandbar Construction

1. During the relocation of fishes from the lateral channel, provide limited water in-flow to the lateral channel until fish relocation is completed. In this way, water quality in the lateral channel will be maintained for fish in the event that considerable vegetative material is present and decomposition is occurring in the lateral channel.

2. Insure that the flume is completely open for out-flow to the Bay before the work-day has ended during all sandbar construction activities. This includes during any required sandbar re-construction activities late in the smolt out-migration period. Do not use

manhole cover spacers to flush sand out of the flume during darkness when the entire outflow from the lagoon must exit through the flume and there is a chance that smolts are still exiting.

3. If stranded fish are detected as a result of sandbar closure or flume clearing, alert the monitoring biologist to discuss the appropriate relocation method for fish, and have the biologist capture and relocate the fish with assistance from Public Works staff. The biologist should be present during all sandbar closure and flume clearing activities when fish may be present (not when the flume is being cleared the week prior to sandbar construction and streamflow is still flowing through the beach). However, if fish become stranded due to unforeseen circumstances unassociated with sandbar closure/ flume clearing and insufficient time is available for the biologist to reach the site, as occurred on 21 June 2011, Public works staff should consult with the biologist prior to any response. Then Morrison (now a private contractor) and Oyama of the Public Works staff should capture and relocate the fish with available dip nets or seine and buckets filled with fresh estuary/ lagoon water, after consultation with the biologist, because of their experience in handling fish. (Other public works staff should be given experience in relocating fish from the lateral channel in the future or during fall sampling so that they may fill in if Morrison or Oyama are unavailable.) If the biologist is unavailable during emergency cases, relocate fish to the main body of the estuary or lagoon near the pilings and boulders adjacent to the restaurants, where cover and good water depth are available.

4. Closing the sandbar in late May is better than mid-June or later because streamflow is sufficient to rapidly fill the lagoon in most years, and the juvenile steelhead most likely to be present in the lagoon are out-migrating smolts. Late May is prior to down-migration of most YOY steelhead from spawning sites above the lagoon. Small steelhead fry remain in the vicinity of spawning sites before moving down into the lagoon. Down-migrant trapping on the nearby San Lorenzo River in 1987 and 1988 by Donald Alley and Stafford Lehr (now with CDFW) indicated that a few YOY steelhead were down-migrating into the lagoon in May, but the number greatly increased in June.

5. The management solution for minimizing the time required for sandbar construction is for the City to remain flexible on timing of the work. If rain is in the forecast within two days after the intended starting date for sandbar construction, Public Works should postpone construction until clear weather is forecasted. If 4-5 working days are set aside to construct the sandbar, the sandbar construction may be delayed as late as 4-5 days before the Memorial Day weekend and may still satisfy the tradition of lagoon formation before then.

6. Continue to rake as much kelp and sea grass out of the lagoon as possible before final closure, from the Stockton Avenue Bridge downstream, including plant material trapped under the restaurants and in depressions around the bridge piers. Discontinue raking if juvenile steelhead are observed near the water surface. It is best to minimize time required to stockpile sand, rake out the decomposing organic material and prepare the flume inlet for fish passage. This will minimize the number of instances of artificial fluctuation of lagoon water level. Sufficient City staff should be assigned to be ready to

enter the estuary at the earliest opportunity each day and quickly rake out decomposing kelp and to clear the sand-filled flume.

7. Dispose of kelp in the Bay rather than bury it in the sandbar. Disperse it up and down the beach. Continue to include this in the Fish and Game permit for sandbar construction. County Environmental Health approved of this method so long as kelp is spread over a wide area (**J. Ricker, personal communication cited in the original 1990 Soquel Creek Lagoon Management and Enhancement Plan**).

8. Continue to retain large woody material that naturally enters the lagoon.

9. Seek funding to secure large woody material to the lagoon bottom with anchor boulders and cabling to bedrock in appropriate locations on the east bank under the railroad trestle or upstream adjacent to the Golino property. This large woody material will provide additional cover and scour deeper habitat to protect juvenile steelhead from predators.

10. Allow a clear path from under the bridge to the beach at Venetian Courts to enable seining for juvenile steelhead during fall censusing.

11. Annually evaluate the structural integrity of the flume and its supports. Continue to maintain and repair cracks in the flume as necessary. This will prevent sinkholes and reduce water leakage from the lagoon along the flume.

12. Repair the flume at a time that does not obstruct fish passage or require lowering of the lagoon water level.

13. During sandbar construction, continue to close the lagoon each day before the incoming tide can wash salt water and kelp into the lagoon. Re-open the sandbar and unplug the flume, if necessary, each morning to facilitate kelp and sea grass removal.

14. Take special care to pack sand under the flume, between the pilings, during final sandbar closure in order to prevent seepage under the flume after closure. Continue to add plywood cutoff sheets between the pilings and perpendicular to underflow to maintain sand under the flume and to reduce water seepage and sink holes from forming.

15. Search under the Stockton Avenue Bridge and in Reaches 2 and 3 for stranded fish to rescue as the lagoon drains each day during raking. It is best to minimize the number of days required to construct the sandbar and rake out the decomposing organic material. This will minimize the artificial fluctuation of lagoon water level. Having a maximum number of personnel to rake decomposing organic material into the bay and to clear the flume of sand will minimize the days needed to prepare the lagoon for the summer.

16. Maintain an underwater portal in the flume intake for out-migration of adult steelhead until June 15, while maintaining a notched top plank for out-migration of smolts until 1 July. However, in dry years such as 2007−2009 and 2013, when stream inflow is insufficient to fill an underwater portal and allow lagoon filling, opt for a larger notch in

the upper boards to accommodate adult kelts and smolts instead of a deeper underwater portal for kelts.

17. Maintain the 1-foot high weir/ baffle inside the flume until July 1 for safe entrance of out-migrating steelhead smolts into the flume inlet before they enter the Monterey Bay.

18. Continue to cover the visquine around the flume inlet with manually shoveled sand instead of tractor shoveled sand. This will prevent the tractor from displacing the visquine. Clear visquine is preferable to black. Key the visquine into the lagoon margin to encourage its retention when the sandbar breaches in the fall.

19. Retrieve visquine from around the flume inlet before or immediately after the fall sandbar breach, if possible.

Procedure for Emergency Sandbar Breaching at Soquel Lagoon by the City of Capitola

In 1990, a bolt was set into a wooden piling adjacent to the restaurants at the lagoon. The bolt's elevation was surveyed to coincide with the water surface elevation at which flooding was imminent. The bolt is 1.77 feet above the elevation of the top of the flume inlet. It allowed 1 foot of freeboard at the residence where flooding was identified as a problem. Since then, another low point has been located near the railroad trestle, which will have flooding problems at approximately 0.5 feet above the bolt. Another bolt is present on a piling to indicate this elevation. The management goal is to pass stormflow through the flume from the first small storm events in the fall while keeping the lagoon surface below the original bolt. This is done by the City removing boards from the flume inlet prior to and during increased stormflow. Water also flows through the top grate that was constructed in the flume inlet in 2003.

A tractor is used in the fall to cut a notch approximately 30 feet wide in the sandbar adjacent to the flume. A berm is left along the lagoon margin between the notch and the lagoon. An additional berm is constructed across the notch near the surf to prevent wave action at the beach from entering the notch. The intent is to prepare the sandbar so that it will breach at the proper time to prevent flooding. The City cuts the sandbar notch at the elevation of the piling bolt. However, the notch fills in from foot-traffic on the beach as time goes on. If, despite efforts to pass all of the stormflow through the flume, the water surface reaches the elevation of the piling bolt, then the City is to facilitate sandbar breaching. A tractor is used to re-cut the sandbar notch and breach the two berms across the notch so that the entire sandbar breaches prior to flooding. If the flume is able to receive all of the stormflow and flooding does not become a threat, boards are replaced in the flume inlet after the stormflow has passed.

Sandbar Breaching During the 2013-2014 Rainy Season.

After successfully passing 3 smaller stormflows through the flume since November, a facilitated breaching was completed by Public Works at 0829 hr on 8 February 2014. The inner berm nearest the lagoon margin was mechanically breached with a shovel after the outer berm had been notched by Kotilla with the wheeled loader under the direction of Morrison. Alley was present. This was done to prevent flooding as the lagoon water surface increased 1 inch each 5

minutes and was within 5 inches of flood stage. After the breach, the water surface rose from 5 inches to 3 inches below the piling bolt, coinciding with the height of freeboard before the lagoon bulkhead margin would be overtopped. The USGS stream gage reading at Soquel Village was 54 cubic feet per second (cfs) at 0830 hr, with a flume capacity estimated at 30 cfs. Light rain continued through 9 February with streamflow reaching a maximum of about 125 cfs at the USGS gage the next morning at approximately 0400 hr on 9 February.

The notch through the sandbar was constructed alongside the flume, perpendicular to the beach sandbar. The biologist left the estuary at 0945 hr with the estuary water surface approximately 40 inches below the piling bolt and 18 inches below the top of the flume. At that time the outlet channel was 20-25 feet wide most of the way through the beach, opening up to about 40 feet wide at the surf. It had been an outgoing tide since the biologist's arrival at half past five o'clock.

Estuary outlet channel after facilitated breach on 8 February 2014
(Time printed on the photo was 1 hour later than actual time of 0942 hr.)

Recommendations Regarding Sandbar Breaching

1. As stated in the Management Plan (**1990**), make sure that parking lots and streets draining into the lagoon are cleaned before the rainy season. This will reduce the pollutants entering the lagoon during the first storm of the season that are lethal to fish. Street sweepers with water and suction may be necessary. In addition, roadwork such as repaving and application of fresh petrochemicals should be done in the early summer to allow sufficient time for penetration and drying before the rainy season.

2. Prior to sandbar breaching in the fall, notch the sandbar across the beach just below the elevation of the piling bolt indicating flooding, minimizing the gradient of the notch to slow the evacuation of water through the beach and to minimize beach erosion. The

purpose is to maximize the residual estuary depth after the emergency breach.

3. Continue to maintain an outer berm near the surf and an inner berm near the lagoon margin with a wide notch in between. The notch in the sandbar should be cut slightly lower than the piling bolt. Continue to make the notch at least 30 feet wide across the beach. The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation.

4. When breaching must be facilitated to prevent flooding, notch the inner berm first, allowing the notch across the beach to fill with water. Then notch the outer berm to finish the sandbar breaching, if necessary. If possible, allow the streamflow and tidal action to "naturally" breach the outer berm.

5. Just as the first storm of the fall season begins, remove boards from each side of the flume if a small storm is anticipated. The number of boards removed will be dictated by the anticipated size of the storm. Remove two boards or more from either side if a large storm is anticipated. Clear the exit to the flume by removing the plate from one side of the exit.

6. As stated in the 1993 monitoring report, management options to delay sandbar breaching include installation of a perimeter fence around the flume inlet to collect algae. Replace the boards after the stormflow subsides, removing them for each succeeding storm until the sandbar is breached during later, larger storms usually occurring after Thanksgiving.

7. After the first small storms of the season with the sandbar still intact, lower the water level to a point where light penetrates to the lagoon bottom. Thus, plants in the lagoon may continue to photosynthesize and remain viable. Thus, vegetation mortality and stressfully low oxygen levels are prevented until the water clarity is re-established. Re-install boards to increase lagoon depth after the lagoon clears up.

8. Notify the California Department of Fish and Game 12 hours before the possibility of a sandbar breach and immediately after the breach occurs.

9. If the sandbar breaches early in the rainy season, followed by a period of 2-4 weeks of a reformed sandbar that prevents water exchange with the ocean, attempt to pull the decomposing kelp out of the stagnating lagoon. Open the flume and encourage streamflow out with the shroud installed.

10. If a stagnant, kelp-filled lagoon forms in fall after an early breach and a dry period, do not empty the lagoon by breaching the sandbar. Instead, use the flume and shrouds to pull salt water out. Breaching of the lagoon will increase the opportunity for more kelp to enter and probably will not empty the entire lagoon anyway. Fish passage need not be maintained through the flume because it should be discouraged until sufficient stormflows develop to provide passage up the Creek. If adult salmonids enter too early, they will become stranded and unable to migrate upstream because of insufficient streamflow.

WATER QUALITY MONITORING IN 2013

Rating Criteria

Water quality parameters were rated according to the tolerances of steelhead. This was because they are least tolerant of low oxygen, higher salinity and higher temperatures of the resident lagoon fishes. Stress to freshwater acclimatized steelhead would probably not occur until conductivity levels reach 12,000 to 15,000 umhos, associated with sudden increases in salinity to 10 − 12 parts per thousand. Water temperatures above 22º C (72º F) (**Table 1**) and oxygen levels below 5 parts per million (mg/L) are thought to stress steelhead. Bjornn and Reiser (1991) state that growth, food conversion efficiency, and swimming performance are adversely affected when dissolved oxygen concentrations are <5 mg/L. However, steelhead have been found surviving in pools in the Carmel River at 1-2 mg/L for 1-2 hours at dawn (**David Dettman, personal observation**) and in San Simeon Lagoon near Cambria at oxygen concentrations less than 2 mg/l on repeated occasions (**Alley 1995b; 2006b**). Based on 1988 monitoring, steelhead appear to survive in Soquel Lagoon at water temperatures of 23-25º C for 1-2 hours in late afternoon or early evening (**Habitat Restoration Group 1990**). Water temperature may rise as much as 3-5º C from a morning minimum, after a sunny, fog-less day.

Oxygen levels critical to steelhead survival were classified as those measured in the lower 0.25 meters from the bottom, where steelhead would inhabit. Early Morning oxygen levels below 2 mg/l were rated "critical" (**Table 2**). Those levels between 2 and 5 mg/l were rated "poor." Early morning oxygen levels of 5 to 7 mg/l were rated "fair" with above 7 mg/l rated as “good.” Early morning water temperatures in the lower 0.25 meters of the water column of less than 20º C were rated "good" while those 20 − 21.5º C were rated "fair." Temperatures between 21.5 and 23º C were rated "poor," while those greater than 23º C at dawn were rated "critical." High levels of dissolved carbon dioxide in water will inhibit absorption of oxygen by fish. However, in the alkaline conditions of Soquel Creek Lagoon, carbon dioxide is poorly dissolved and is not a problem (**J. Smith, personal comm**.). Therefore, its monitoring was unnecessary.

Lagoon water level was monitored with the staff gage on the eastern bulkhead, upstream of the Stockton Avenue Bridge (**Figure 1.**) Readings below 1.5 feet were rated "critical" while readings between 1.5 and 1.85 were rated poor (**Table 2**). Readings between 1.85 and 2.2 were rated "fair." Readings above 2.2 were rated "good." These criteria were somewhat arbitrary, being based on an as yet poorly defined relationship between lagoon depth and associated fish cover, water temperature and algal growth. If the upper lagoon becomes too shallow, steelhead habitat is eliminated and algae growth may be stimulated. An important factor not directly under control by the City is change in streambed elevation resulting from winter scour or fill in the estuary.

Locations and Timing of Water Quality Monitoring

As required under the CDFG permit for 2013, water quality was monitored in late afternoon, as well as in the early morning near first light. Water quality was monitored at four lagoon stations and one stream station. Station 1 was at the flume inlet (**Figure 1**). Station 2 was on the downstream side of the Stockton Avenue Bridge in the deepest thalweg area. Station 3 was just

downstream of the railroad trestle on the east side. Station 4 was at the mouth of Noble Gulch. Station 5 was monitored in the morning and afternoon in Soquel Creek near the Nob Hill shopping center, just upstream of the lagoon. The stream data were compared to lagoon conditions of water temperature and oxygen levels in early morning.

In 2013, as required by the CDFG permit, 6 HOBO temperature loggers were launched on 30 May 2013, just downstream of the railroad trestle in Reach 2 (as in 2008−2012) at 1-foot intervals through the water column, beginning at 0.5 feet above the bottom and ending 5.5 feet from the bottom. Another logger was placed in Soquel Creek near the Nob Hill Shopping Center. All 7 loggers were removed on 14 October 2013, prior to any forecasted rain.

Water quality in terms of oxygen concentration, temperature, conductivity and salinity was measured at each lagoon station at two-week intervals after the sandbar was constructed until the sandbar breached in the fall. Prior to the first full monitoring, salinity was measured in deeper portions of the lagoon to determine if saltwater had been trapped during sandbar construction. Saltwater was detected in 2013 after the sandbar closure, and the inlet shroud was needed to pull saltwater off of the bottom. The shroud was removed on 23 June after salinity was no longer detected in Reach 1.

Table 1. Temperature Equivalents for Degrees Celsius and Degrees Fahrenheit.

Degrees Celsius	Degrees Fahrenheit
10	50.0
11	51.8
12	53.6
13	55.4
14	57.2
15	59.0
16	60.8
17	62.6
18	64.4
19	66.2
20	68.0
21	69.8
22	71.6
23	73.4
24	75.2
25	77.0
26	78.8
27	80.6
28	82.4
29	84.2
30	86.0

Table 2. Criteria for Rating Water Quality Measurements within 0.25 Meters of the Bottom after Sunrise and for Rating Gage Height Readings.

MORNING RATING	MORNING TEMPERATURE (Celsius)	MORNING OXYGEN (mg/L)	GAGE HEIGHT (ft)
Good	< 20	> 7	> 2.20
Fair	20-21.5	5-7	1.85-2.20
Poor	21.5-23	2-5	1.50-1.85
Critical	> 23	< 2	< 1.50

Water Temperature Goals for Soquel Creek and Lagoon

Regarding Soquel Creek Lagoon in summer, where food is more abundant than upstream, a management goal for steelhead should be to maintain water temperature below 20ºC (68ºF) at dawn within 0.25 m of the bottom and the afternoon maximum below 22ºC (71.6ºF) near the bottom. This early morning goal coincides with a "good" rating at monitoring sites (**Table 2**). This lagoon management goal is somewhat higher than the enhancement goal we established for Soquel Creek upstream, where the goal was to maintain water temperature below 20ºC. Maximum daily water temperature in the lagoon should not reach 26.5ºC (79.5ºF). Although Coche (**1967, cited in Kubicek and Price 1976**) determined that temperatures between 20 and 24ºC were responsible for high maintenance requirements and low conversion efficiency of food into growth for his stock of juvenile steelhead, our annual sampling of juvenile steelhead in Soquel Lagoon indicates that growth rate in the lagoon has been greater than in the upstream stream reaches (**Alley 2008a; 2008b**), with nearly all young-of-the-year juveniles rearing in the lagoon reaching smolt size the first summer each year. This indicates that higher water temperature has not prevented relatively rapid growth of juveniles in the lagoon, where food is abundant.

Water temperatures above 20ºC (68ºF) are considered limiting to juvenile coho salmon in the presence of steelhead (depending on food abundance), and lagoon temperatures below 16ºC (60.8ºF) are preferred (**J. Smith, personal communication**). Therefore, the management target for making Soquel Creek Lagoon habitable for coho should be to maintain summer water temperature below 20ºC (68ºF). The 2010 lagoon was the coolest in the last 20 years, with temperatures near the bottom exceeding 20° C for only a 3-day period in early June and a 4-day period in mid-July. However, we do not believe that Soquel Creek Lagoon may be cooled sufficiently to support juvenile coho salmon in most years.

The management goal for water temperature in stream habitat upstream of the lagoon should be maintenance below 20ºC (68ºF) in April and May when baseflow still remains above summer low-flow and juvenile salmonids are feeding and growing rapidly. From June 1 to September 1, the water temperature should not rise above 20ºC (68ºF) more than 4 hours a day (15% of the month) and preferably the maximum daily temperature, averaged weekly, should not rise above

21ºC (70ºF). These goals are based on literature review of physiological relationships between fish metabolic rate and water temperature (**Kubicek and Price (1976); Brett (1959, cited in Kubicek and Price 1976); and Snyder and Blahm (1971, cited in Kubicek and Price 1976**)).

The temperature optimum is a moving target, increasing and decreasing with food supply. According to Moyle (**2002**), Baltz et al. (**1987**) reported that optimal temperatures for growth of rainbow trout (not steelhead) to be around 15-18ºC, a range that corresponded to temperatures selected in Sierran streams when possible. According to Moyle (**2002**), regarding temperature optima, "The optimal temperatures for growth of rainbow trout are around 15-18ºC, a range that corresponds to temperatures selected in the field when possible. Thus, in a section of the Pit River containing a thermal plume from an inflowing cold tributary, rainbow trout selected temperatures of 16-18ºC. However, many factors affect choice of temperatures by trout (if they have a choice), including the availability of food." The Santa Ynez River Technical Advisory Committee (SYRTAC) proposed guidelines with upper limits of 20ºC average daily temperature and 25ºC daily maximum as providing acceptable habitat conditions for steelhead in the Santa Ynez River (**SYRTAC 2000**), much further south of Soquel Creek and the Santa Maria River and in the southern ESU for steelhead. The SYRTAC (**2000**) decided that a mean daily temperature of 22ºC may be the threshold between acceptable and unsuitable from a long-term perspective. This was based on studies by Hokanson et al. (**1977;** Cited in Santa Ynez River Technical Advisory Committee 2000), who concluded that the highest constant temperature at which the effects of growth and mortality balance out was 23ºC.

The management goal regarding water temperature prior to re-introduction of coho salmon to Soquel Creek should be that water temperature in specified reaches meet the criteria that average daily water temperature (averaged weekly) during summer/fall months (June 1 to October 1) be 16.7ºC (62ºF) or less in the warmest week and that the weekly maximum temperature be 18.0ºC (64ºF) or less during the warmest week (**Welsh et al. 2001**). The targeted stream segments include 1) the mainstem Reaches 7−9 (Moores Gulch confluence to Hinckley Creek confluence on the East Branch), 2) Reaches 11 and 12A (Soquel Demonstration State Forest between the Soquel Creek Water District Weir at the lower end of the canyon and the gradient increase below the Fern Gulch confluence) and 3) Reaches 13 and 14a on the West Branch (downstream of the lowermost Girl Scout Falls I). Coho salmon juveniles were detected in Fall 2008 by NOAA Fisheries biologists and D.W. ALLEY & Associates in Reach 9 of the East Branch, supporting the potential for coho recovery in Soquel Creek.

Results of Lagoon Water Quality Monitoring After Sandbar Closure

Lagoon Level

Appendix A provides detailed water quality and lagoon height data. **Table 3** rates habitat conditions according to a rating scale (**Table 2**). The lagoon level was maintained in the good range for the summer and during the Begonia Festival. It remained good into the fall until after the first rain in November (**Figure 26**). Lagoon water level was lowered to a critical level after the 20 November stormflow that colored the water, forcing the management technique of reducing depth until water penetrated the bottom to allow continued photosynthesis. A "fair" rating was noted on 8 December (gage height = 2.09 ft) after boards had been removed to pass the second stormflow of the season occurring on 7 December. Another "fair" rating was noted on 9 December (gage height = 1.85) during a water clarity check in the morning. Two flashboards were added to the flume inlet in the afternoon. The lagoon level was monitored 18 times in 2-week intervals from 8 June 2013 to 1 February 2014. For 2013, lagoon levels as measured on the staff gage were rated "good" (**Table 2**) on 16 two-week monitorings, "fair" on one monitoring and "critical" on another (**Table 3; Figure 2**).

Maintenance of lagoon gage height was maintained well into the good range for the entire summer/fall until it rained on 20 November (Figure 2). It was consistently the highest gage height recorded through the dry period in the last 4 years. This good management combined with the scour of the streambed during the previous winter resulted in the deepest lagoon in the 23 years of monitoring. Typically, it is more difficult for the City to maintain the highest water surface elevation during wetter years. But this was not the case when comparing the wetter 2011 and the drier 2012 years in which lagoon levels were similar between years for June through September. A small amount of saltwater was trapped on the lagoon bottom near the Venetian Court wall at the time of sandbar closure as measured on 30 May and 8 June, justifying shroud installation. On 22 June, no salinity was detected.

No vandalism of the flume inlet was detected in 2013. Plywood over the flashboards protected against both back- pressure and vandalism after the adult portal was removed. However, with early, small storms, the plywood is not used between storms. While the wedges discourage all but the most determined vandals and prevent dislodging of boards, they do not allow easy removal of boards when surface algae and debris near the flume needs to be drained out or when sandbar breaching is to be prevented by increasing the volume through the flume. The grated hole in the top of the flume alleviates the need for rapid board removal and replacement during small stormflows.

Flume Passability

According to the Management Plans (**Alley et al. 1990; 2004**), steelhead adult passage is to be maintained with an underwater portal through 15 June and smolt passage is to be maintained with a notch in the uppermost flashboard until July 1 with an open flume to the Bay. A flume depth of 12 inches or deeper is desired at the entrance until July 1.

The flume was cleared of sand prior to sandbar construction in 2013. Unfortunately because of the very low streamflow during sandbar construction, the flume outlet was closed to steelhead passage during the period of sandbar construction and until the lagoon filled sufficiently to allow water into the adult passage portal, and smolts had no access to the ocean nightly (5 nights; 20

May – 24 May). The sandbar was closed for the summer on 23 May. With only 2-3 cfs inflow to the lagoon, the lagoon could not even reach the flume inlet after a night of filling. It took 2 days of lagoon filling for lagoon water surface to reach the flume. The lagoon was completely full by 28 May. Once sandbar construction was complete, both sides of the flume inlet were screened with 2"x 3" mesh that allowed smolt passage through. The screening on the east (restaurant) side had an 8"x 8" underwater portal for adult fish access to the flume. The screen was painted white, and the border of the portal was flagged with yellow flagging for easy visibility, as requested by the biologist. The flume remained passable to steelhead smolts during the entire summer, with the flume inlet depth approximately 1 foot and the flume outlet depth 0.8−1.0 ft until at least 3 August. A 4"x 4" inch board was placed in the base of the flume exit to maintain depth. The upper flashboard in the flume inlet was notched until 1 July. A closed flume was detected on 14 September. However, this was long after smolt outmigration was complete.

The inner berm across the beach was notched to initiate a facilitated sandbar breach on 8 February 2014. The streamflow at the Soquel Village USGS gage was 54 cfs at the time of the breach, with stormflow reaching a maximum of 125 cfs in early morning on 9 February.

Water Temperature Results from Two-Week Monitoring

In 2013, water temperature of stream inflow for much of the dry season through mid-September was the warmest in the last 5 years and 2−3°C warmer from mid-August to mid-September than in the higher flow years of 2010 and 2011 (**Figure 3e**). During the last 23 years of monitoring, the 1994 and 2013 lagoons were the warmest and most similar in early morning water temperatures, though the lagoons of 2007−2009 (other dry years) were nearly as warm. In 2013, the lagoon was warmer near the bottom in the morning and afternoon compared to 2012 until late September (**Figures 3a-d; Appendix A**). In contrast, 2011 had the coolest lagoon temperatures in the past 23 years of monitoring. The warmer water temperatures in 2013 did not corresponded with the consistently cooler air temperatures measured at the lagoon in June and July but did correspond to the warmer air temperatures in August until mid-September (**Figure 3f**). The warmest water temperature measured in 2013 near the bottom in the morning after the saline layer was dissipated was 22.2°C (72°F) on 1 September at Stockton Bridge compared to 20.3°C (68.5°F) on 3 July 2013 at the flume inlet (**Figure 3g**). In 2013, *water temperatures near the lagoon bottom in the early morning* were rated "good" at all stations during the 2 monitorings in June and from late September onward until sandbar breaching in February (**Tables 2 and 3**). However, ratings of "poor" (21.5−23°C) or "fair" (20−21.5°C) occurred throughout July and August up to 1 September, except for a "good" (<20°C) rating at Noble Gulch on 3 August (**Table 3**). The warmest afternoon water temperature recorded in 2013 near the bottom during two-week monitoring was 23.5°C on 1 September (**Figure 3h**) compared to 21.2°C on 14 August 2012, both at the flume inlet (**Figure 3i**), 19.4°C on 26 July 2011, 19.6°C in mid-July 2010, 21.9° C in late August 2009 and 24.6° C after tidal overwash that had created a stagnant saline layer under the Stockton Bridge in early July 2008. In 1994, the warmest lagoon temperature measured during the monitoring period was 24.8°C (76.6°F) at the surface near the flume at 1746 hr on 12 August (morning temperature was 21°C). In 1994 the lagoon was very shallow, with the depth under the Stockton Bridge only 1.35 m (4.4 ft) compared to 2.25 m (7.4 ft) in 2013. At 0600 hr on 21 July 1992 the water temperature through the water column at the Stockton Bridge went from 23°C at the surface to 24°C for the remainder of the water column from 0.25 m down to 1.75 m at the bottom. This was the warmest morning water temperature measured in 23 years.

At the mouth of Noble Gulch in 2013 as in past years, the water temperature near the bottom was cooler than at other lagoon sites in the morning and afternoon, likely due to cooler inflow from Noble Gulch (**Figures 3g and 3h**). In the afternoon, water temperature was sometimes 1−2°C cooler at the bottom than at the surface (**Appendix** A).

As in past years, lagoon water temperatures in 2013 closely reflected those of the stream inflow and were somewhat elevated above stream inflow temperature, but were typically 3−4 degrees Celsius warmer in the lagoon in 2013 (**Figures 3g−h**). Daily temperature minima in the lagoon were consistently warmer near the bottom than the stream inflow in 1999-2013 (**Table 4**). The cool inflow from Noble Gulch maintained cooler lagoon water temperature in the morning at Station 4 near the bottom than the other three lagoon stations (**Figures 3g and 3h**). Usually in 2013, morning water temperature was 0.5 to 1° C cooler at Station 4 than Station 1 near the bottom. In the afternoon, the difference was 1 to 1.5° C cooler at Station 4 than Station 1in June−mid-August and less so afterwards. Water temperature stratification was absent in the water column after 4 June, with thorough nightly mixing and cooling of the water throughout the lagoon (**Appendix A**).

Table 3. 2013 Morning Water Quality Ratings in Soquel Creek Lagoon, Within 0.25 m of Bottom.

Date	Flume Passage	Gage Height	Water Temperature	Oxygen	Salinity	Lagoon In-flow Estimated @ 0.5 cfs less than Soquel Village Gage Readings (cfs)
8June13	open	2.55	good	good	good	2.6 cfs
		Good	good	*poor*	good	
			good	good	good	
			good	good	good	
22June13	open	2.57	good	good	good	1.9 cfs
		Good				
06Jul13	open	2.58	*poor*	good	good	1.2 cfs
		good	*poor*	good	good	
			fair	good	good	
			fair	good	good	
20Jul13	open	2.61	fair	good	good	1.2 cfs
		Good	fair	good	good	
			fair	good	good	
			fair	*poor*	good	
3Aug13	open	2.60	fair	good	good	0.9 cfs
		good	fair	good	good	
			fair	good	good	
			good	*poor*	good	
17Aug13	open	2.60	*poor*	good	good	0.7 cfs
		good	*poor*	good	good	
			poor	good	good	
			fair	*poor*	good	
01Sep13 Begonia Festival	open (morning)	2.62 good	*poor*	good	good	< 0.1 cfs
			poor	good	good	
			poor	good	good	
			poor	fair	good	
01Sep13	open (afternoon)	2.61 good	*critical*	good	good	< 0.1 cfs
14Sep13	closed	2.62	fair	good	good	< 0.1 cfs
		good	fair	good	good	
			fair	good	good	
			good	good	good	
28Sep13	open	2.55	good	fair	good	< 0.1 cfs
		good	good	good	good	
			good	good	good	
			good	good	good	
12Oct13	open	2.64	good	good	good	0.5 cfs
		Good	good	good	good	
			Good	good	good	
			Good	*poor*	good	
26Oct13	open	2.62	good	good	good	0.4 cfs
		Good				
09Nov13	open	2.62	good	good	good	0.7 cfs
		good				

Table 3. 2013 Morning Water Quality Ratings in Soquel Creek Lagoon, Within 0.25 m of Bottom (continued).

Date	Flume Passage	Gage Height	Water Temperature	Oxygen	Salin-ity	Lagoon In-flow Esti-mated @ 0.5 cfs less than Soquel Village Gage Readings (cfs)
23Nov13	open	1.06	good	fair	good	1.0 cfs
		*Critical***	good	fair	good	
			Good	good	good	
			Good	good	good	
08Dec13	open	2.09	good	good	good	5.5 cfs
		Fair				
21Dec13	open	2.61	good	good	good	1.2 cfs
		Good				
04Jan14	open	2.22	good	good	good	1.2 cfs
		Good				
18Jan14	open	2.43	good	good	good	1.4 cfs
		Good				
01Feb14	open	2.62	good	good	good	1.3 cfs
		Good				

* Four ratings refer to Monitoring Sites 1-4. One rating per column represents all sites.
**Water level was intentionally lowered after a small stormflow to allow light to penetrate to plant life to maintain healthy oxygen concentrations.

Water Temperature Results from Continuous Data Loggers

In analyzing water temperature data from the 6 data loggers throughout the water column in the deepest portion of the lagoon, just downstream of the railroad trestle, results were consistent with temperature data collected at 2-week intervals through the water column at monitoring stations over the past 23 years. However, for the period 30 May− 4 June before 2-week monitorings began on 8 June, a temporarily warm saline layer (approximately 1.5 feet (0.5 meter) thick) along the bottom was detected by the data loggers in the deeper area. The following analysis pertains to the vicinity of these continuous data loggers only. Keep in mind that our 2-week monitoring at the 4 sites indicated that Station 4 near the mouth of Noble Gulch usually had cooler water temperatures near the bottom than Site 3 near the trestle, across from where these continuous data loggers were deployed (**Figures 3g and 3h**).

Juvenile steelhead likely spend most of their time near the bottom, except when feeding on emerging aquatic insects at dusk and dawn. This assumption is based on many years of underwater observations of salmonids. Therefore, the water temperature recorded near the lagoon bottom (0.5 feet from the bottom) has greatest relevance to assessing habitat quality.

As in past years, lagoon water temperatures in 2013 closely reflected those of the stream inflow (**Figures 4a-l; 5a-b**), except for 30 May− 4 June when there was a temporarily warm saline layer

along the bottom in the deeper area where the data loggers were positioned. Daily temperature *minima* in the lagoon were consistently warmer near the bottom than the stream inflow in 1999-2013 (**Table 4**). In 2013 from 30 May to 15 September, the maximum and minimum 7-day rolling average temperatures were 4.7°C and 3.2°C cooler, respectively, in the stream than near the lagoon bottom near the trestle, as was substantiated by seasonal maxima (21.0°C vs. 25.2°C) and minima (14.1° C vs. 17.1°C) (**Table 4**). The average 7-day rolling average of 17.0°C in the stream was 3.7°C less than the average 7-day rolling average of 20.7°C at 0.5 feet from the lagoon bottom. Consistently, the difference in 7-day rolling averages, day by day, was also approximately 3−4°C warmer in the lagoon near the bottom in the morning compared to the stream inflow. Stream inflow temperature in 2013 was generally about 3−4°C cooler in the morning and 2−3°C cooler in the afternoon than near the lagoon bottom, with much greater daily fluctuation in the stream than in the lagoon (**Figures 4a and 5a**). We see from comparisons of the 7-day rolling average for 2013 and 2012 near the bottom that it fluctuated more in 2013 and generally at least 2°C warmer than in 2012 and about 3°C warmer than in 2011 (higher stream inflow) for July through mid-September. In fact, 2013 consistently had the warmest 7-day rolling averages heretofore recorded. In 2009, another low-flow year, the rolling average was about 1°C cooler than 2013 (**Table 4; Figures 4a-t; 5a-f**).

As in past years, no lagoon thermocline (*a thermocline has a warm, well-mixed, oxygen-rich epilimnion above it and a cool, non-circulated, oxygen-poor hypolimnion below*) was detected in 2013 by the data loggers in the deep area near the railroad trestle. However, temperature stratification associated with a saline layer approximately 1.5 feet (0.5 meter) thick was detected as late as 4 June by the data loggers (**Figures 4a-41**). The lagoon was likely 7−8 feet deep, at most, and subject to daily inland breezes that circulated the water, surface to bottom. There was complete, diurnal (daily) mixing of the water column except in deeper pockets when a temporary, heavy and stagnant saline layer developed from saltwater being trapped during sandbar closure. In this case, the saltwater had dissipated 10 days afterwards. During this short period, a stagnant saline layer developed in the deeper areas adjacent to the Venetian Court wall and just downstream of the railroad trestle.

Lagoon water temperature was warmer near the surface than near the bottom in the heart of the dry summer season, as indicated by the maximum water temperatures and maximum 7-day rolling averages at each location (Table 4; Figures 4b and 4l). However, at the cooler beginning and end of the season, the surface has cooler water, as indicated by minimum water temperatures and minimum 7-day rolling averages at each location (Table 4; Figures 4b and 4l).

Table 4. Water Temperature Statistics from Continuous Water Temperature Probes at 30-minute Intervals in Soquel Lagoon and Immediately Upstream, Late May – 15 September in 2010, 2012 and 2013 and 30 June – 15 September in 2011.

Year	Statistic	Stream Inflow Temperature °C	Near-Surface Lagoon Temperature @5.5 ft from Bottom °C	Near-Bottom Lagoon Temperature @ 0.5 ft from Bottom °C
2013	Maximum Water Temperature °C	21.0 (26 Jun)	23.2 (5 July; 31 Aug–5 Sep)	25.2 (1 June due to saline layer)
2013	Minimum Water Temperature °C	14.1 (31 May; 4-5 June)	17.1 (5 June)	17.1 (26 June)
2013	Maximum 7-Day Rolling Average	18.7 (26 June–2 July)	22.5 (30 Aug–5 Sep)	23.4 (30 May–5 June)
2013	Minimum 7-Day Rolling Average	15.7 (3-9 June)	18.4 (4-10 Jun)	18.9 (20 June–26 June
2013	**Average 7-Day Rolling Average**	**17.0**	**20.8**	**20.7**
2012	Maximum Water Temperature °C	20.2	23.2	21.0
2012	Minimum Water Temperature °C	12.6	11.0	14.5
2012	Maximum 7-Day Rolling Average	17.7	19.9	19.3
2012	Minimum 7-Day Rolling Average	15.5	15.6	16.2
2012	**Average 7-Day Rolling Average**	**16.2**	**17.9**	**18.1**
2011	Maximum Water Temperature °C	20.3	21.0	19.8
2011	Minimum Water Temperature °C	14.1	16.0	15.6
2011	Maximum 7-Day Rolling Average	17.3	19.0	18.2
2011	Minimum 7-Day Rolling Average	15.4	16.8	16.2
2011	**Average 7-Day Rolling Average**	**16.4**	**18.0**	**17.2**
2010	Maximum Water Temperature °C	19.8	21.0	20.6
2010	Minimum Water Temperature °C	13.7	15.2	15.2
2010	Maximum 7-Day Rolling Average	17.5	19.5	18.8
2010	Minimum 7-Day Rolling Average	14.8	16.7	16.3
2010	**Average 7-Day Rolling Average**	**16.0**	**17.9**	**17.4**

Days when lagoon water temperatures exceeded 22º C (71.6º F) near the lagoon bottom would likely be stressful for juvenile steelhead. Therefore, the lagoon management goal is to maintain water temperature below 22ºC. In 2013, water temperature rose above 22º C near the bottom for

25 days (18.5% of the monitored period) (4 days 30 May−2 June; 7 days 30 June−6 July; 14 days 28 August−8 September) (**Figure 4a**). In 2010−2012, water temperature did not rise above 21°C near the bottom, with a maximum in 2012 of 21°C on 1 July. The years 2007−2009, stream inflow was lower and water temperatures were higher. In 2009, it was above 22° C on 8 days, primarily in early August (4 successive days). In 2008, it was above 22ºC on 13 days, primarily in early July (4 successive days) and mid-July (6 successive days) related to a warm saline layer. In 2007, it was above 22º C on 20 days, primarily in mid-July (9 successive days) and early September (6 successive days). This was compared to only 4 days (22-25 July) in the higher stream inflow year of 2006 (**Alley 2006**). In 2005, water temperature near the bottom never reached this threshold with high stream inflow. It only went above 22°C once (12 July) at the surface (**Alley 2005**). In 2004, the <22ºC goal near the bottom was not met for 5 days after tidal overwash on 19 July, 4 days in August and 2 days in early September (**Alley 2005**). But conditions were more stressful in 2001 when there had been two major tidal overwashes. In 2001, daily temperatures near the bottom fluctuated between approximately 23 and 26ºC (73.4–78.8ºF) for 14 days (**Alley 2003c**).

In 2013, the lagoon steelhead management goal of maintaining early morning minimum temperature below 20°C near the bottom was not met on 63 of 135 days (47%), including 33 consecutive days from 15 August to 16 September (**Figure 4a**). In 2010−2012, the lagoon met the steelhead management goal of maintaining early morning minimum temperature below 20°C near the bottom throughout the season (**Figures 4m−4r**) compared to not meeting the goal on 16 of 131 days (12%) in 2009, 54 of 130 days (42%) in 2008 and 35 of 124 days (28%) in 2007 (**Alley 2010b)**. In 2005 and 2006 (after wetter winters), the management goal was reached during the lagoon season. In the 2004 lagoon, 27% of the days (34 of 125 days) failed to meet the management goal partially due to tidal overwash. This was compared to 19% in 2003 and 10% in 2002.

The coho management goal of keeping maximum water temperatures below 20ºC (68ºF) near the bottom in the presence of steelhead was NOT met until mid-September except for a few days in June and early August (11 days during the 2 months), totaling 73% of the days NOT being met (99 of 135 days) of the lagoon period in 2013 compared it being met for all but 5% of the days in 2012, it being met all the time in 2011, it NOT being met 6% of the days measured (7 of 127 days) in 2010 and NOT being met 57% of the days measured (75 of 131 days) in 2009; 69% in 2008, 66% in 2007 and 17% in 2006. However, coho prefer temperatures below 16°C (depending on food abundance) (**J. Smith pers. communication**), and the lagoon temperature near the bottom went down to 16°C on only the last day of the measurement period in 2013 compared to 24 days (18%) in 2012 compared to 26 days (28%) in 2011 and 56 days (44%) in 2010. But the daily maximum was above 16°C except for the last 3 days in October 2012, always above 16°C in 2011 and above 16°C except for 5 days in early October 2010. In 2009, lagoon temperature went down to 16° C or below on 9 days but the daily maximum was always more. The 2008 lagoon failed to cool to 16°C.

At the creek site near Nob Hill in 2013, the stream management goal was met for steelhead of *no more than 4 hours a day at greater than 20ºC (68ºF)* was met except for 1 day (**0.7%**) (**Figure 5a**). In 2009−2012, the stream management goal was met for steelhead (**Figures 5c−5e**) and failed on only 1 day (**0.8%**) in 2008 (**Alley 2013**). In 2013, water temperature reached 20°C on 7

days. In 2011 and 2012, water temperature reached 20°C on one day while, in 2009 and 2010, water temperature did not reach 20°C. In 2007, water temperature failed to meet this management goal on **4%** of the days (**Figure 5e**) compared to **12%** in 2006 (**Figure 5f**). At the creek site in 2005, water temperature failed to meet the management goal **5%** of the days (**Alley 2005**). In 2004, **7%** of the days did not meet the goal. September was unusually cool in 2004 and 2005 (**Alley 2005**). At the Creek site in 2003, **17%** of the days failed to meet the management goal (**Alley 2005**).

The Soquel Creek water temperature goal for coho salmon in stream habitat is to have an average weekly temperature (7-day rolling average) of 16.7º C (62º F) or cooler. In 2013, the management goal was not met on 83 of 135 days (65%) (**Figure 5a**). In 2012, the management goal was not met on 9 days (7%) (**Figure 5c**). In 2011, the management goal was not met 23 days (25%) in July of the 93-day lagoon period (**Figure 5d**), with it reaching a maximum of 17.3°C. In 2010 the goal was met except for 7 days (6% of the days) consisting of 3 days in early June and 4 days in mid-July (**Figure 5e**). Coho salmon may have survived in the 2010−2012 stream habitat near the lagoon if present. However, in all other past monitoring years, especially a low flow year such as 2013, considerably more stream shading and streamflow would be required to make lower Soquel Creek habitable for coho salmon. From late May to the end of September 2009, the 7-day rolling average went as high as 17.5° C and was higher than 16.7° C for a 13-day period and a separate 15-day period (**Figure 5c**). From late May to the end of September 2008, the 7-day rolling average went as high as 18.2ºC (64.7ºF) on 9 July and was higher than 16.7° C for a 20-day period (**Figure 5d**).

The daily stream water temperature fluctuated more than the daily lagoon water temperature near the bottom in 2013, which was typical for previous years except 2010. The maximum daily lagoon water temperature typically occurred between 1700 and 2100 hr each day.

Creek water temperatures in 1999-2013 were much cooler than in 1998 (measured by Brooke Kraeger in 1998), despite the much higher baseflow in 1998. In 1998, there was a 20-day period in which water temperature rose above 21º C (69.8º F) for several hours each day in the stream above the lagoon, with a maximum of approximately 23.5º C (74.3º F) on 3 August 1998 (**Alley 2005**). Daily maxima were still approaching 21ºC on 4 September 1998. Considerable riparian vegetation had been removed by El Niño stormflows the previous winter. Despite warm stream temperatures and higher stream inflow in 1998, lagoon water temperatures were relatively cool compared to other years (**Alley 2003**).

Aquatic Vegetation Monitoring

In 2013 at the time of sandbar construction on 23 May, only approximately 20-25% of the decomposing kelp and seagrass had been raked out of the lower lagoon, and the lagoon bottom was soft with a thick layer of detritus. This was compared to 90% removal in 2012, 60% removal in 2011, 90% in 2010 and 70% in 2009. Therefore, there were more nutrients available for plant growth in 2013 than previous years. Thicknesses of bottom algae and pondweed (with attached algae) were much greater in all reaches in 2013 compared to 2010−2012, with similar coverage (**Tables 5-8**). Thickness and coverage was similar in 2010−2012 (except reduced at the mouth of Noble Gulch in 2012) and less than in 2009 (**Tables 6-9**). Evidence of nutrient inputs from

Noble Gulch in 2013 was expressed by recurrent thick planktonic algae and sporadically high levels of surface algae nearby, though bottom algae was not thicker than at other sites as had been the case in past years.

Filamentous algae was first noted in mid-June 2013. Bottom algae thickness in the 2013 lagoon was more than in 2010−2012 and somewhat similar to that in 2009. In 2013, bottom algae thickness in Reaches 1−3 and at the mouth of Noble Gulch averaged 2.0 ft, 1.1 ft, 1.2 ft and 1.2 ft, respectively (**Table 5**), compared to 0.5 ft, 0.4 ft, 0.4 ft and 0.5 ft, respectively in 2012 (**Table 6**). This was compared to 2011 averages of 0.6 ft, 0.6 ft, 0.3 ft and 1.1 ft, respectively, 2010 averages of 0.8 ft, 0.8 ft, 0.8 ft and 2.2 ft, respectively, and 2009 averages of 1.7 ft, 1.2 ft, 0.9 ft and 1.4 ft, respectively (**Tables 6−9**).Pondweed had nearly disappeared in 2011, but flourished in 2012 and 2013 with the thickest growth in 2013 of the past 5 years. Pondweed was first detected in early August, it being initially most prominent in Reaches 1 and 2 in September and then later reaching 20−25% coverage and 3−5 ft thickness in all three reaches by late September.

Surface algae in 2013 varied between 0 and 7% in Reach 1 (0 and 7% in 2012), 0 and 5% in Reach 2 (0 and 5% in 2012), 0 and 10% in Reach 3 (0 and 25% in 2012) and 0 and 30% at the mouth of Noble Gulch (0 and 15% in 2012) (**Tables 5 and 6**). Surface algae was less prevalent in 2010−2013, on average, than 2009 (**Table 9**), except on isolated dates such as in July in 2012 it was as high in Reach 3 just downstream of Noble Gulch, forming a raft 50 ft x 120 ft on 3 July. On 1 September 2013, the day of the Begonia Festival it was the highest in 5 years at 30%. It was consistently much more prevalent in 2009 than most years except in Reach 3, with the average and maximum surface coverage being more than double that of 2008 in Reaches 1 and 2 and at the mouth of Noble Gulch (**Table 9; Alley 2013**). 2013 averages were the second highest in 5 years in Reaches 1 and 3 (except for the one high episode in July 2012 that inflated the average). Averages in 2009 and 2010 were higher at Noble Gulch than in 2013. The average surface algae coverage for Reaches 1−3 and the mouth of Noble Gulch in 2013 were 2.2%, 1.2%, 2.8% (Reach 3 below Noble Gulch) and 4.3%, respectively, compared to 0.6%, 0.6%, 3% (inflated from one instance of 25%) and 3%, respectively in 2012 (0.1%, 3.6%, 1.3% and 1%, respectively in 2011; 0.1%, 1.1%, 3.8% and 7.5%, respectively in 2010 and 2%, 4%, 0.6% and 8.2% respectively in 2009). The years, 2007−2009 and 2013, were dry years with minimal stream inflow to the lagoon, although 2012 baseflow was similar in fall to those years. Surface algae coverage in 2007 and 2008 varied between 0 and 10% in the different reaches, with similar 2-week estimates between the two years, except for a higher amount in mid-August 2007. In 2007, the average coverage at the mouth of Noble Gulch was similar to 2009 and 2010 due to 30% and 15% coverage in mid-August and early September 2007 (**Alley 2008**). Surface algae in 2006 (a relatively wet year with high stream inflow) varied between 0 and 5% coverage, with the most being present in Reach 3 and near Noble Gulch (**Alley 2007**). In contrast, surface algae in 2005 (also a wet year) varied between 0 and 20% coverage of Reach 3, with very little in the lower 2 reaches (maximum was 2%) (**Alley 2006**). In conclusion, surface algae in the vicinity of Noble Gulch seemed to be sporadically high and was seemingly unrelated to Soquel Creek stream inflow to the lagoon when comparing different years. Surface algae coverage was somewhat correlated with bottom algal thickness because 2009 and 2013 had relatively high bottom algae thickness in Reaches 1−2 and correspondingly high surface algae coverage there. In some years (2009 and 2010), Noble Gulch had the highest average bottom algae thickness and surface algae coverage of the 4 locations in the lagoon.

Table 5. Visually Estimated Algae Coverage and Thickness in the 2013 Lagoon (pondweed with attached algae included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month /Day	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover
6-8	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6-22	Soupy	Soupy	0	0.8	20	0	0.8	15	0	0.2	30	0
7-6	Soupy	Soupy	0	0.8	100	0	1.0	100	0	0.5	100	0
7-20	Dark	Dark	0	1.0	100	0	Dark	Dark	0	1.2	100	0
8-3	2.0	100	0	1.5	100	0	0.5 (1.0 Pond-Weed	99 (<1% pond-weed)	0	2.0	60	0
8-17	2.0	100	0	1.0	100	0	0.5 (2.0 pond-Weed)	99 (1 pond-Weed)	0	1.5	100	0
9-1 Begonia Festival	3.0 (4.0 Pond-weed)	85 (15 Pond-weed)	0	1.0 (2.0 Pond-weed)	78 (20 pond-weed)	0	2.0 (2.0 pond-weed)	85 (15 pond-weed)	1	2.0	100	30
9-14	3.0 (4.0 pond-weed)	85 (15 pond-Weed)	5	2.0 (4.0 pond-weed)	85 (15 pond-weed)	2	3.0 (4.0 pond-weed)	85 (15 pond-weed)	10	2.0	100	1
9-28	2.0 (5.0 pond-weed)	80 (20 pond-weed)	3	2.0 (4.0 pond-weed)	80 (20 pond-weed)	0	2.0 (3.0 pond-weed)	75 (25 pond-weed)	10	1.0 (3.5 pond-weed)	75 (25 Pond-Weed)	0
10-12	Dark	Dark	5	1.0 (3.0 pond-weed)	80 (20 pond-weed)	<1	1.0 (3.0 pond-weed)	80 (20% pond-weed)	2	1.0 (2.5 pond-weed)	80 (20 Pond-Weed)	2
10-26	Dark	Dark	7	Dark	Dark	5	Dark	Dark	5	2.0 (3.0 pond-weed)	70 (30 Pond-Weed)	10
11-9	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
11-23	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
12-8	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
Avg-6-08 – 10-26	**2.0 algae**	**50 algae**	**2.2**	**1.1 algae**	**74 algae**	**0.7**	**1.2 algae**	**62 algae**	**2.8**	**1.2 algae**	**74 algae**	**4.3**

Table 6. Visually Estimated Algae Coverage and Thickness in the 2012 Lagoon (pondweed with attached algae included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month /Day	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover
6-5	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6-19	0.2	10	0	0.2	30	0	0.4	60	0	0.4	60	0
7-3	0.50	90	5	0.7	100	5	0.5	100	25/3 below/above Noble G.	0.4	60	15
7-16	1.0	70	0	0.5	40 (<1% pond-weed)	0	1.0	90	0	Thick plankton bloom- no vis.	Turbid	0
8-1	0.4	90	0	0.4 (1.0 pond-Weed)	99(1% pond-weed)	0	0.2 (1.0 Pond-Weed	99(1% pond-weed)	0	0.2	100	0
8-14	0.2 (1.5 pond-Weed)	80 (10 pond-Weed)	0	0.3 (0.8 pond-Weed)	85 (15 pond-Weed)	0	0.3 (0.8 pond-Weed)	85 (15 pond-Weed)	0	0.5	80	0
8-29	0.4 (2.5 Pond-weed)	70 (25 Pond-weed)	0	0.3 (2.5 Pond-weed)	85 (15 pond-weed)	0	0.4 (2.5 pond-weed)	80 (20 pond-weed)	0	0.5	70	10
9-12	0.2 (3.0 pond-weed)	65 (35 pond-Weed)	<1	0.5 (2.5 pond-weed)	70 (30 pond-weed)	0	0.5 (2.0 pond-weed)	70 (30 pond-weed)	0	0.4	70	0
9-26	2.0 (3.0 pond-weed)	55 (35 pond-weed)	0	0.7 (1.5 pond-weed)	70 (30 pond-weed)	0	0.3 (1.0 pond-weed)	50 (50 pond-weed)	0	1.5 (2.5 pond-weed)	70 (10 pond-weed)	0
10-10	Dark	Dark	0	Film (1.5 pond-weed)	60 (40 pond-weed)	0	Film (1.0 pond-weed)	30 (70% pond-weed)	0	Thick plankton bloom- no vis.	Turbid	0
10-24	Turbid	Turbid	0	Turbid	Turbid	0	Turbid	Turbid	0	Turbid	Turbid	0
11-7	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
Avg-6-05 – 9-26	**0.5 algae**	**59 algae**	**0.6**	**0.4 algae**	**64 algae**	**0.6**	**0.4 algae**	**70 algae**	**3 below Noble G.; 0.3 above**	**0.5 algae**	**64 algae**	**3**

Table 7. Visually Estimated Algae Coverage and Thickness in the 2011 Lagoon (pondweed with attached algae included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month /Day	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover
7-10	0	0	0	0	0	0	0	0	0	Turbid-Yellow/brown water	Turbid	0
7-26	0.6	60	0	0.5	70	0	0.3	60	0	Thick plankton bloom	Turbid	0
8-10	1.0	60	0	1.0	70	0	Dark	Dark	2% ds Noble; 5% us Noble	1.0 Thick plankton bloom	80	20 after-Noon
8-23	Dark	Dark	<1 morning	0.3	100	25 morning	0.3	80	10% ds Noble; <1% us Noble	Turbid Thick plankton bloom	Turbid	5 morning
9-5	0.5	100	<1	1.0	70 (1 pond-weed)	0	0.3	70 (1 pond-weed)	0	Thick plankton bloom/gray water	Turbid	0
9-18	0.4	100	0	0.6	100 (1 pond-weed)	0	0.4	100	0	0.8 Thick plankton bloom/gray water	100	0
10-01	1.0	90	0	0.5	100 (5 pond-weed)	0	0.5	95	0	1.5 Turbid-gray/brown Water	90	0
Avg-7-10 – 10-01	**0.6**	**68**	**0.1**	**0.6**	**73**	**3.6**	**0.3**	**68**	**1.7 ds Noble/ 0.8 us/ 1.3 total**	**1.1 (limited obs.)**	**90 (limited obs.)**	**1**

Table 8. Visually Estimated Algae Coverage and Thickness in the 2010 Lagoon (pondweed with attached algae included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month /Day	**Avg. Bottom Thick-ness (ft)**	**% Bottom Algae Cover**	**% Surf. Algae Cover**	**Avg. Bottom Thick-ness (ft)**	**% Bottom Algae Cover**	**% Surf. Algae Cover**	**Avg. Bottom Thick-ness (ft)**	**% Bottom Algae Cover**	**% Surf. Algae Cover**	**Avg. Bottom Thick-ness (ft)**	**% Bottom Algae Cover**	**% Surf. Algae Cover**
6-19	0.3	10	0	0.3	15	0	0.3	25	0	Turbid	Turbid	0
7-04	0.3	30	0	0.3	60	0	0.3	30	0	Turbid	Turbid	0
7-19	0.8	70	<1	0.8	60	2	0.5	80 (<1 pond-weed)	20 ds Noble/<1 us/8 total	Turbid	Turbid	25
8-02	1.0	80 (1 pond-weed)	0	1.0	65	5	2.0	40 (<1 pond-weed)	15 ds Noble/ 1 us/5 total	0.5	30	5
8-15	1.0(pond-weed 3.0)	85 (15 pond-weed)	0	0.8	40	0	1.0	50 (<1 pond-weed)	0	Turbid	Turbid	0
8-29	2.0(pond-weed 4.0)	60 (10 pond-weed)	0	1.0	30	0	1.0	99	0	Turbid	Turbid	0
9-12	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
9-26	0.5(pond-weed 2.0)	40 (20 pond-weed)	<1	0.5 (pond-weed 2.0)	85 (15 pond-weed)	3	0.5(pond-weed 3.5)	90 (10 pond-weed)	2	3.0	35	30
10-09	0.7(pond-weed 4.0)	60 (20 pond-weed)	1	2.0(pond-weed 3.0)	50 (30 pond-Weed)	1	1.0(pond-weed 3.0)	70 (20 pond-weed)	1	3.0	30	15
10-23	Turbid	Turbid	0	Turbid	Turbid	0	Turbid	Turbid	0	Turbid	Turbid	0
Avg-6-19 – 10-23	**0.8**	**53**	**0.1**	**0.8**	**51**	**1.1**	**0.8**	**97**	**3.8 ds Noble/ 0.4 us/ 1.6 total**	**2.2 (limited obs.)**	**32 (limited obs.)**	**7.5**

Table 9. Visually Estimated Algae Coverage and Thickness in the 2009 Lagoon (pondweed with attached algae included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month /Day	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover	Avg. Bottom Thick-ness (ft)	% Bottom Algae Cover	% Surf. Algae Cover
6-07	–	–	5	–	–	2		–	<1	0.4	60	2
6-21	1.1	40	3	0.3	70	10	0.5	80	2	0.5	60	20
7-02	–	–	0	0.5	100	0	0.5	100	0	0.8	70	5
7-19	1.0	70	<1	1.5	100 (1 pond-weed)	25	0.5	100 (1 pond-weed)	3	1.0	95	2
8-01	2.0	100	0	2.0	100 (2 pond-weed)	<1	1.5	100 (2 pond-weed)	<1	1.2	70	25
8-15	2.0	95 (20 pond-weed)	0	0.5	90	0	1.0	100 (1 pond-weed)	0	2.0	90	1
8-29	2.0	90	5	1.5	95	3	1.0	98	<1	2.0	70	7
9-12	2.0	100	<1	2.0	80 (<1 pond-weed)	<1	1.5	100 (1 pond-weed)	1	3.0	60	20
9-26	Turbid	Turbid	0	Turbid	Turbid	0	Turbid	Turbid	<1	Turbid	Turbid	0
10-10	Dark	Dark	5	Dark	Dark	0	Dark	Dark	0	Dark	Dark	0
Avg-6-07 – 9-12	**1.7**	**83**	**2.0**	**1.2**	**91**	**4.0**	**0.9**	**97**	**0.6**	**1.4**	**72**	**8.2**

Dissolved Oxygen Results During the 2-Week Monitorings

Oxygen concentration was lowest at dawn, or soon after, because oxygen was depleted by cell respiration overnight before plant photosynthesis could begin producing oxygen with the light. Near dawn is the time when oxygen concentrations are most importantly measured and rated. In 2013, the average oxygen level remained "good" (greater than 7 mg/l at dawn) for steelhead *near the bottom* at all 4 stations during the 18 two-week monitorings (**Table 2; Figure 6a-1**). However, oxygen concentration was "poor" at Stockton Bridge (Site 2) on the first monitoring due to the saline layer on along the bottom (**Tables 2 and 3, Figure 6a-1 and Appendix A**). In addition, oxygen concentration at the mouth of Noble Gulch (Site 4) was "poor" during 4 monitorings and "fair" on 1 monitoring. In 2013, oxygen levels at the mouth of Noble Gulch were sporadically lower than in at least the past 5 years (and the only year with it in the "poor" range), including the low flow years of 2007−2009 (**Alley 2008−2013**). This "poor" rating then improved through the day into the "good" range once photosynthesis began, except at Stockton Bridge when the saline layer was present (**Figure 6a-2**). At the flume (Site 1) the oxygen concentration was "fair" in the fall on 2 monitorings, as it was at Stockton Bridge on one monitoring. Ed Morrison and Public Works staff did an excellent job of managing lagoon water

level after small storms to maintain light penetration to plant life to produce oxygen.

Lower oxygen concentration at dawn is usually associated with more algae present in concert with a previously cloudy/foggy day or a stagnant saline layer along the bottom that prevents the bottom layer from circulating with the surface and other oxygen-rich water. When water clarity is reduced after small stormflows, if light does not penetrate to photosynthesizing plant life, oxygen concentrations will also rapidly decline. At dawn after a previously sunny day with good water clarity, oxygen levels are higher because the water becomes supersaturated with oxygen from high photosynthetic rates of the lagoon algae and pondweed the previous day.

Although average lagoon oxygen levels in 2013 at dawn were in the "good" range above 7 mg/l throughout the lagoon phase, it was lower than the previous 3 years until August (**Figure 6h**). In 2013, less than "good" oxygen levels were avoided after small fall stormflows, unlike in 2010 and 2012. The relatively lower oxygen concentrations in late October in 2010 and 2012 and early November in 2012 resulted from early fall storms creating turbidity to inhibit light penetration and photosynthesis and generally less plant growth and photosynthesis associated with lower sun angle and shading by the western slope as the fall season progressed.

In comparing morning and afternoon oxygen levels in the lagoon, usually oxygen concentration was higher in the afternoon than morning, despite warmer water temperature in the afternoon which has a lower oxygen saturation point. This was the case for lagoon sites in 2013 to early 2014 except for 21 December and 1 February (**Figures 6b-e**). At the stream Site 5 at Nob Hill, oxygen was only slightly higher in the afternoon on 23 November and less in the afternoon on 21 December and 1 February (**Figure 6f**). In comparison, 2012 oxygen concentration was only slightly higher in the afternoon on the lightly rainy 10 October and lower in the afternoon than in the morning on the cloudy 24 October (**Figure 6g**). This was in contrast to 2011 when oxygen levels were consistently less in the afternoon than in the morning at Site 5 above the lagoon (**Alley 2013**). In stream settings, oxygen is typically at or close to full saturation due to water turbulence in riffles. In 2011, the morning air and water temperatures were generally cooler (**Figures 3e and 3f**) with a higher oxygen saturation point than in 2012, yielding higher oxygen concentration in the morning.

Salinity Results

In 2013, saline conditions were only detected a short time after sandbar closure (30 May and 8 June) in the deeper lagoon area along the wall at Venetian Court and at Stockton Bridge (**Appendix A**). Warm water was also detected from data loggers in a 1.5 ft (0.5 m) layer along the bottom in the deepest part of the lagoon, downstream of the railroad trestle until 4 June. This indicated that saltwater was also present there. Saline conditions resulted from a small amount of saltwater being trapped in the lagoon at the time of sandbar closure on 23 May, which created a stagnant layer along the lagoon bottom that heated up. A shroud was installed on the sandbar inlet on 30 May to pull saltwater off the bottom and out through the flume. No salinity was detected on 22 June. Despite limited lagoon outflow in 2013, saltwater was not periodically flushed back into the flume on certain high tides. A freshwater lagoon was maintained from mid-June until 29 December when tidal overwash occurred. At that time, the shroud was installed on the flume inlet and only slight salinity was detected at Stockton Bridge on 4 January. The estuary phase began on 8 February.

Conductivity Results

Measured conductivity remained low throughout 2013, except in the Venetian Court's wall-hole and beneath the Stockton Bridge (and likely in the deep area near the railroad trestle) early on when saltwater was present at the bottom. Otherwise, it ranged between a low near the bottom of 750 umhos on 22 June and a high of 878 on 14 September (**Appendix A**). After that, it declined until tidal overwash on 29 December. Conductivity was the highest since the drought years of 1991−92 (**Alley 1992 and 1993**). Conductivity was lower at Station 5 above the lagoon than in the lagoon through the summer.

Stream In-Flow to the Lagoon

The lagoon water quality is generally best with relatively higher summer baseflow. Higher summer baseflow flushes saltwater out through the sandbar and flume more quickly than less baseflow, thus reducing the heating effects of a stagnant saline layer on the lagoon bottom. Higher baseflow causes more outflow through the flume to prevent saltwater back-flushing through the flume into the lagoon. The lagoon mixes and cools more overnight when inflow is higher. In 2008, there were repeated problems with apparent saltwater back-flushes through the flume at high tides. This was not a problem in 2009−2012 with higher streamflow than in 2008 (**Table 10**). There was not a problem in 2013 due to the use of plywood over the flashboards, despite low inflow. The year 2001 was most affected by tidal overwash in the last 13 years (**Alley 2002a**). In recent years, the sandbar around the periphery of the lagoon has been maintained at a higher elevation to reduce tidal overwash.

With proper flume management and the new grated flume ceiling installed in 2003, it should be easier to maintain lagoon depth and prevent fluctuations in lagoon level when the summer begins with high baseflow. To maximize summer baseflow, water percolation into the aquifer during the rainy season must be maximized and surface runoff must be minimized. Summer water diversion and pumping from the underflow of the creek reduce summer baseflow and should be curtailed quickly if surface flow becomes discontinuous in lower Soquel Creek.

Stream inflow in 2013 was considerably below the median and the lowest since the drought of 1987-92 and 1994. It was insufficient to prevent water temperatures to potentially rise to stressful levels when the management goal of maintaining early morning minimum temperature below 20°C near the bottom was not met for 47% of the monitoring period until 13 October. Stream inflow to the 2013 lagoon followed a below average winter rainfall amount that came primarily from two storms in December (**Figures 24 and 25**). There were three very small stormflows during the January−April period, resulting in very low baseflows through the dry season (**Figures 26 and 27**). Baseflow at the time of sandbar closure was approximately 2−3 cfs (compared to 10 cfs in 2012 and 25 cfs in 2011) (**Table 10**). 2013 had the lowest baseflow on 1 June of the past 23 years of monitoring. By 1 September, prior to any fall rainfall, 2013 streamflow had declined to only 0.4 cfs at the Soquel Village USGS gage, compared to 1.8 cfs in 2012 and 5.8 cfs in 2011. The 1 September 2013 baseflow of 0.4 cfs at the gage was third lowest in the last 23 years, just above those in 1992 and 1994. Since streamflow is lost between the gage and the lagoon, streamflow was merely a trickle as it entered the lagoon in September.

The 4th relatively small stormflow in the fall/winter peaked at 125 cfs, but exceeded the flume

capacity, necessitating a facilitated breach of the sandbar on 8 February 2014 (**Figure 27**).

Drain Line Test for Restaurants Contiguous with Soquel Creek Lagoon

The 6 restaurants, contiguous with the Soquel Creek Lagoon that had accessible plumbing systems were tested for leaks and deficiencies in plumbing connections and repaired as necessary. Confirmation is contained in **Appendix B**.

Table 10. Daily Mean Discharge Recorded at the USGS Stream Gage (11160000) in Soquel Village, At One Month Intervals from 1 June to 1 October, 1991-2013.

Year	1 June Streamflow (cfs)	1 July Streamflow (cfs)	1 August Streamflow (cfs)	1 September Streamflow (cfs)	1 October Streamflow (cfs)
1991	4.1	2.6	1.5	0.65	0.37
1992	4.0	4.0	0.6	0.1	0.2
1993	12	5.8	3	1.8	1.6
1994	4.2	1.3	0.7	0.2	0.05
1995	24	17	7.8	4.5	3.7
1996	23	17	8	4.6	3.6
1997	9	7.7	4.2	2.6	2.3
1998	58	22	13	9.7	7.2
1999	16	10	7.4	5.7	4.3
2000	14	9.5	6.2	4.6	7.4
2001	7.2	4.0	3.4	2.6	1.6
2002	9.1	4.9	3.3	2.8	2.2
2003	15	7.2	4	2.2	1.8
2004	5.2	3.3	2.7	1.8	1.4
2005	20	13	7.5	5.1	3.1
2006	28	17	8.7	6.6	7.1
2007	4.7	2.3	2.0	1.4	1.3
2008	3.8	2.0	1.3	0.7	1.4
2009	6.2	3.3	2.5	1.2	0.5
2010	14	7.3	5.3	3.4	2.2
2011	25	15	8.6	5.8	4.5
2012	9.8	5.6	2.9	1.8	1.4
2013	3.3	1.7	1.3	0.4	0.5

Begonia Festival Observations and Water Quality Findings

The City's fishery biologist (Donald Alley) was present before, during and after the Begonia Festival parade on 1 September. The day of the parade was clear and warm. Air temperature at the flume was 17.1°C (63.5°F) at 0731 hr and 20.8 C (69.4°F) at 1610 hr. Water temperatures near the bottom were the season's highest since the saline layer dissipated in the first 10 days of sandbar closure and were rated "poor" (**Table 2**) in the morning at between 21.6 and 22.2°C (**Figure 3g**). Water temperature increased to between 23 and 23.5°C near the bottom in the afternoon (**Figure 3h**) and was likely stressful to steelhead. Lagoon water surface elevation was excellent and was maintained relatively high at 2.61−2.62 (**Figure 2**). Morning oxygen levels were in the "good" range at the 3 lower sites and "fair" at the mouth of Noble Gulch (**Figure 6a-1**). There were 6 floats, 19 other boats, kayaks and surf boarders. 2 paddle surfboarders collided and fell into the lagoon and disturbed bottom for 20 seconds. In conformance with the permit requirements from the California Department of Fish and Game, no floats were set up to be propelled by waders. Means of propulsion could be by paddling or use of an electric motor. All floats were electric motor-powered. Thus, the lagoon bottom was undisturbed. Conductivity near the bottom increased very slightly at the Stockton Avenue Bridge from 845 before to 861 umhos after the parade. Conductivity at the mouth of Noble Gulch was 860 umhos near the bottom before the procession and 893 afterwards. The measured levels of conductivity were not stressful to steelhead, though they were the highest of those measured during the summer/fall season. There was no odor of hydrogen sulfide, and no fish mortality was observed. Oxygen concentrations in the afternoon near the bottom following the nautical parade were high and supersaturated, ranging between 11.44 at Noble Gulch at 1500 hr and 13.91 mg/l at the flume at 1610 hr. The secchi depth (water clarity) was to the lagoon bottom after the float procession. Flower petals were collected by Begonia Festival staff and volunteers the following week, and there were minimal petals left by the parade of floats.

Floats were dismantled the following week, and flowers were gathered from the lagoon, using a boat. More than 90% of the petals were retrieved. Water quality measurements on 14 September detected no oxygen depletion resulting from decomposing begonias (**Figure 6a-1; Appendix A**).

Pollution Sources and Solutions

The lagoon near the beach was closed to human contact due to bacterial levels above the maximum acceptable level. The gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria. They forage through the human refuge left on the beach. They bathe and defecate in the lagoon. They roost and defecate on the buildings surrounding the lagoon. The gull population in summer/fall 2013 was the largest observed in 23 years of monitoring. There was an abundance of anchovies in the Monterey Bay, attracting hundreds of brown pelicans and other marine life. Reducing the gull population at Soquel Creek Lagoon would be a major step in reducing pollution. The use of gull sweeps has been observed to be successful in other locales to prevent gull roosting. The parallel wires strung across the roof of the Paradise Grill have been effective in discouraging roosting on that restaurant. All of the refuse cans on the beach were equipped with gull-proof lids since 2006 (**Ed Morrison, pers. comm.**). Refuse containers with gull-proof lids may reduce gull numbers. City building permit conditions of future remodeling will require addition of roof deterrents (**Steve Jesberg, Public Works Director, pers. comm.**). Rock doves (pigeons) are another source of bird pollution as they circulate between the wharf and the railroad trestle over Soquel Creek Lagoon. As stated in the original Management Plan, the trestle could be screened to eliminate pigeon roosting areas.

All storm drains leading to the lagoon should ideally be re-directed away from the lagoon in summer. Included in these is the culvert draining Noble Gulch. Significant quantities of gray water and oily slicks have consistently emptied into the lagoon from Noble Gulch. There was a large surface algal raft just downstream of Noble Gulch on 3 July 2012. Therefore, Noble Gulch continues to be a pollution source to the summer lagoon. In past years when gray water was observed at the Noble Gulch culvert outlet to the lagoon, streamflow was clear in Noble Gulch at the park when checked, before the creek went underground into the culvert. By minimizing the summer stream inflow from Noble Gulch, nutrients and bacteria entering the lagoon would be reduced.

Another drain into the lagoon is situated under the railroad trestle, where slight oxygen depletion has been detected in recent years and in October 2011 and in October and early November 2012. This drain could be capped if summer runoff was re-directed into the sewer. Another source of bird pollution is the rock dove (pigeon) population that circulates between the wharf and the railroad trestle over the lagoon. As stated in the original management plan, the trestle could be screened so that roosting areas were eliminated and bird pollution reduced.

Regarding pollution from urban runoff once the rains start in fall, installation and maintenance of silt and grease traps on storm drains is critical to reducing pollution by petro-chemicals. All new drainage systems from new development and parking lots should be installed with effective traps and percolation basins to encourage winter percolation of storm runoff. There has been a pollution problem and high flashiness in streamflow in the past during the first small storms of the fall. Early storms turn the lagoon water dark, requiring lagoon water level reduction to allow light to penetrate to the bottom and allow photosynthesis and oxygen production to continue. At times, the lagoon required breaching prematurely because the flume could not accept all of the stormflow, and flooding was imminent. Retrofitting of storm drainage systems with holding tanks or percolation basins could reduce the sudden increase in street runoff and pollution during early storms. Drains leading from Wharf Road (across the Rispin property), the Auto Plaza and

41st Avenue businesses north of Highway 1 are some of the sources of this problem.

The storm drain along the Esplanade was connected to the sewer line in 2006 for summer diversion of water in the drain to the sewer system. However, the pump was in manual mode, requiring Public Works staff to turn it on and off. Now an automatic pump switch has been connected to a float system to improve the operation.

The historical lagoon had large tule beds prior to construction of the bulkheads following the 1955 flood. Tules are commonly used in managed wetlands to remove nutrients and other pollutants from wastewater effluent. Re-establishment of tule marsh in Soquel Lagoon would reduce nutrient pollution and may reduce bacterial counts. Tule re-establishment would also provide fish habitat in Soquel Lagoon.

Capitola's Soquel Lagoon with tule marsh.
(circa 1927; Provided by the Capitola Historical Museum.)

Recommendations to Maintain Good Water Quality and Fish Habitat in the Lagoon

1. Prior to sandbar breaching in the fall, notch the sandbar across the beach at an elevation just below the piling bolt for flooding, minimizing the gradient of the notch to slow the evacuation of water through the beach and to minimize beach erosion. The purpose is to maximize the

residual estuary depth after the emergency breach.

2. The notch in the sandbar should be cut slightly lower than the piling bolt. *Orient the notch laterally (diagonally) across the beach to the southeast of the flume. Continue to* m*ake the notch at least 30 feet wide across the beach to also maximize the possibility of maintaining an estuary with some depth after the breach.* The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation. Continue to maintain an outer berm near the surf and an inner berm near the lagoon margin with the wide notch in between. *When breaching must be facilitated, notch the inner berm first, allowing the notch across the beach to fill with water. Then notch the outer berm to the east to finish the sandbar breach.*

3. Seek volunteers to re-establish tules in the alcoves under the railroad trestle, near the Golino property and in Margaritaville Cove.

4. To provide cover for juvenile fishes and to scour deeper habitat, secure large woody material to the lagoon bottom with anchor boulders in appropriate locations. Continue to retain large woody material that naturally reaches the lagoon.

5. Allow a clear path from under the bridge to the beach at Venetian Courts to enable seining for juvenile steelhead during fall censusing.

6. Require that Margaritaville staff not wash their patio and adjacent walkway (containing refuse dumpsters) off into the lagoon.

7. Restrict the number/weight of float participants allowed to ride on the floats to a safe level.

8. Enforce the ban on waders during the Begonia Festival Parade.

9. Continue to recommend to the Begonia Festival organizers that floats be safely maneuvered downstream of Stockton Avenue, with a water marshal present to direct floats in a circular direction along the periphery of the lagoon after they clear the bridge.

10. Continue to recommend to the Begonia Festival organizers to discourage alcohol consumption by float participants and rowdy behavior on their floats.

11. Continue to use gull-proof lids on refuse cans at and around the lagoon and beach. Use enough refuse containers to satisfy the demand for refuse disposal.

12. Consider screening the railroad trestle to discourage roosting and nesting by rock doves.

13. Re-install the 12-inch high wooden baffle inside the flume prior to directing water through the flume, if it was destroyed during the previous winter.

14. Maximize lagoon depth throughout the dry season, while maintaining passage through the flume for adult steelhead until June 1 and for steelhead smolts until July 1. If the lagoon level

begins to drop below the notch for steelhead smolts on one side of the flume because of the hole for adult steelhead after June 1, close the underwater portal for adults. If there is plenty of flow to maintain lagoon depth with the adult portal open, leave it open throughout the summer. If adult steelhead are seen in the lagoon after June 1 and the adult portal has been closed, then open the portal for a week to allow out-migration.

15. After July 1, leave the flume exit closed once it closes, unless flooding is eminent. Install visquine or plywood on the outside of the flashboards to prevent leakage into the flume. Maximize the number of boards in the flume entrance to maximize lagoon depth.

16. Secure the flume boards at all times to prevent their lifting by vandals or bay back-flushing to drain the lagoon.

17. If the lagoon bottom becomes invisible due to turbidity after the rains that do not breach the sandbar, immediately lower the lagoon level to the point where the bottom is visible. This will allow algal growth despite the high turbidity. Plant photosynthesis will produce oxygen and prevent anoxic conditions. A previous recommendation in the original Management Plan (**1990**) should be emphasized to prevent fish mortality; parking lots and streets draining into the lagoon should be cleaned thoroughly before the first fall rains.

18. Road repaving and application of petrochemicals should be done early in the summer. This will allow chemical penetration into the pavement and drying before fall rains.

19. Do not reduce the lagoon level for the Begonia Festival's nautical parade.

20. Regarding the nautical parade during the Begonia Festival, we continue to recommend that float propulsion by surfboard paddling or rowboat or electric outboard motor be required by the City rather than allowing pulling and pushing by waders. The latest CDFG permit prohibits wading. Allow float passage in one direction only, presumably downstream, before dismantling near the Stockton Avenue Bridge. In the past, floats were taken down the lagoon and then back up before dismantling back at the bridge.

21. Check the gage height at the lagoon once a week (preferably the same day each week) and log the of measurements so that the biologist may contact the City to obtain a weekly update.

22. "Gull Sweeps" sold by West Marine Products should be installed on Esplanade roofs to test their effectiveness in deterring gulls. According to the catalogue, "Powered by the slightest breeze, the Gull Sweep's motion will deter the most determined bird." These were successfully used on San Diego restaurants (**Y. Sherman, pers. communication**).

23. The City should influence planners, architects and property owners through the permit review to maximize water percolation and to filter out and collect surface runoff pollutants from new and existing land development within the City and upstream.

24. The City should request from the responsible flood control district that sediment and grease traps leading into lower Soquel Creek be annually inspected and cleaned.

25. The City should continue to fund activities to permanently remove invasive Arundo from residences along the lagoon and other non-native plants in the riparian corridor between Highway 1 and the lagoon in order to maximize stream shading, minimize water temperature of inflow water and protect aquatic and wildlife habitat.

FISH CENSUSING

Steelhead Plantings. No steelhead were planted in Soquel Creek in 2013, as was the case in 2003–2012. CDFG allowed juvenile planting of smolts in spring only in streams where planted juveniles were descendents of captured adult steelhead brood stock from those streams (San Lorenzo River and Scott Creek). No adult steelhead were captured from Soquel Creek for hatchery propagation. Therefore, no juveniles were planted there.

Fish Sampling Results. Fall sampling for steelhead occurred on 6 and 13 October 2013, from just upstream of the Stockton Avenue Bridge to the beach. A bag-seine with dimensions 106 feet long by 6 feet high by 3/8-inch mesh was used. The seine was set perpendicular to shore, parallel to the Stockton Avenue Bridge and just upstream of it. Juvenile steelhead congregate in the shade under the bridge. The seine was pulled to the beach in front of Venetian Court. With this larger, coarser-meshed seine, no tidewater gobies were captured. A total of 194 juvenile steelhead were captured and marked on 6 October after 4 seine hauls. There were no mortalities. A total of 260 juvenile steelhead were captured on 13 October in 3 seine hauls, with 30 recaptures and no mortalities. Other species captured with the large seine on both days combined were 12 prickly sculpin, 25 staghorn sculpins, 2 adult Sacramento suckers and 1 juvenile Sacramento sucker. The median size of juvenile steelhead captured on 6 Oct 2013 was 125-130 mm SL and on 13 October 2013 was 130-134 mm SL (**Figure 7; Table 12**) compared to 140-144 mm SL on both sampling days in 2012 (**Figure 8**), 155-159 mm SL on the first day and 160-164 mm SL on the second day in 2011 (**Figure 9**). A unimodal histogram was evident in 2013, unlike in 2012, 2011 and 2009 (**Figure 11**). There may have been few yearlings in the 2013 lagoon due to the two 5,000+ cfs stormflows in December 2012 that may have flushed many yearlings out of the drainage and then given the remaining yearlings clear water to feed effectively in spring with the absence of stormflow and growth rates sufficient to allow emigration without staying another summer (**Figure 24**). Yearlings were scarce in the watershed's stream sampling sites in 2013 (**Alley 2014**). Size histograms for other years of sampling back to 1998 may be found in **Figures 12−22**.

Our steelhead population estimate based on mark and recapture for fall 2013 was 1,681 compared to 220 in 2012 and 678 in 2011 (**Table 11; Figure 23**) (methods in **Ricker 1971**). This was the fifth highest estimate in 21 years and slightly above the average of 1,599.

On 13 October 2013, 7 seine hauls were made for tidewater gobies with a 30-foot x 4-foot x 1/8-inch mesh beach seine in lower Soquel Lagoon near the beach. Ten tidewater gobies were captured without mortality. They were last captured in 2008 and 2009 after dry winters. Fish captured with the small seine included threespine sticklebacks in high abundance. The low number of tidewater gobies captured in 1992-1997, and their absence since the El Niño stormflows in winter 1997-98 until 2008 and 2009, probably indicated a lack of backwater areas

to be used as refuges during high winter stormflows. This species was plentiful in Soquel Lagoon during the previous drought of the late 1980's and early 1990's and reappeared during the recent, less severe 2-year drought (2007-2008). Tidewater gobies have been reported in recent years in adjacent Moran Lake Lagoon by Jerry Smith (**pers. communication**).

Tidewater gobies from up-coastal-current Moran Lake likely re-colonized Soquel Lagoon in 2008, when Soquel Creek had two mild winters in a row. They likely re-colonized Soquel Lagoon again in 2013 after the two large stormflows in December 2012. They were found in Aptos Lagoon in 2011−2013 (**Alley 2012; 2013; 2014**).

More juvenile steelhead were expected to use the lagoon in 2013 than years with more numerous stormflows, such as WY 2011 and WY 2012, because adult passage opportunities to the upper watershed were less after December during the drier 2012-2013 winter, with assumedly more spawning near the lagoon (**Figures 23-24; 27-28; 30**). This was the case. More numerous stormflows in 2011 and 2012 encouraged more spawning in the upper creek with easier access, assumedly seeding the lagoon less with young-of-the-year steelhead than the previously dry years of 2007−2009 (**Figures 33-35**).

Another likely reason for a larger lagoon population size in 2013 was that the adult return was from the wetter 2010 instead of the previous drought year of WY 2009. Findings indicated that juvenile densities sampled by us at stream sites in 2009 in 4 watersheds, including Soquel Creek, were less than half those detected in 2008. The likely poor adult returns in 2009 would have resulted from three consecutive years of poor food conditions in the ocean (**Jerry Smith, pers. comm**.).

Past calculations indicated that lagoon production represented nearly 1/3 of the smolt-sized steelhead production in the lower 7.2 miles of mainstem Soquel Creek in both 1999 and 2000. In 1993, the lagoon production estimate of nearly 2,800 fish represented 10% of the smolt production in the 16.6 miles of steelhead habitat in the mainstem, East and West Branches. The 2004 lagoon population estimate of 3,900 fish represented an estimated 47% of the smolt production for the 16.6 miles of stream and lagoon habitat. Though we do not have 2007–2013 population estimates for the entire Soquel Creek watershed, the lagoon population of larger smolt-sized fish was likely a significant percentage of the total watershed population in both of these dry years. The lagoon provides valuable habitat through proper management.

Two factors that may influence growth of juvenile steelhead at the time of fall sampling are population size and the time of lagoon closure prior to sampling. A summary table was prepared for the years, 1998−2013 (**Table 12**), corresponding to scatter plots of the data found in previous reports (**Alley 2011**). Scatter plots of median juvenile size versus weeks of sandbar closure and versus population size done for data in 1998−2010, indicated no strong relationship between these factors when considered separately.

One would predict that if the population was large, then competition for food would be high and juvenile size at the time of fall capture would be less. One would expect that since the lagoon is a very food-productive habitat, then juvenile size would be larger with longer lagoon growth periods. The population estimates may not be entirely precise but likely are accurate in reflecting

relative annual differences in actual population size. The proportion of larger yearlings may also vary between years. But usually the lagoon population is overwhelmingly dominated by young-of-the-year steelhead, based on past scale analysis. Median size was slightly smaller in 2013 compared to 2012, which had a much smaller juvenile population, a likely higher proportion of yearlings and presumably less competition. In addition, the 2013 lagoon was warmer than previously, which increased metabolic rates and food demands of juvenile steelhead and may have slowed growth rate in 2013. The median size in 2011 was larger than the following years with the population likely dominated by larger yearlings after poor overwinter YOY survival with multiple large stormflows as late as April (**Figure 31**).

Table 11. Estimates of Juvenile Steelhead Numbers in Soquel Creek Lagoon for the Years 1988 and 1992-2013.

Year	Steelhead Population Estimate for Soquel Creek Lagoon
1988-	Rough estimate of a few hundred. No mark/recapture activity done. 157 juveniles captured in 5 seine hauls.
1992-	Rough estimate of a few hundred. No mark/recapture activity was done. 60 juveniles captured in 4 seine hauls.
1993-	2,787 +/- 306 (standard error). 1,046 fish marked from two seine hauls.
1994-	1,140 +/- 368 (standard error). 76 fish were marked from two seine hauls.
1995-	360 +/- 60 (standard error). 59 fish were marked from 4 seine hauls.
1996-	255 +/- 20 (standard error). 105 fish were marked from 3 seine hauls.
1997-	560 +/- 182 (standard error). 53 fish were marked from 3 effective seine hauls.
1998-	671 +/- 74 (standard error). 164 fish were marked from 3 effective and one snagged seine haul.
1999-	928 +/- 55 (standard error). 397 fish were marked in 4 effective seine hauls.
2000-	875 +/-156 (standard error). 185 fish were marked in 4 effective seine hauls.
2001-	454 +/- 27 (standard error). 186 fish were marked in 4 effective seine hauls.
2002-	1,042 +/-84 (standard error). 363 fish were marked in 4 effective seine hauls.
2003-	849 +/-198 (standard error). 109 fish were marked in 5 effective seine hauls.
2004-	3,869 +/-1,009 (standard error). 281 fish were marked in 4 effective seine hauls.
2005-	1,454 +/-347 (standard error). 212 fish were marked in 5 effective seine hauls and one with rope tangled around one pole.
2006-	992 +/- 125 (standard error). 178 fish were marked in 5 effective seine hauls.
2007-	6,064 +/- 1,671 (standard error). 226 fish were marked in 5 effective seine hauls
2008 -	7,071 +/- 1,574 (standard error). 551 fish were marked in 2 effective seine hauls
2009 -	449 +/- 87 (standard error). 114 fish were marked in 6 effective seine hauls.
2010-	1,174+/- 111 (standard error). 318 fish marked in 2 effective seine hauls.
2011-	678 +/- 107 (standard error). 197 fish marked in 5 effective seine hauls
2012-	220 +/- 94 (standard error). 44 fish marked in 6 seine hauls hindered by submerged log.
2013-	1,681+/- 265 (standard error). 195 fish marked in 4 effective seine hauls.

Table 12. Summary of Annual Fish Sampling Dates, Population Estimates, Steelhead Size and Lagoon Growth Period Prior to Sampling, 1998−2013.

Year	Sandbar Closure Date	Fish Sampling Dates	Weeks of Sandbar Closure Prior to Final Fish Measurements	Days of Sandbar Closure Prior to Final Sampling	Steelhead Population Estimate	Median Size Grouping of Captured Fish (mm SL)
1998	9 July	4/11 Oct	13.1	92	671	115-119 First Day
1999	18 May	3/10 Oct	20.6	144	928	120-124 First Day
2000	7 June	1/8 Oct	17.4	122	875	135-139 First Day
2001	14 June	7/14 Oct	17.3	121	454	125-129
2002	23 May	6/13 Oct	20.3	142	1,042	105-109 First Day
2003	22 May	5/12 Oct	20.3	142	849	110-114 First Day
2004	26 May	3/10 Oct	19.4	136	3,869	115-119 First day
2005	9 June	2/9 Oct	18.1	127	1,454	105-109& 110-114
2006	14 June	30Sep/8 Oct	16.4	115	992	150-154 & 145-149
2007	23 May	7/14 Oct	20.4	143	6,064	125-129 Both days
2008	22 May	27Sep/ 11 Oct (no lengths)	18.1	127	7,071	115-119 First day
2009	21 May	4/11 Oct	20.3	142	449	155-159 Both days
2010	2 June	3/10 Oct	18.4	129	1,174	115-119 Both days
2011	20 June	2/16 Oct	15.3+1.6 estuary	106+11 days estuary	678	155-159 & 160-164
2012	24 May	7/14 Oct	20.3	142	220	140-144 Both days
2013	23 May	6/13 Oct	20.3	142	1,681	125-129 & 130-134

We suspect from the size distributions of juveniles captured, that steelhead grew faster in 2006, 2009 and 2012 than either 2007 or 2008 because of less competition for food with much smaller juvenile populations (**Table 12**). The food-rich lagoon was in place nearly 3 weeks less in 2006 than in 2007 and 2008 before sampling, and the steelhead still grew faster in 2006. We see that with similarly low population sizes in 1998, 2001 and 2009, as the growth period increased, the median size also increased, respectively. 2012 also had relatively large juveniles with a long growth period. However, in years like 1999 and 2003 that had similar population size to 2000 and 2006, growth rate remained relatively slower despite longer growth periods. So, other factors influence growth rate.

Other factors that may strongly influence growth rate are water temperature and food availability. The density of aquatic vegetation, which may be an indirect indication of food availability, may vary considerably between years. Also, pondweed with attached algae may provide more invertebrate food than just filamentous algae alone. So, the density of pondweed is also important. 2013 had good densities of pondweed with attached algae (15-25% of bottom coverage in various reaches) from 1 September onward **(Table 5).** However 2012 had much higher densities (15-70% bottom coverage in various reaches) that began in mid-August **(Table 6).** Consideration must be given to potentially diminished water quality (oxygen levels at the end of the night) and/or fish foraging efficiency if aquatic vegetation becomes too dense.

Cooler lagoons reduce fish metabolic rate for maintenance and may allow a higher portion of the food intake to be used for growth. However, cooler lagoons may have less production of aquatic vegetation, and fish digestion rate is slower in cooler lagoons, which slows the processing of food for growth. The 2013 lagoon was relatively warm with very limited stream inflow. The 2012 lagoon was cooler with the 2011 lagoon cooler still. Aquatic plant production was less in 2011 than in the warmer lagoons of 2008, 2009, 2012 and 2013 (more pondweed) (**Tables 5-9**), indicating less food in 2011. There may have been a higher proportion of yearlings in the lagoon population in 2011 compared to other years due to overall low YOY survival in the watershed. A higher proportion of yearlings would have increased the median size of juveniles.

In order to maintain good steelhead nursery habitat in Soquel Creek Lagoon, the sediment input from the watershed must be reduced. The 2013 lagoon was relatively deep. The two large stormflows in December must have scoured out the lagoon, with limited sedimentation occurring for the remainder of the winter/spring. Stream shading must be increased to provide cooler stream inflow. The City must maintain the water level as high as possible throughout the summer until sandbar breaching, without large fluctuations. It is potentially easier to maintain good water quality and water depth when there is higher streamflow into the lagoon in summer (known as summer baseflow). The ceiling grate constructed in 2003 makes it easier to maximize lagoon depth because a portion of the flow can spill over the boards into the ceiling opening with all of the flashboards in place. However, even with the grate, it was difficult to maximize lagoon depth in 2006 because of the seepage of water and sand under the flume (**Figure 2**). Seepage again occurred in 2009 as previously, and sandbags were piled into the hole that developed in front of the flume inlet. Seepage was prevented in 2007, and lagoon depth was maintained. After the seepage was stopped, the 2009 lagoon level increased in mid July and August and early

September. However, the lagoon level was lowered after the 13-14 September storm, and was not raised to maximal levels until early October. With the turbidity remaining for an extended period due to low stream inflow, water depth could not be raised above a gage height of about 2.0 for 3+ weeks (14 September – 10 October). Although a seepage problem existed in 2012, it was largely solved in 2013. Prior to sandbar construction, plywood sheets were inserted between the flume pilings to slow or divert any water and sand underflow beneath the flume and discourage undermining. The lagoon water surface was kept at the top of the flume inlet throughout the summer/ fall until lagoon depth had to be reduced to allow light penetration to the bottom after early, small stormflows that created turbidity. Usually, in drier years it is easier to maintain a high gage height.

If the lagoon water surface drops, steelhead habitat in the upper lagoon is lost. Therefore, the lagoon level should be kept as high as possible during summer. The flume's flashboards must be secured against vandals removing them and against tidal backpressure that may dislodge them.

Maintenance of the lagoon in the fall after the first small storms is important. If the sandbar opens with the first small stormflows and closes again, kelp and seagrass may become trapped to rot and create an anoxic lagoon leading to a fish kill. Public Works staff succeeded in maintaining the sandbar and intact lagoon until 8 February 2014 when stormflow that could maintain an open sandbar finally occurred. Minimization of pollutant input from early fall storms is also important for reducing biological oxygen demand and avoiding fish kills.

Piscivorous Birds, Turtles and other Waterfowl. Predation may be a factor in population size and size distribution of juvenile steelhead. If bird predation rate was heavier, smaller steelhead would be most vulnerable because swimming speed increases with size. Heavy predation could increase the size distribution of juveniles surviving until fall sampling. Maintenance of lagoon depth is important to make feeding more difficult for piscivorous animals.

In 2013, mergansers were more common than in 2011 or 2012, ranging between 1 and 6 individuals at a time (**Appendix A**). Six mergansers were first observed on 20 July and fewer later during 8 of the 18 two-week monitorings (44%). Three were seen together late in the lagoon phase, twice in January. One hooded merganser was observed in February. In 2012, one merganser was observed on only 3 days of monitorings (25% of the time). No egrets were sighted in 2013 (1 observation in 2012). However, 1 cormorant was observed during 3 monitorings (17 August, 12 October and 23 November) compared to 4 times in 2012. One to 4 pied-billed grebes were seen in the lagoon not until 14 September but for the 10 monitorings thereafter (56% of the monitorings). Usually they are observed earlier in the summer. Four grebes were common in late December and January of the lagoon phase. In 2012, 1 pied billed grebe was observed on 4 monitoring days early in the season and a pair of pied-billed grebes were observed on 4 monitoring days late in the season (67% of the monitoring days with grebe sightings). Brown pelicans were observed only twice in the lagoon (a pair on 3 August and 1 on 14 September), despite the hundreds fishing the Bay nearby in summer and fall. No pelicans were seen feeding in the lagoon. A flock of 500-600 pelicans were observed roosting on the beach at the mouth of the Pajaro River in early October. Black-crowned night herons were observed on 3 occasions, including the first day of sandbar construction and the morning of the sandbar emergency breach. Greenback heron were observed on 3 occasions (6 July, 17 August

and 21 September).

In past years, piscivorous western pond turtles regularly basked on the instream cottonwood log and additional logs further downstream adjacent to the Golino Property. However, in 2013 no turtles were observed. The cottonwood that had been previously used had sagged and was mostly underwater in 2013, offering no basking location. In 2012, as many as 3 pond turtles were observed at one time on the cottonwood log and another nearby log.

Other bird species that utilized the lagoon included mallard (as many as 26), coots (as many as 49) and gulls (as many as 200+ in late October). Gulls were especially abundant in October and November during the anchovy population explosion, with hundreds using the beach. With the lagoon intact as late as February 2014, other species of waterfowl were observed that were not seen when the sandbar opened earlier. Those included buffleheads, golden eye, and hooded merganser. All domestic ducks mysteriously disappeared in 2013. There had been 5 the previous summer.

Recommendations Regarding Fish Management

1. Seek volunteers to re-establish tules in the alcoves under the railroad trestle, near the Golino property and beside Margaritaville.

2. Seek funding to secure large wood to the lagoon bottom with anchor boulders as added fish cover and as scour objects to deepen the lagoon and enhance rearing habitat.

3. If the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, notify nurseries having surface diversions upstream and the Fish and Game Department of the streamflow conditions so that direct water diversion of surface flow may be reduced or discontinued until flow returns. Pumping by the Soquel Creek Water District from the Main Street well may also need to be curtailed. Complete loss of surface flow should be avoided.

4. Maximize lagoon depth by maximizing flashboards in the flume inlet as streamflow declines and by sealing the boards with visquine and/or plywood, as was done in the past.

5. Secure the flume boards at all times so that vandals cannot pry them up and drain the lagoon. This will prevent tidal surges through the flume from dislodging boards and doing the same thing. Installation of a louver system on one side of the flume inlet would eliminate the need to deal with boards all summer. The design and installation of a louver system is recommended.

6. Do not unplug the flume exit after 1 July unless flooding is eminent.

7. Do not remove flume boards for the Begonia Festival's nautical parade or prior to taking fall vacation time.

8. Remove flume boards as the first small storms begin in fall and replace the boards after the stormflow has subsided while maintaining light penetration to the lagoon bottom. The effort

should be to minimize lagoon fluctuation until the sandbar actually breaches for the winter. Many forecasts for rain and storm intensities are incorrect in the early fall. It is harmful to steelhead to drop the lagoon level in anticipation of a storm that fails to develop, followed by failure to re-install the flume board afterwards.

9. Maintain the lagoon in fall until streamflow has increased enough (20-25 cfs) to prevent stranding of spawning adult steelhead or coho salmon and to prevent osmotic stress to lagoon-inhabiting steelhead. If necessary, install a perimeter fence with 2"x 4" mesh and with 6-foot panels around the flume entrance by October to prevent plugging of the flume's screen with aquatic vegetation during the first minor storms. Maintain the lagoon until approximately Thanksgiving in late November, before allowing stormflow to breach the sandbar. By this time, the winter storm pattern has usually developed to keep the sandbar open.

10. If sufficient turbidity occurs after the first small storms of the season to prevent light from penetrating to the bottom of the intact lagoon for more than one day, reduce lagoon depth temporarily to insure that light reaches the bottom. This will prevent death of aquatic vegetation and increased biological oxygen demand, with the associated loss of oxygen production that would have occurred from photosynthesis. Thus, anoxic conditions will be prevented. When the lagoon clears up, re-establish the maximum lagoon depth.

11. If the sandbar is still in place after November 15, maintain an opening in the flume inlet to allow early spawning adults to pass through the flume from the Monterey Bay.

12. Continue to census the juvenile steelhead in the fall to monitor the use of the lagoon as an important nursery area under varying management scenarios and restoration efforts.

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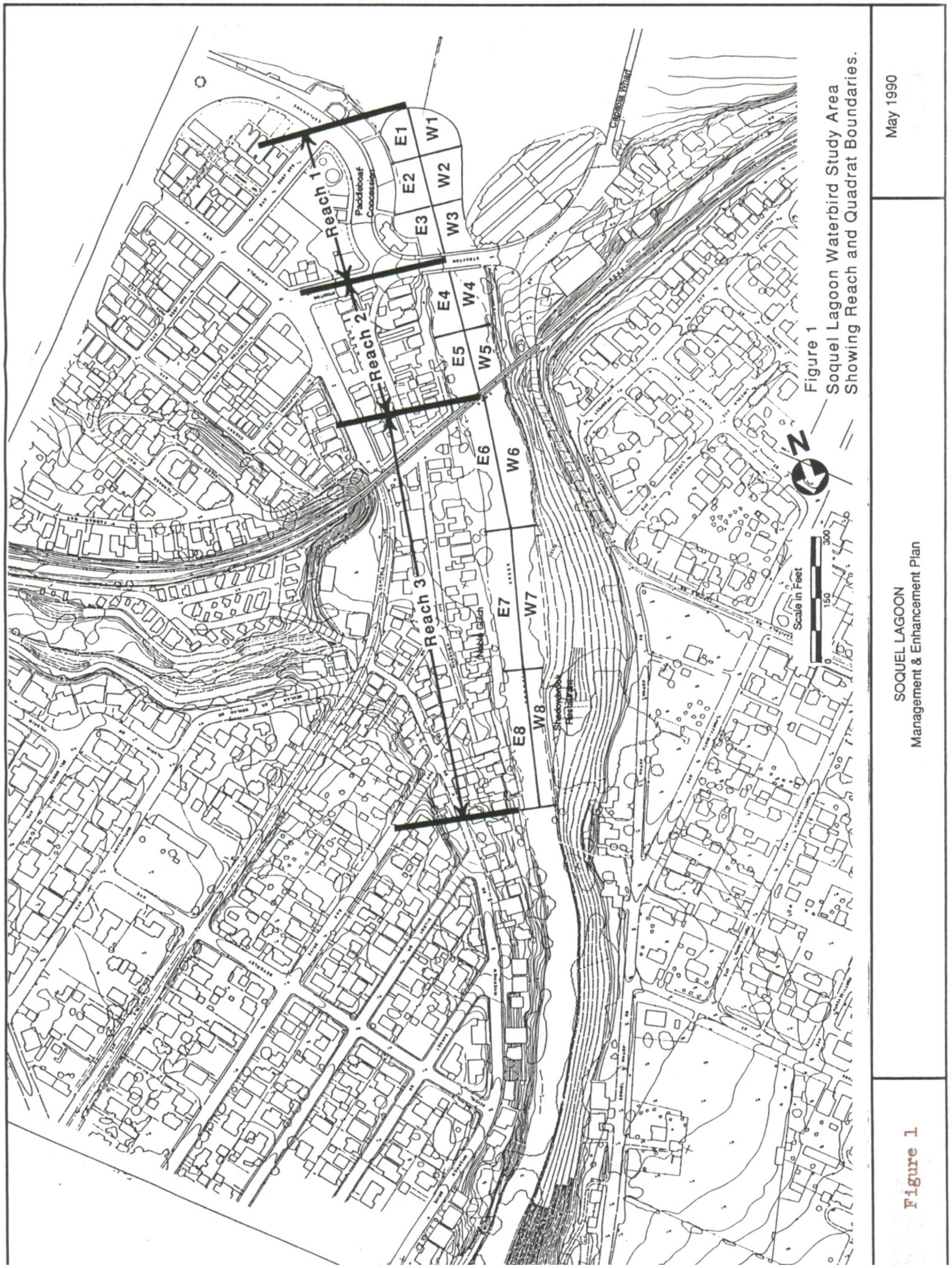
Soquel Lagoon Post-Venetian Court Construction- Older Stockton Avenue Bridge and prior to expanded development on eastern margin of the Lagoon, above and below the Railroad Trestle; circa 1931.
(Courtesy of the Capitola Historical Museum)

Post-World War II Soquel Creek Estuary at very low tide (present-day Stockton Bridge with flume exposed on the beach after the December 1955 flood). Riparian corridor re-established on west side above Stockton Bridge; circa 1955-56 after the flood.
(Courtesy of the Capitola Historical Museum)

FIGURES


Reach 1
Reach 2
Reach 3
Paddleboat Concession
Capitola Wharf
E1
W1
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W5
E6
W6
E7
W7
E8
W8
Noble Gulch
Shadowbrook Restaurant
N
Scale in Feet
0
150
300
Figure 1
Soquel Lagoon Waterbird Study Area
Showing Reach and Quadrat Boundaries.
May 1990
SOQUEL LAGOON
Management & Enhancement Plan
Figure 1

Figure 1. Map of Reaches in Soquel Creek Lagoon

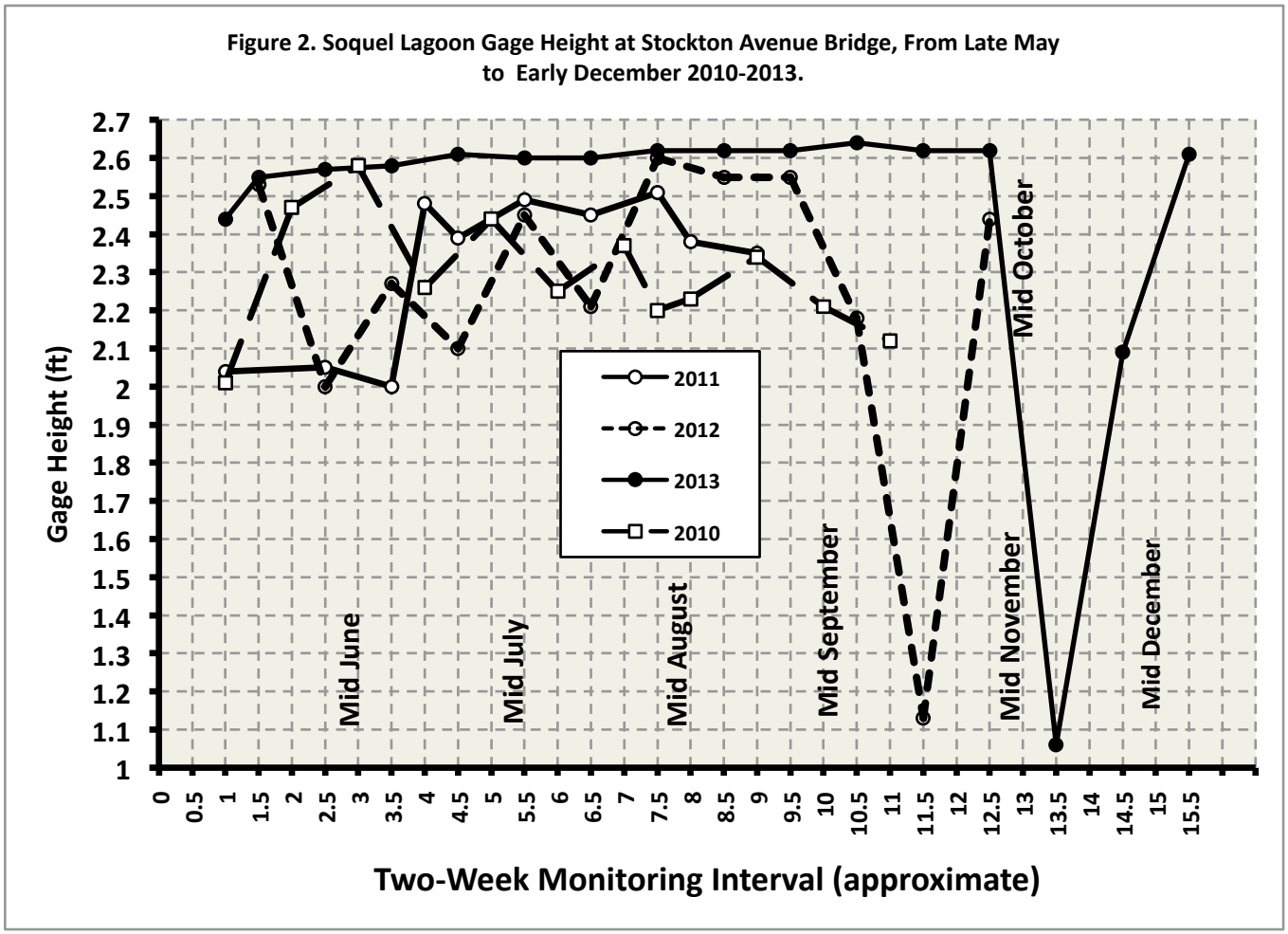


Figure 2. Soquel Lagoon Gage Height at Stockton Avenue Bridge, From Late May to Early December 2010-2013.

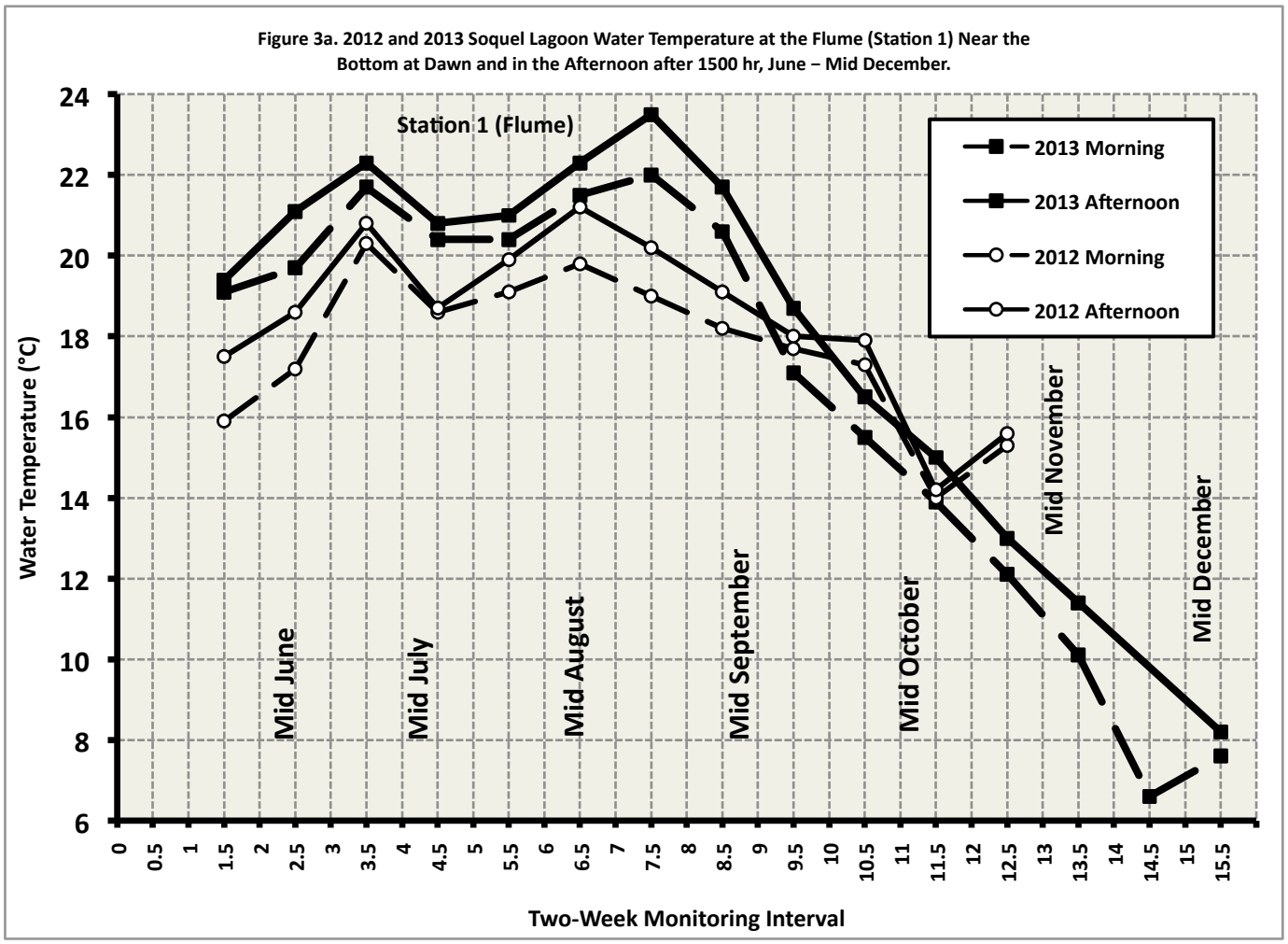


Figure 3a. 2012 and 2013 Soquel Lagoon Water Temperature at the Flume (Station 1) Near the Bottom at Dawn and in the Afternoon after 1500 hr, June − Mid December.

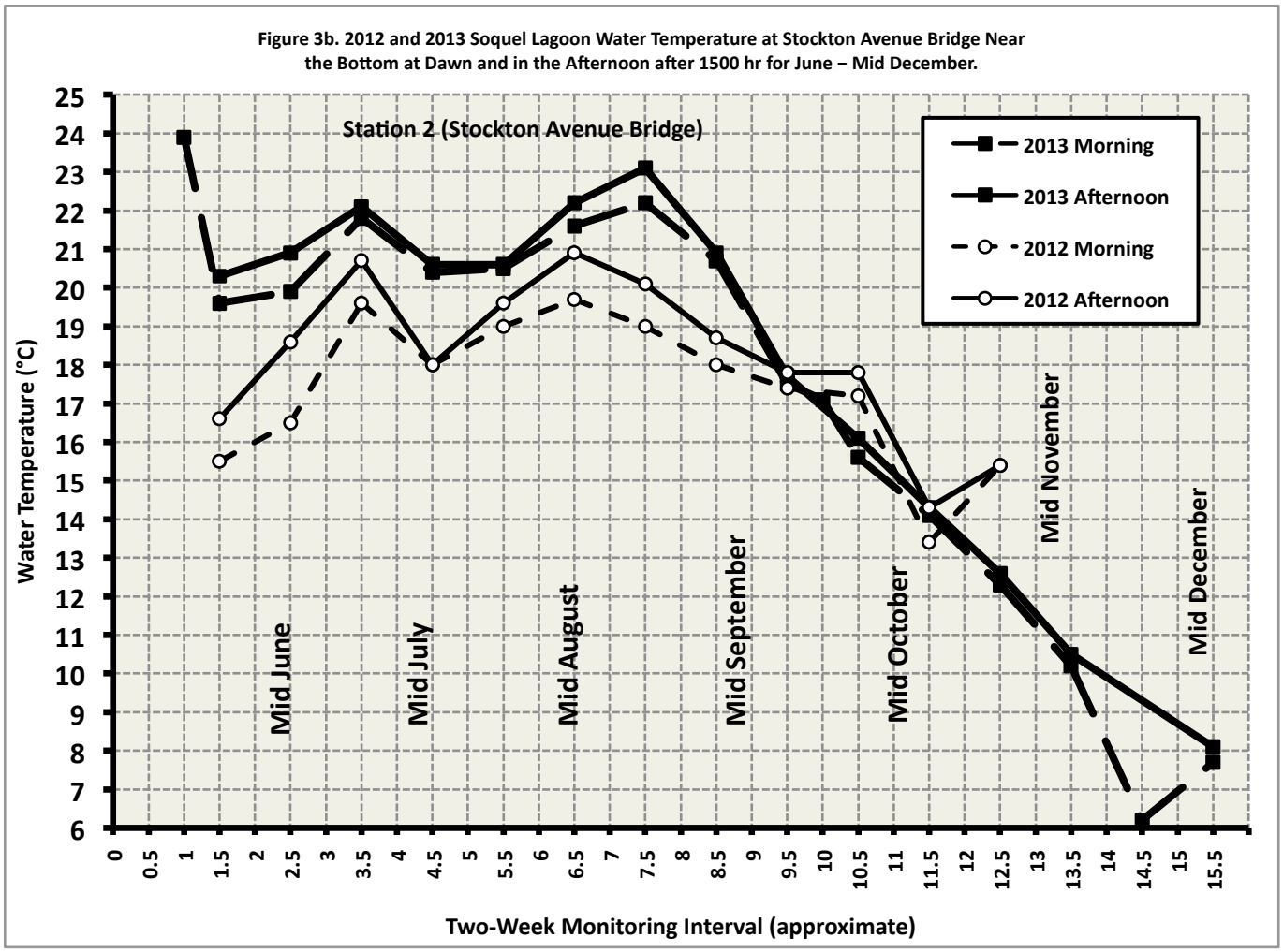


Figure 3b. 2012 and 2013 Soquel Lagoon Water Temperature at Stockton Avenue Bridge Near the Bottom at Dawn and in the Afternoon after 1500 hr for June − Mid December.

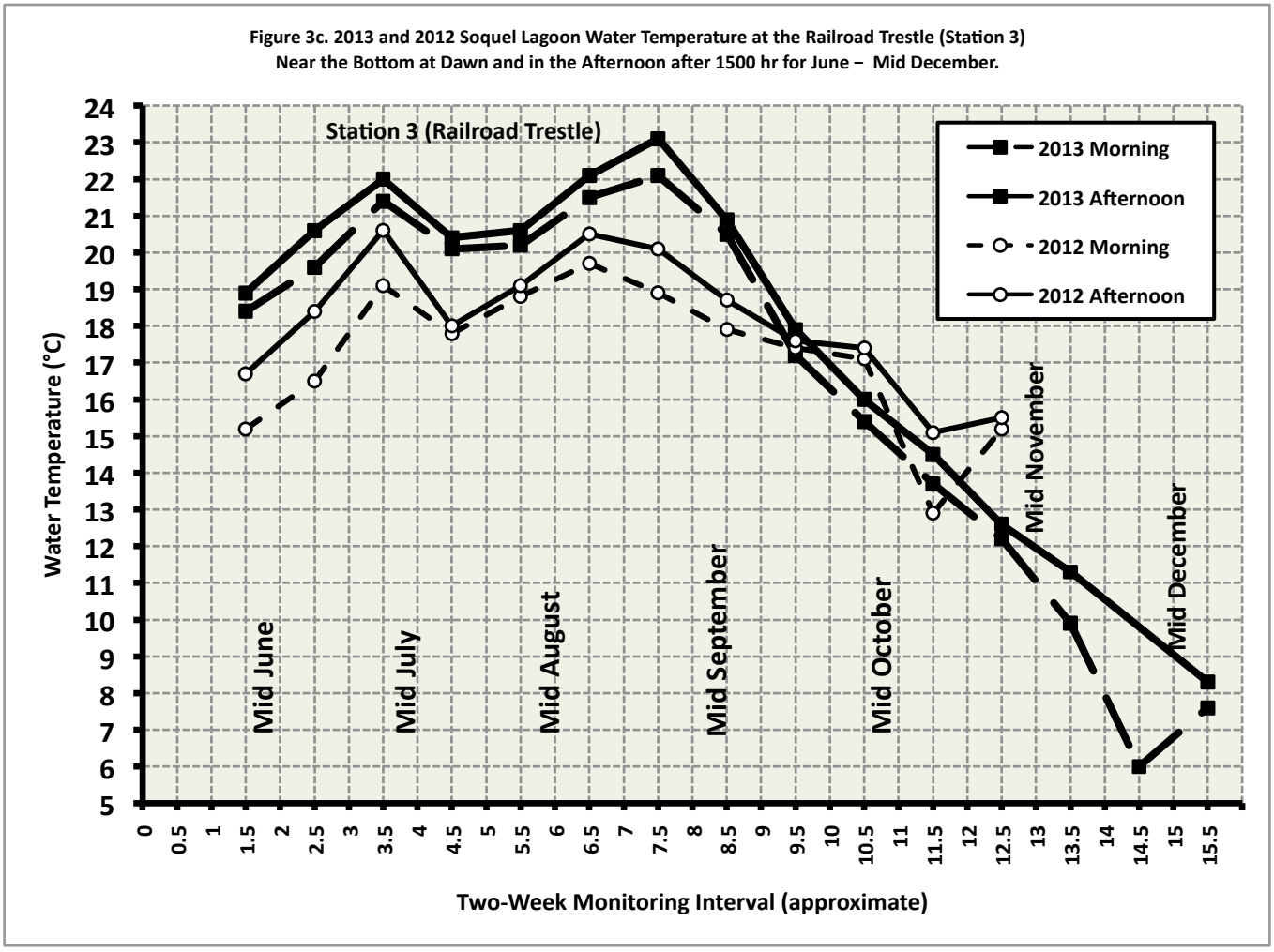


Figure 3c. 2013 and 2012 Soquel Lagoon Water Temperature at the Railroad Trestle (Station 3) Near the Bottom at Dawn and in the Afternoon after 1500 hr for June− Mid December.

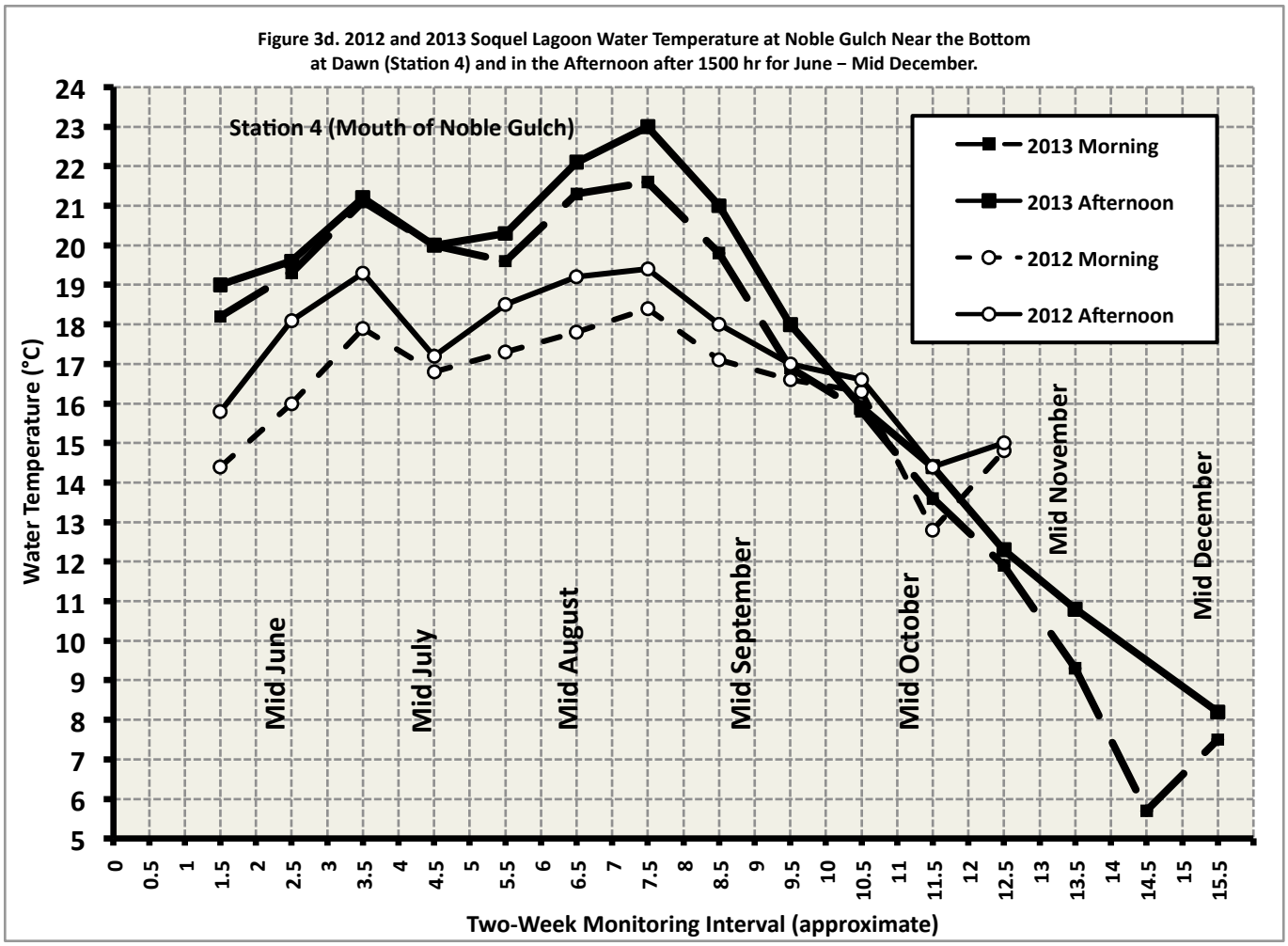


Figure 3d. 2012 and 2013 Soquel Lagoon Water Temperature at Noble Gulch Near the Bottom at Dawn (Station 4) and in the Afternoon after 1500 hr for June − Mid December.

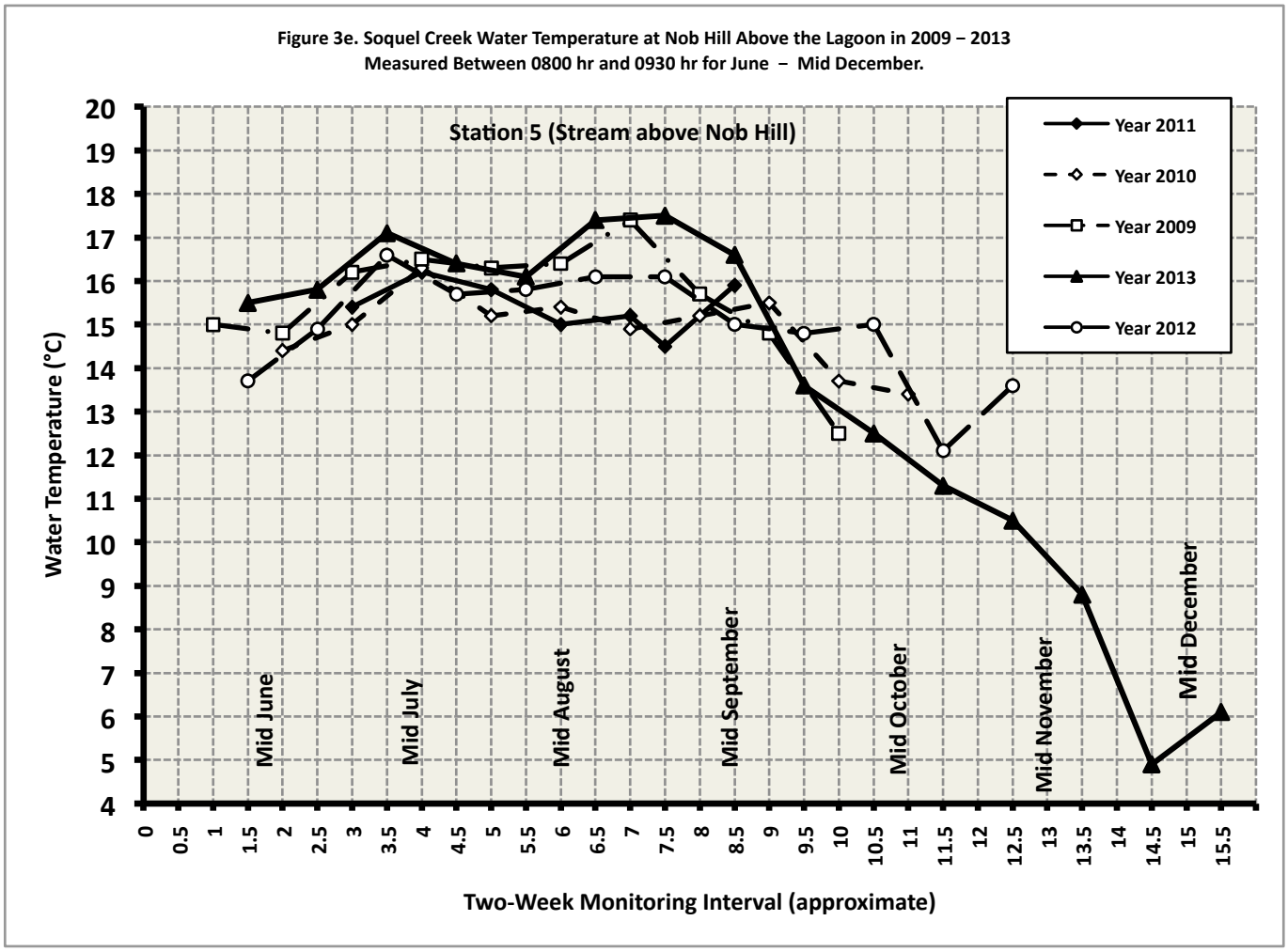


Figure 3e. Soquel Creek Water Temperature at Nob Hill Above the Lagoon in 2009 − 2013 Measured Between 0800 hr and 0930 hr for June − Mid December.

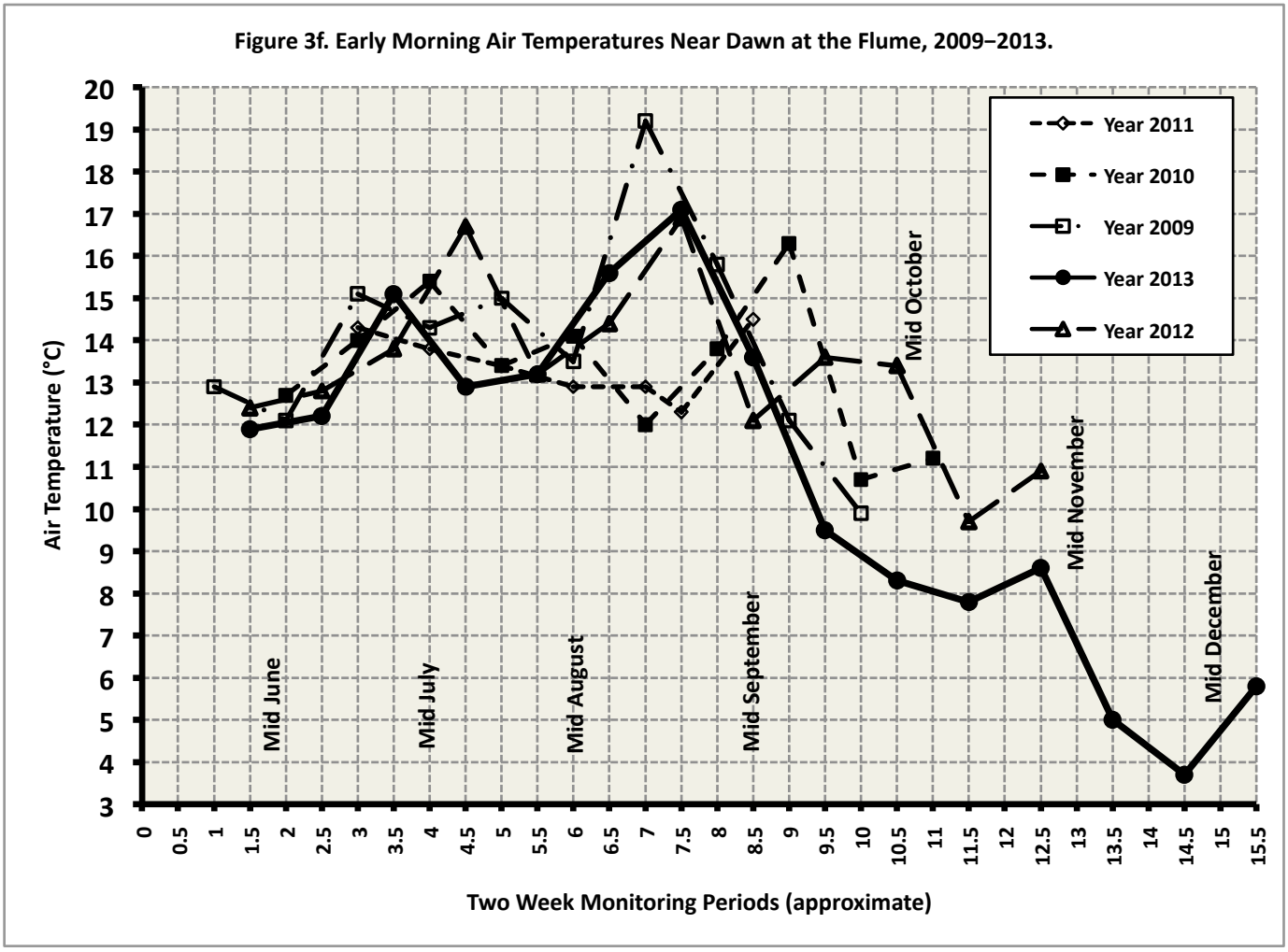


Figure 3f. Early Morning Air Temperatures Near Dawn at the Flume, 2009−2013.

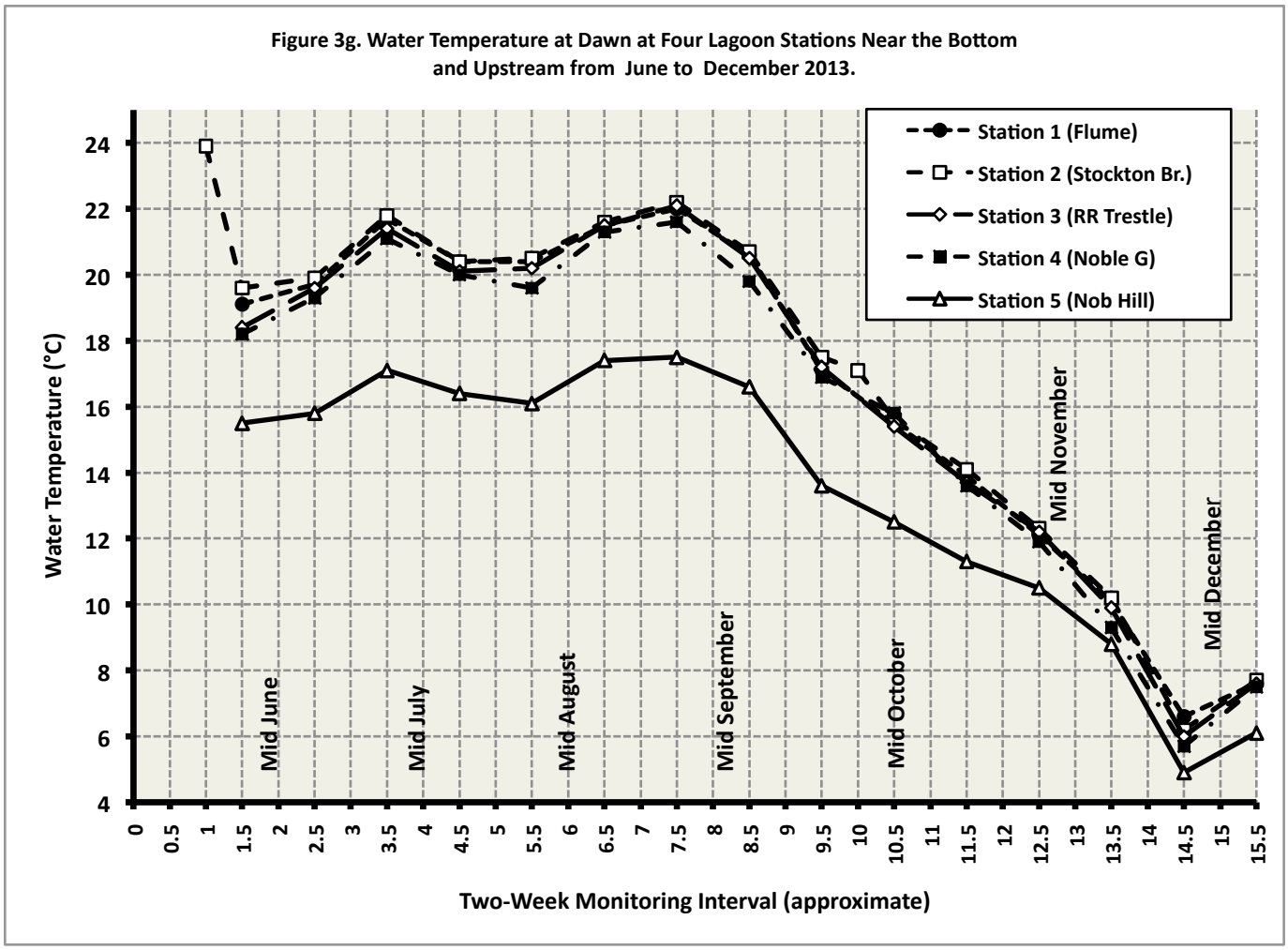


Figure 3g. Water Temperature at Dawn at Four Lagoon Stations Near the Bottom and Upstream from June to December 2013.

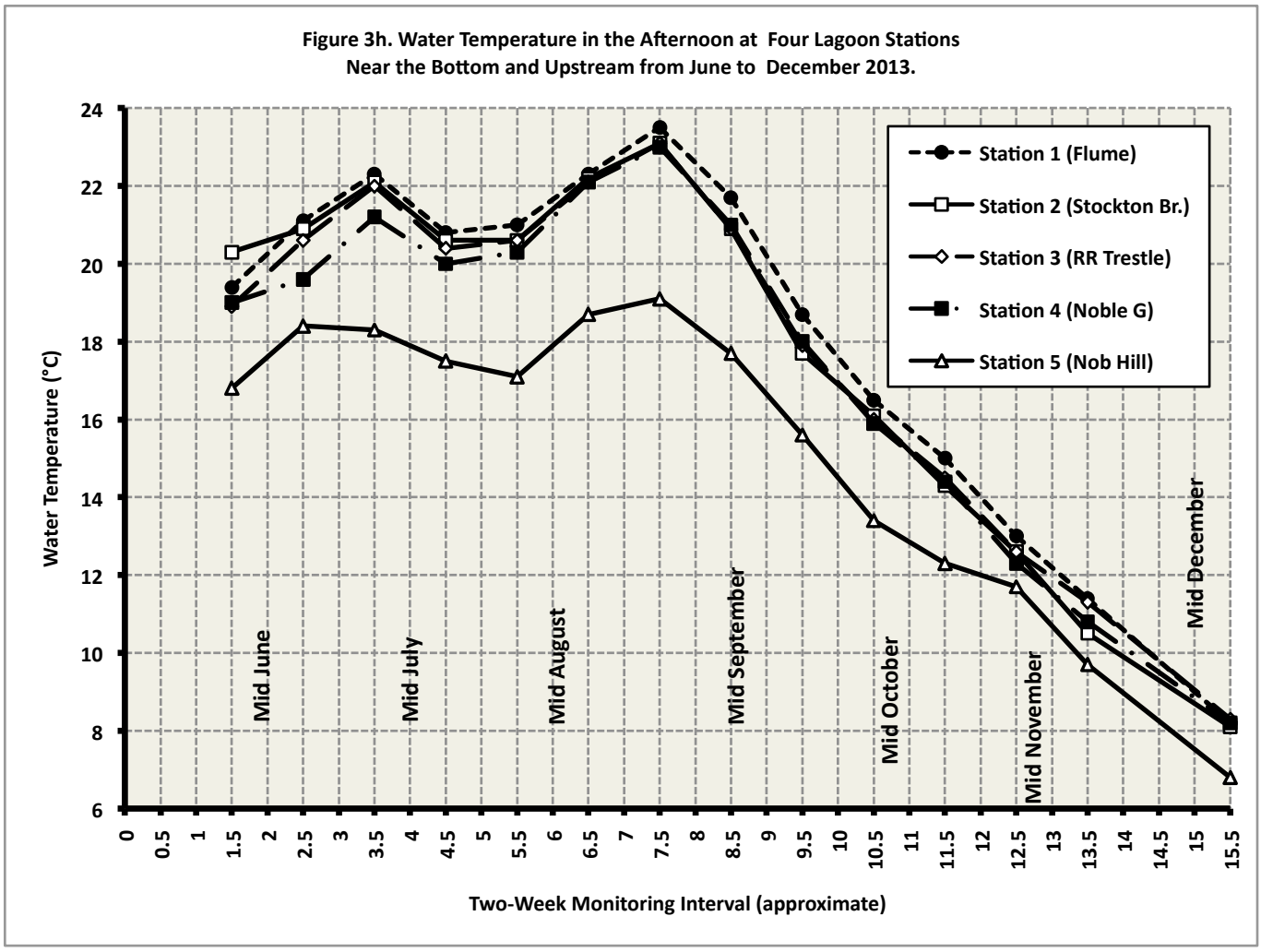


Figure 3h. Water Temperature in the Afternoon at Four Lagoon Stations Near the Bottom and Upstream from June to December 2013.

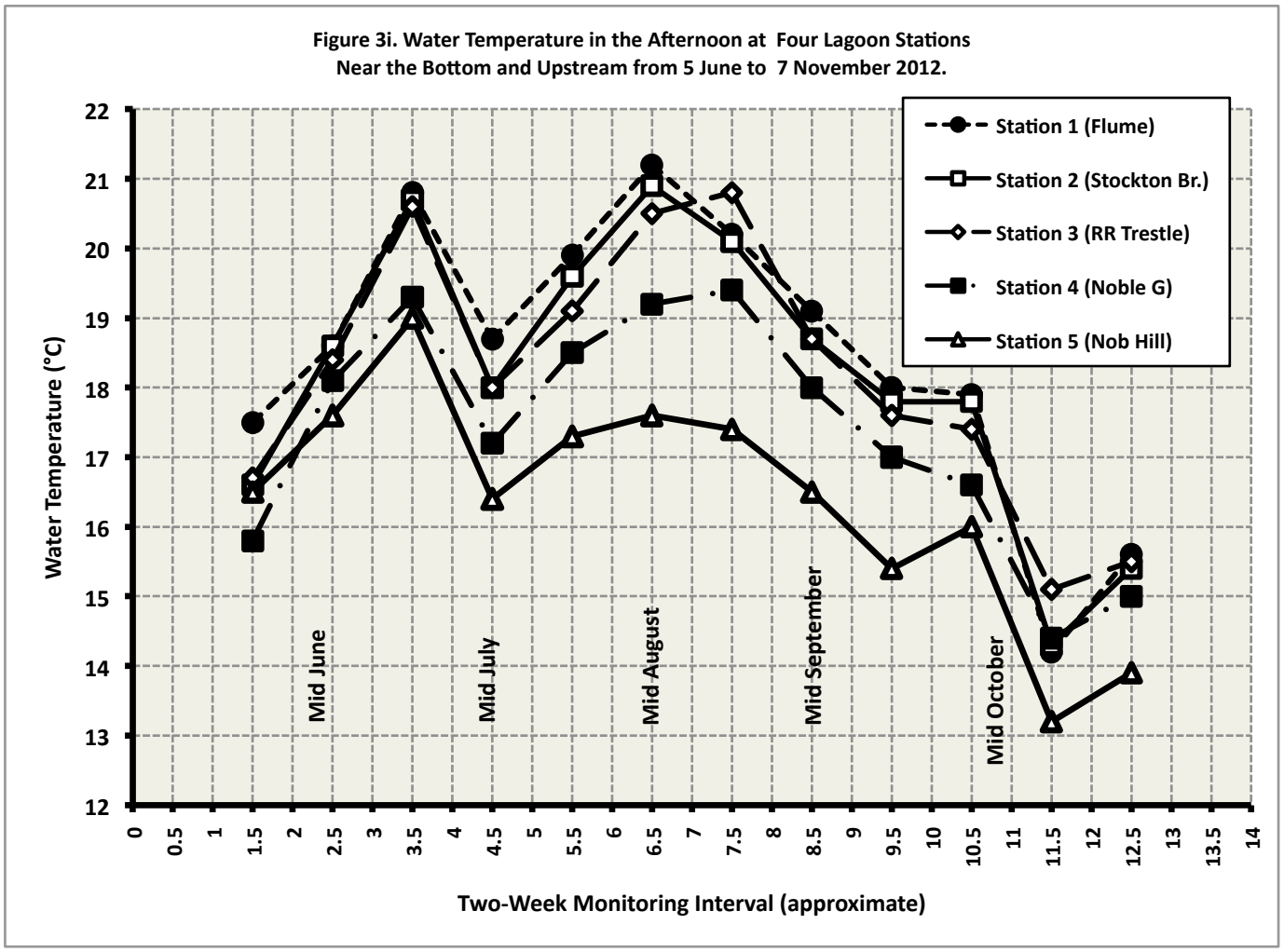


Figure 3i. Water Temperature in the Afternoon at Four Lagoon Stations Near the Bottom and Upstream from 5 June to 7 November 2012.

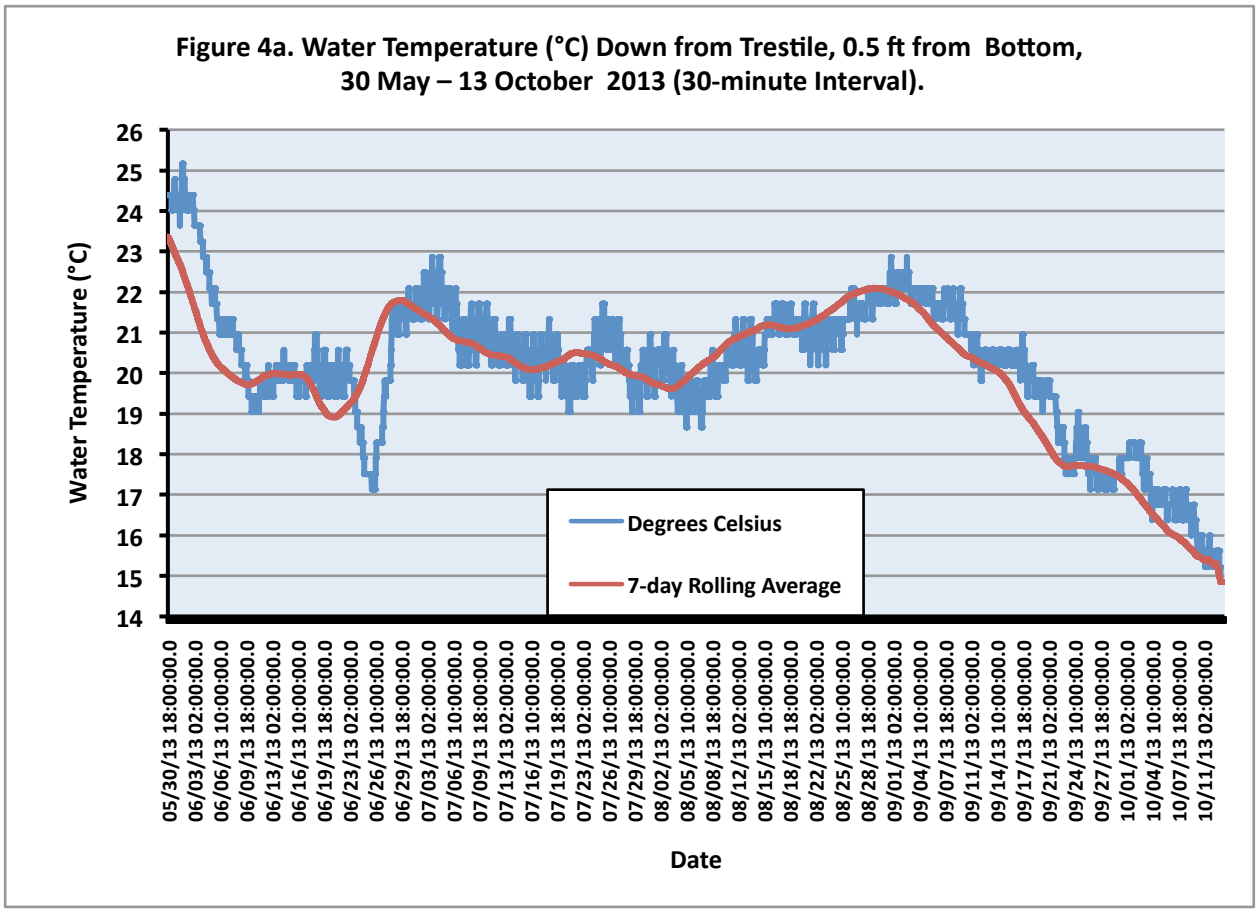


Figure 4a. Water Temperature (°C) Down from Trestile, 0.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

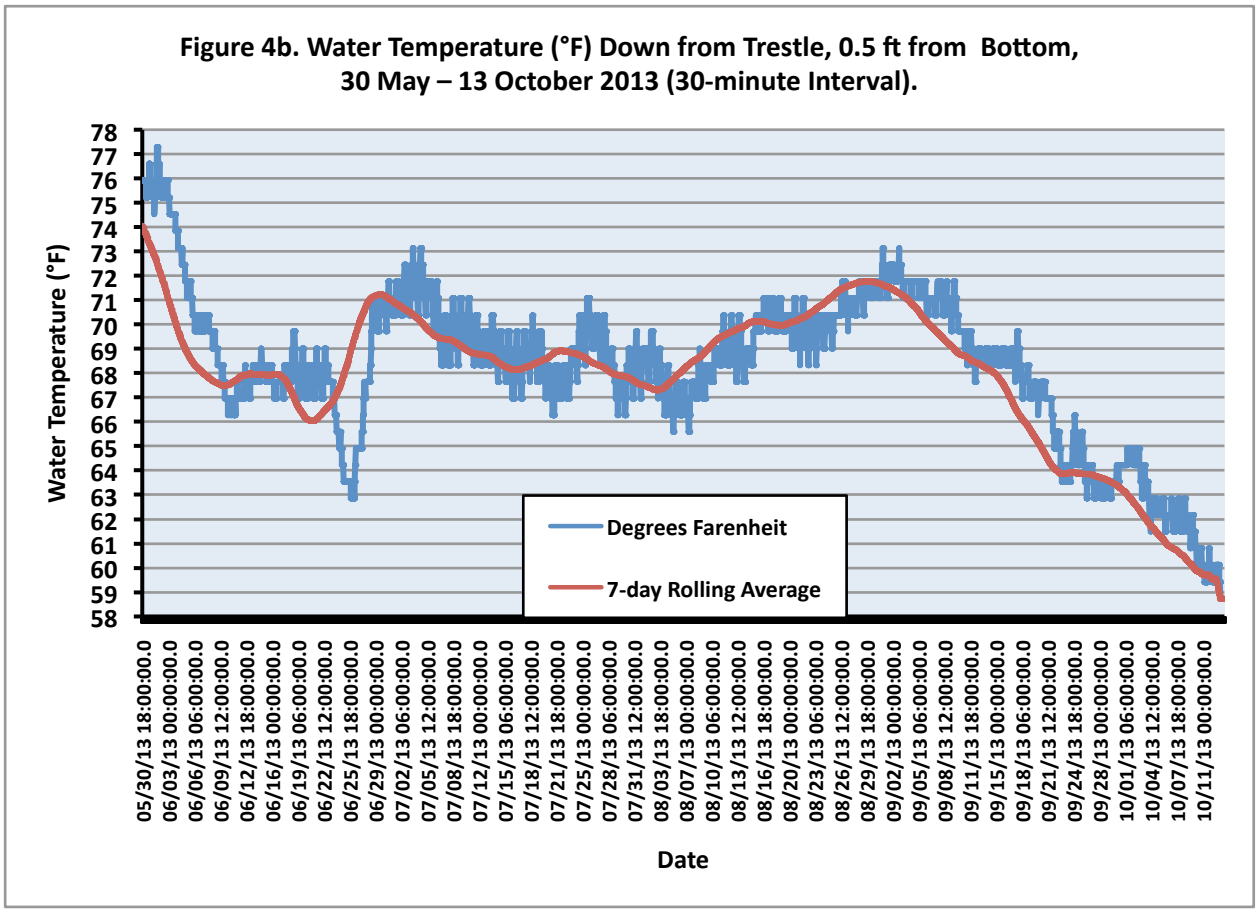


Figure 4b. Water Temperature (°F) Down from Trestle, 0.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

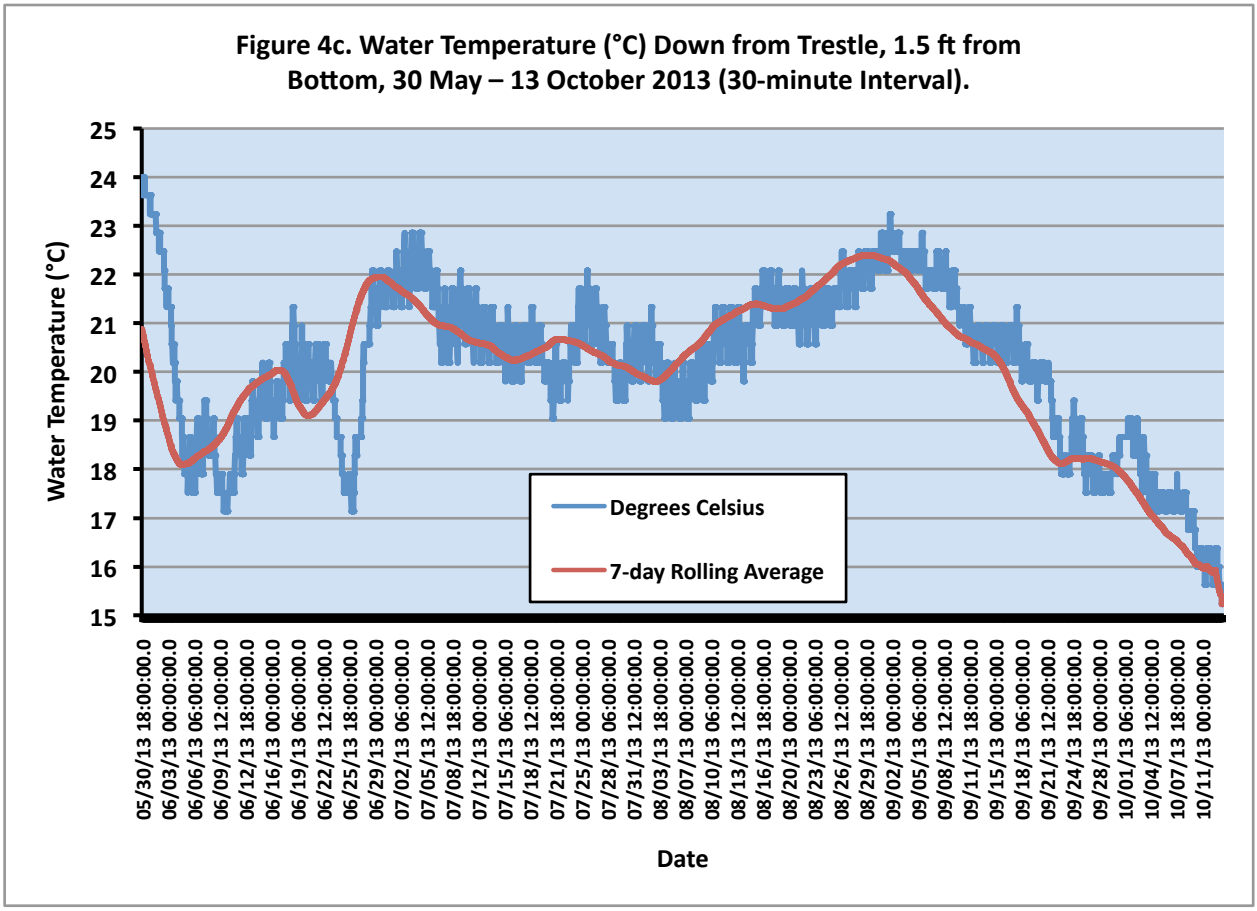


Figure 4c. Water Temperature (°C) Down from Trestle, 1.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

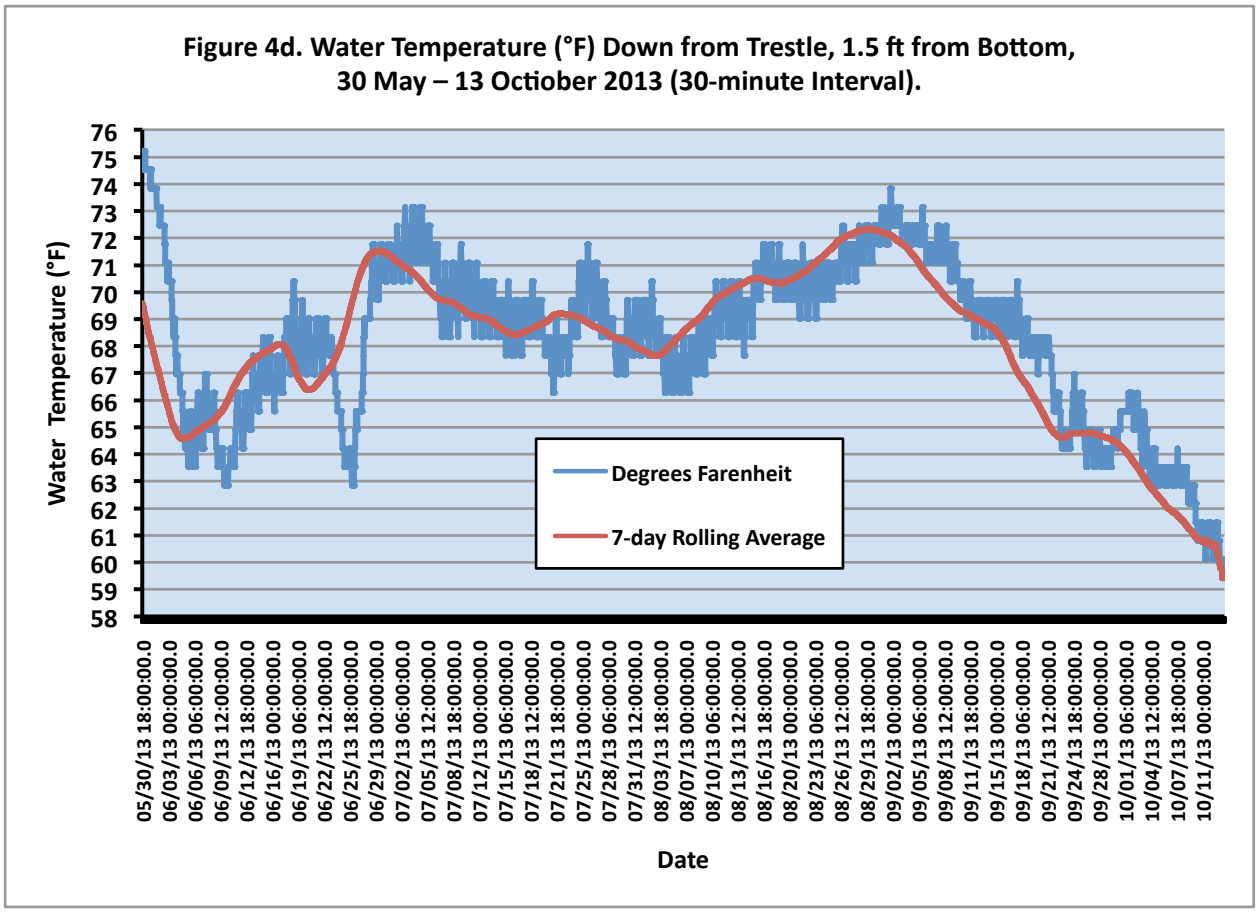


Figure 4d. Water Temperature (°F) Down from Trestle, 1.5 ft from Bottom, 30 May – 13 Octiober 2013 (30-minute Interval).

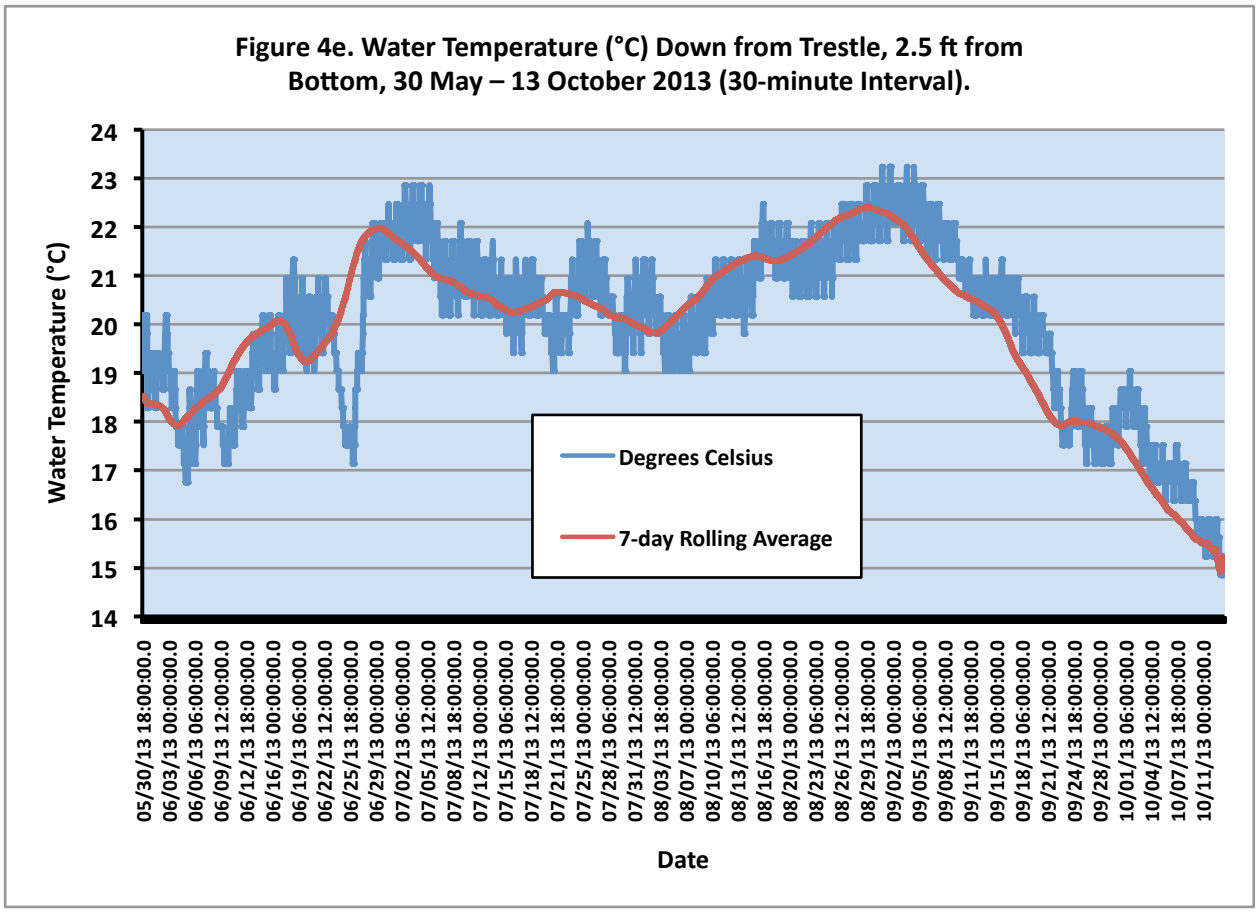


Figure 4e. Water Temperature (°C) Down from Trestle, 2.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

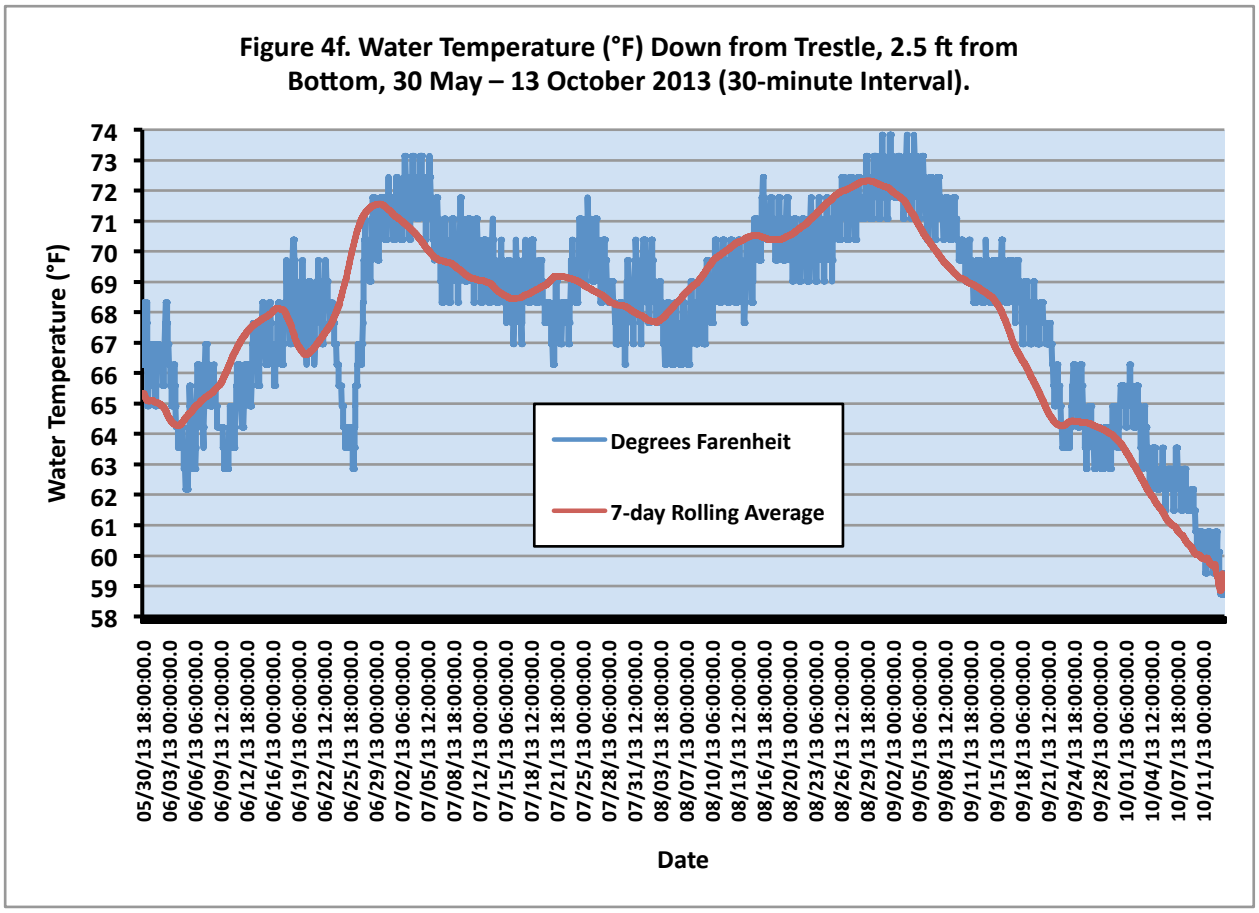


Figure 4f. Water Temperature (°F) Down from Trestle, 2.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

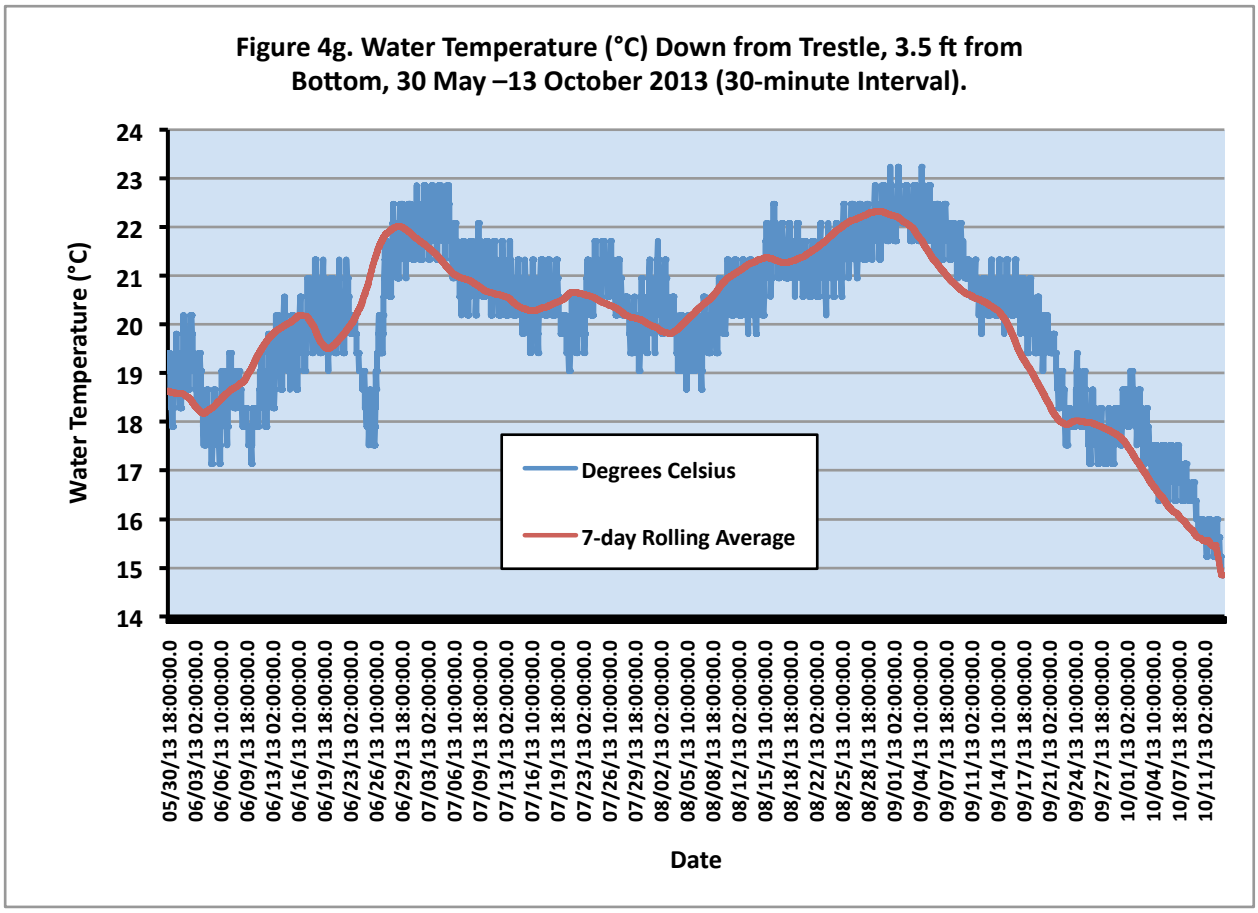


Figure 4g. Water Temperature (°C) Down from Trestle, 3.5 ft from Bottom, 30 May –13 October 2013 (30-minute Interval).

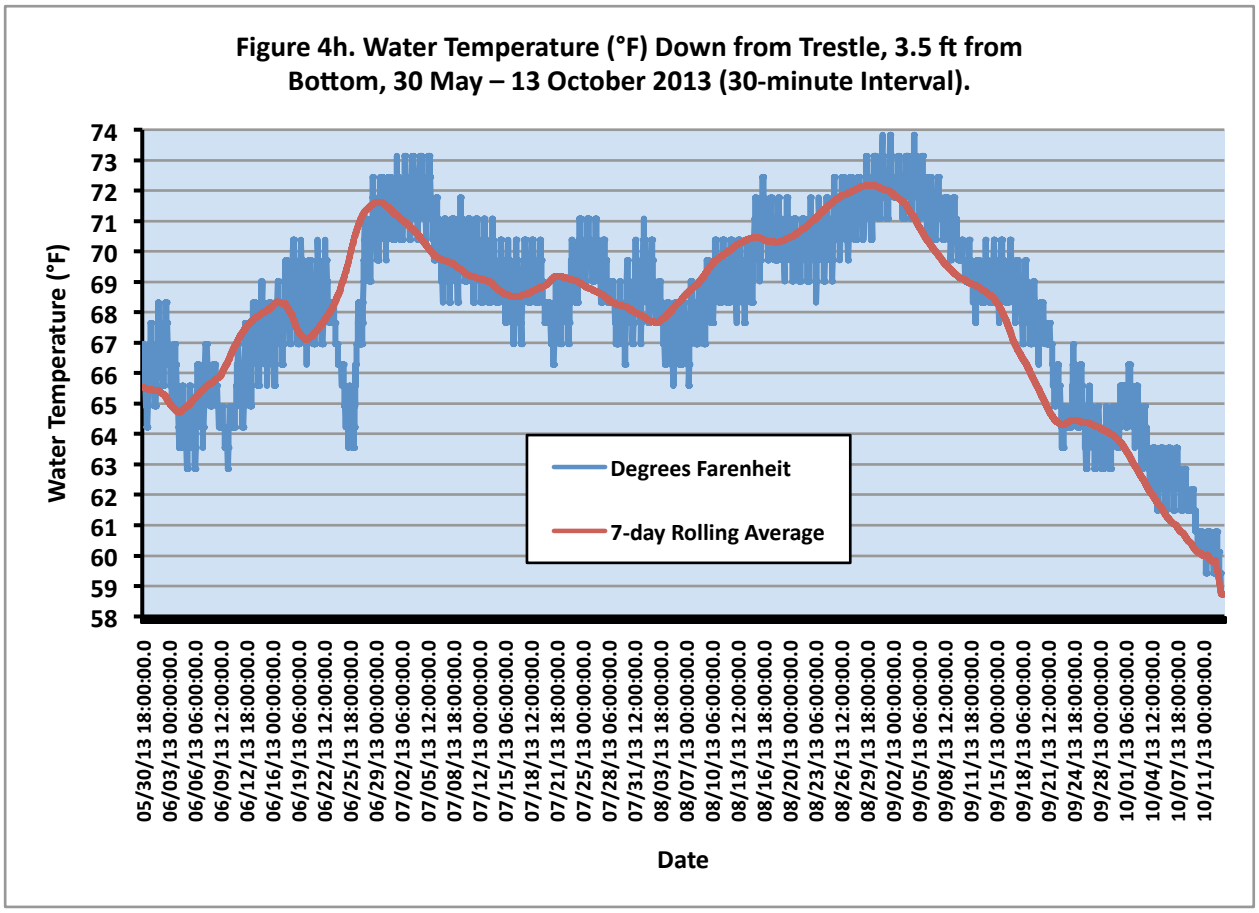


Figure 4h. Water Temperature (°F) Down from Trestle, 3.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

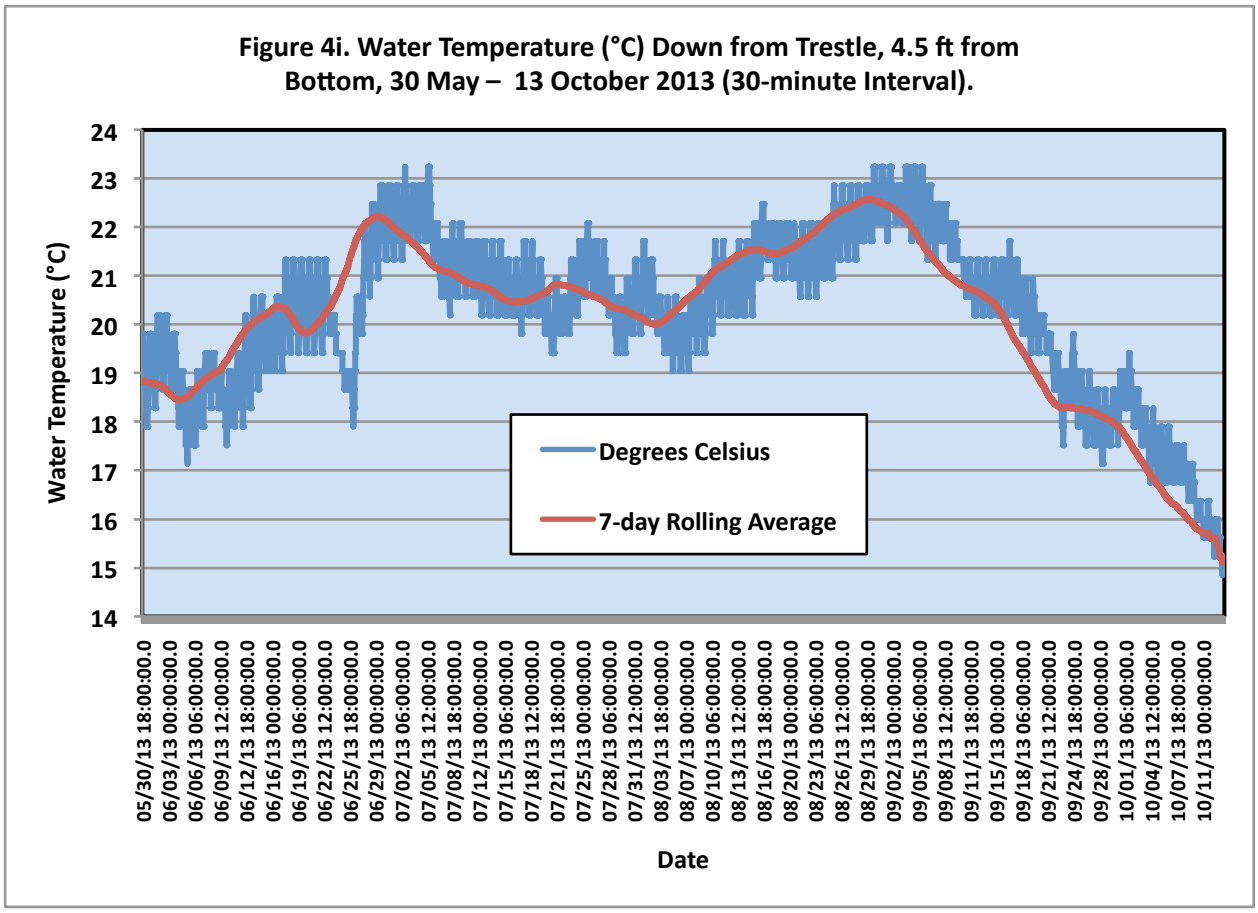


Figure 4i. Water Temperature (°C) Down from Trestle, 4.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

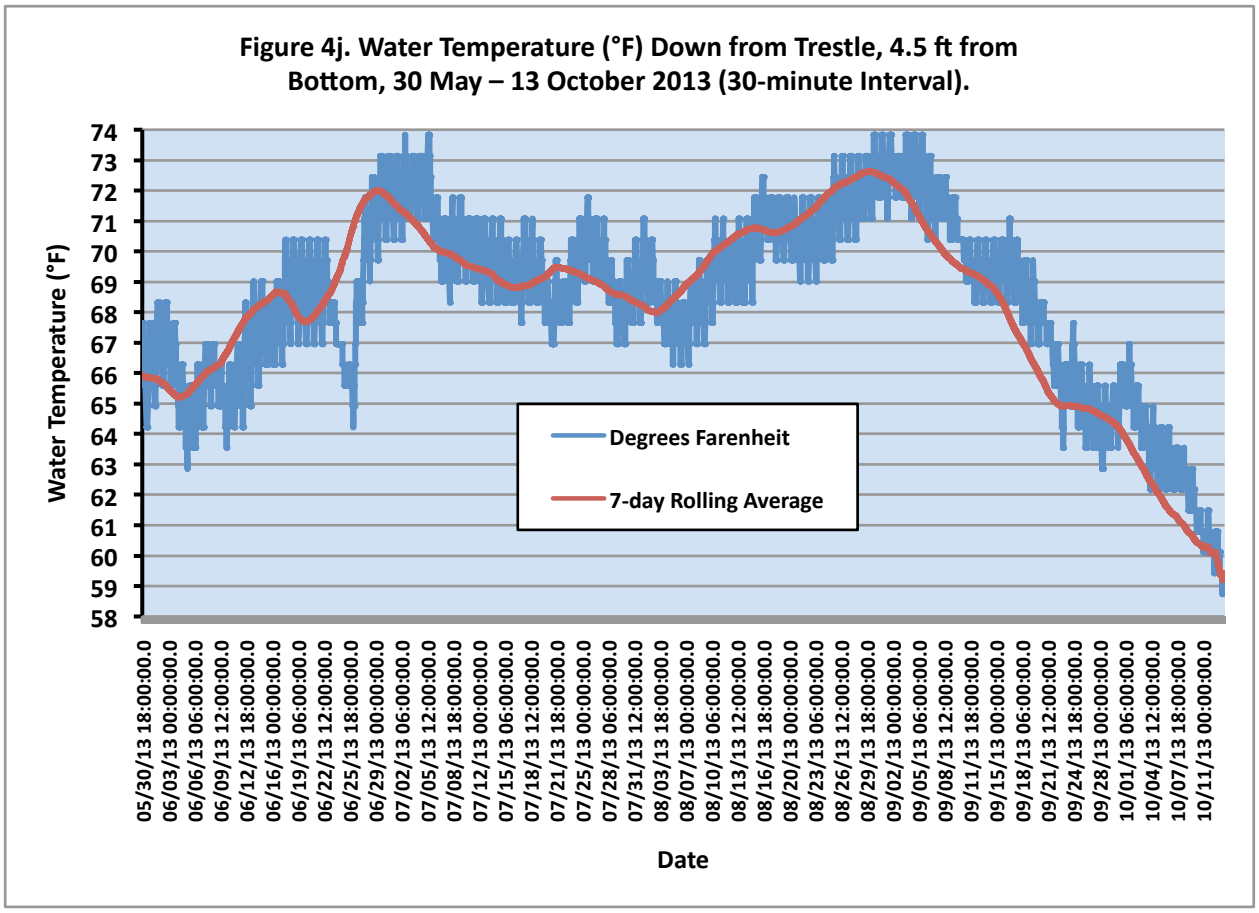


Figure 4j. Water Temperature (°F) Down from Trestle, 4.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

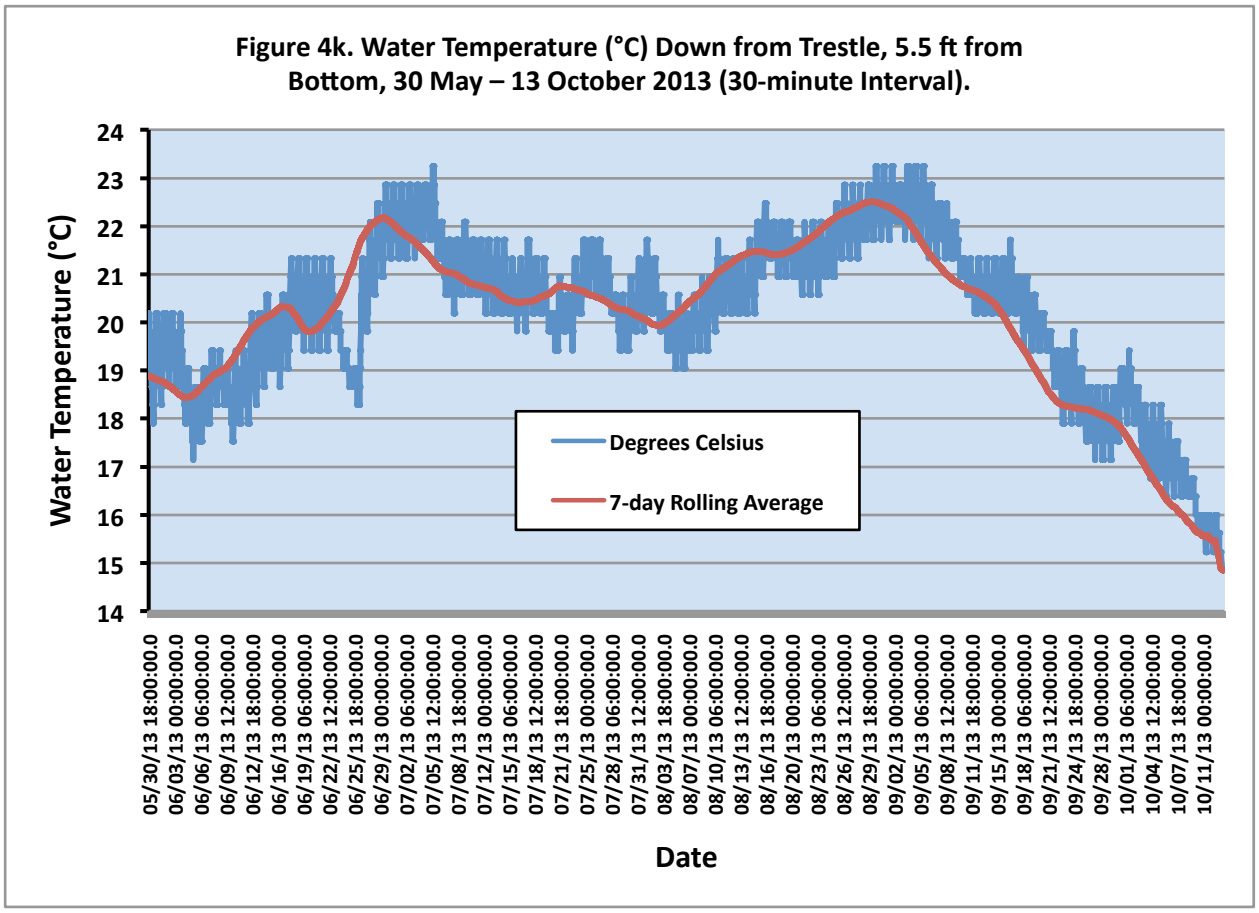


Figure 4k. Water Temperature (°C) Down from Trestle, 5.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

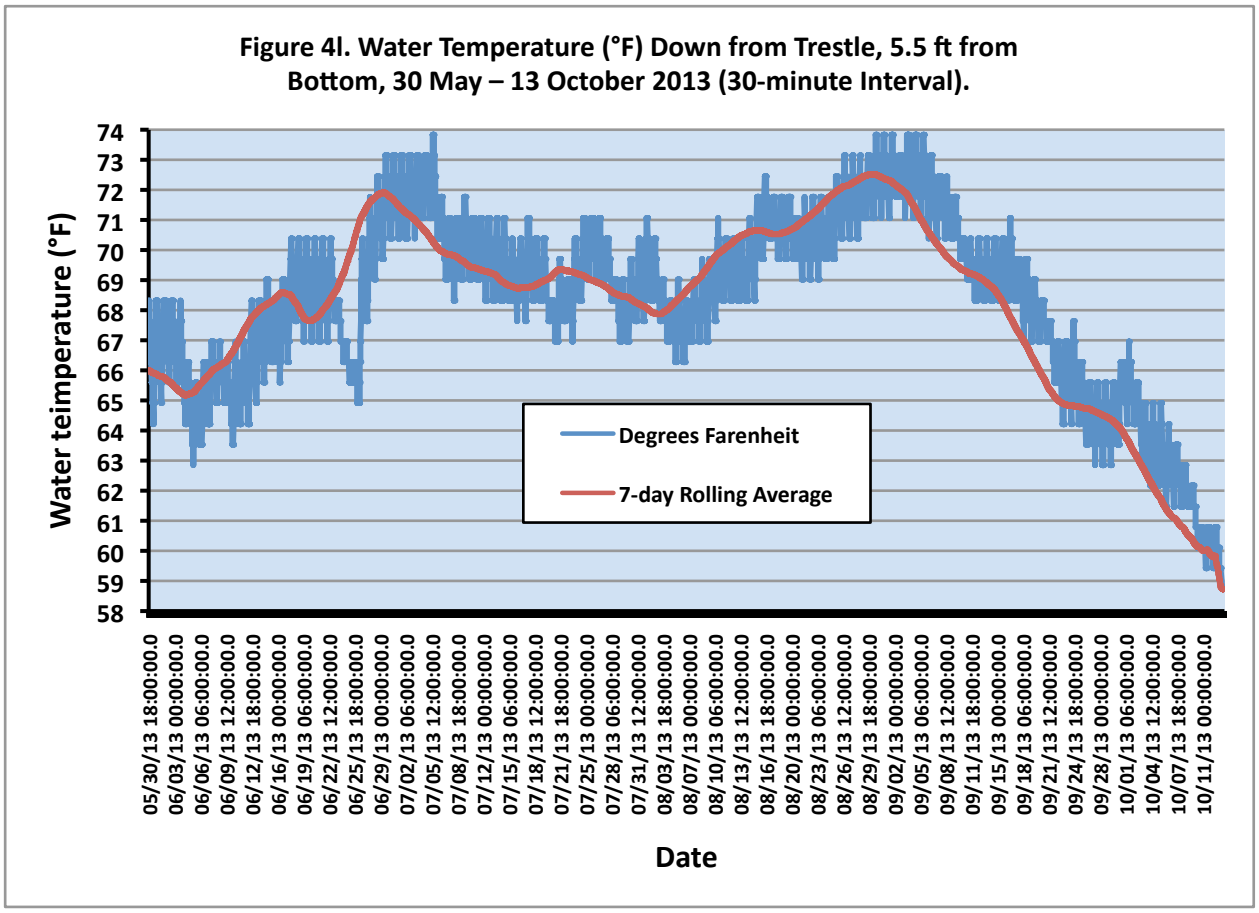


Figure 4l. Water Temperature (°F) Down from Trestle, 5.5 ft from Bottom, 30 May – 13 October 2013 (30-minute Interval).

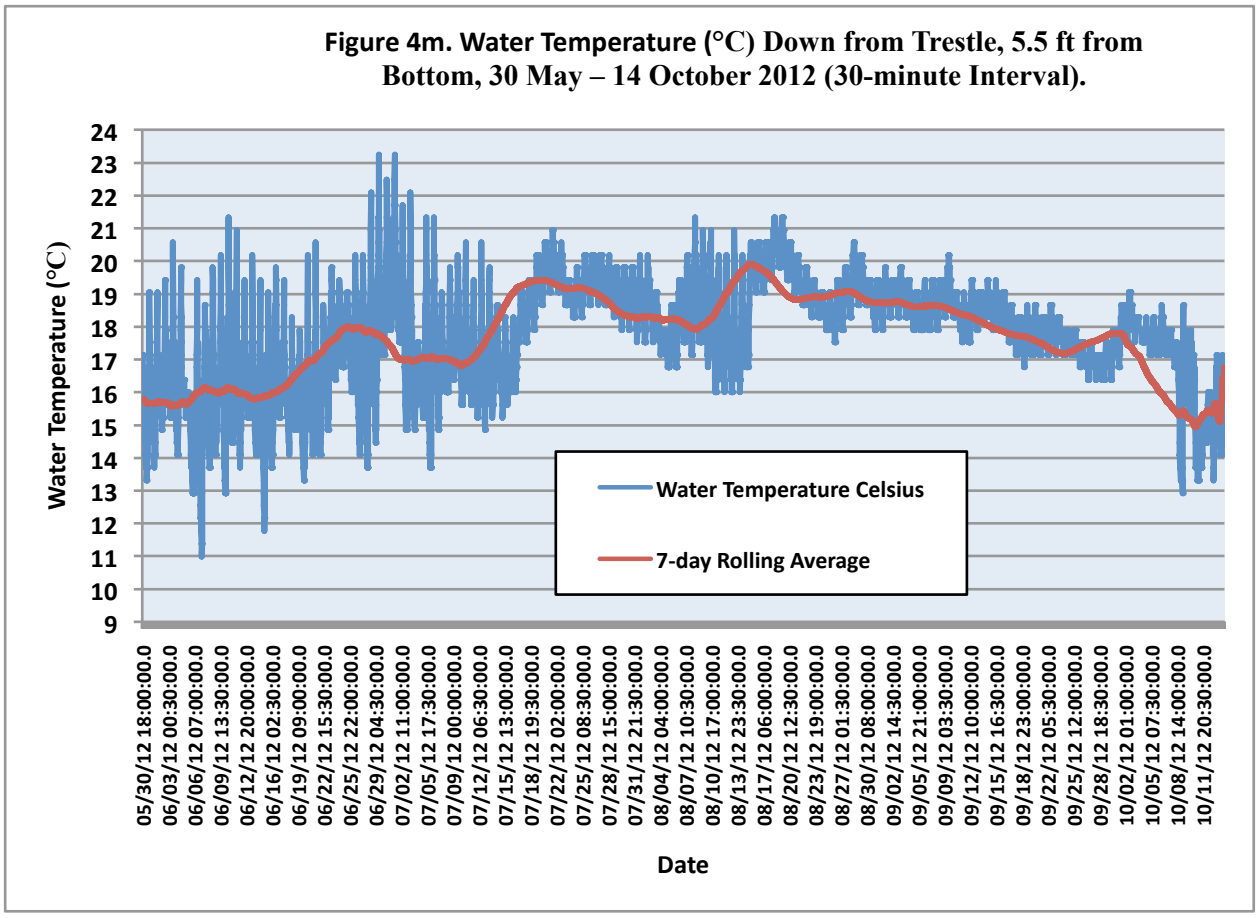


Figure 4m. Water Temperature (°C) Down from Trestle, 5.5 ft from Bottom, 30 May – 14 October 2012 (30-minute Interval).

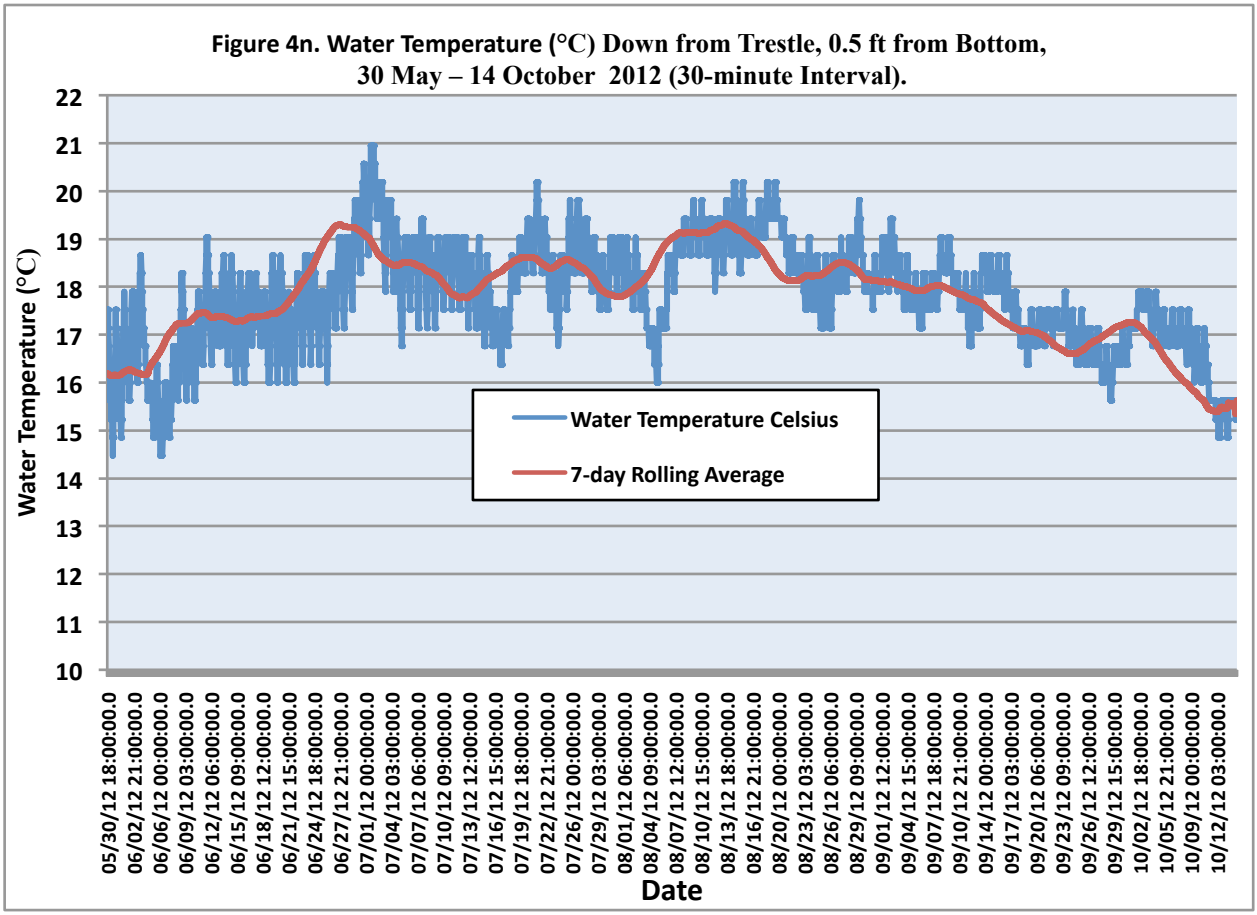


Figure 4n. Water Temperature (°C) Down from Trestle, 0.5 ft from Bottom, 30 May – 14 October 2012 (30-minute Interval).

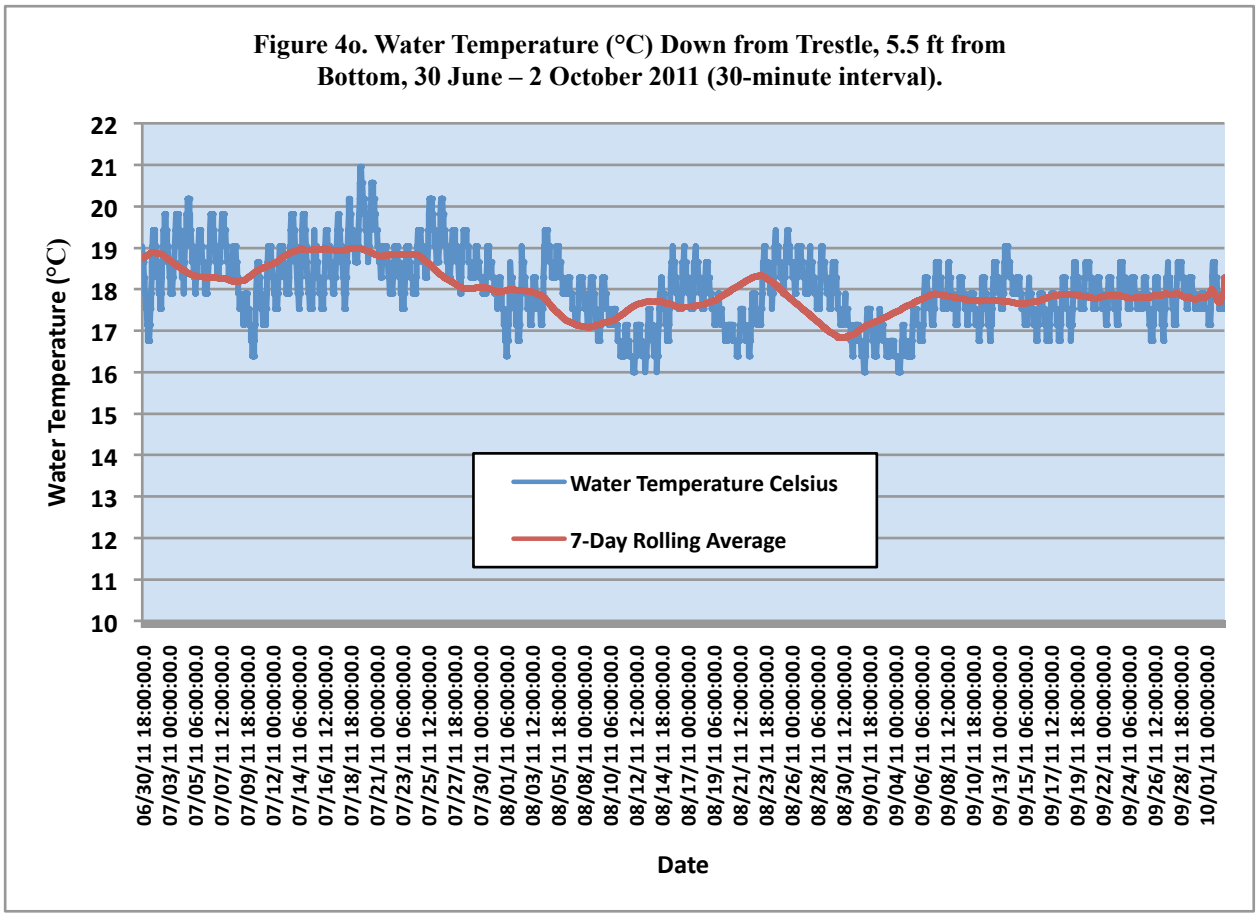


Figure 4o. Water Temperature (°C) Down from Trestle, 5.5 ft from Bottom, 30 June – 2 October 2011 (30-minute interval).

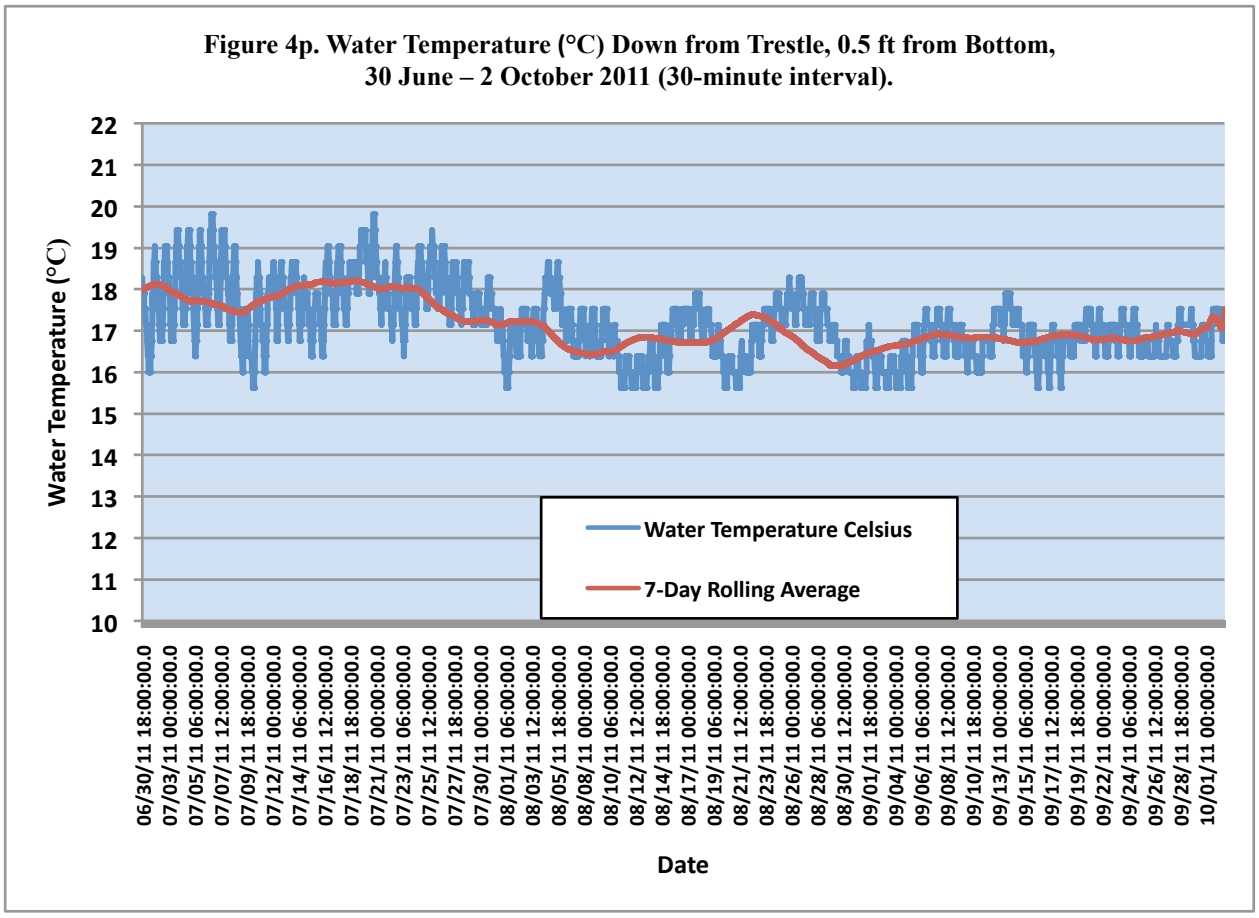


Figure 4p. Water Temperature (°C) Down from Trestle, 0.5 ft from Bottom, 30 June – 2 October 2011 (30-minute interval).

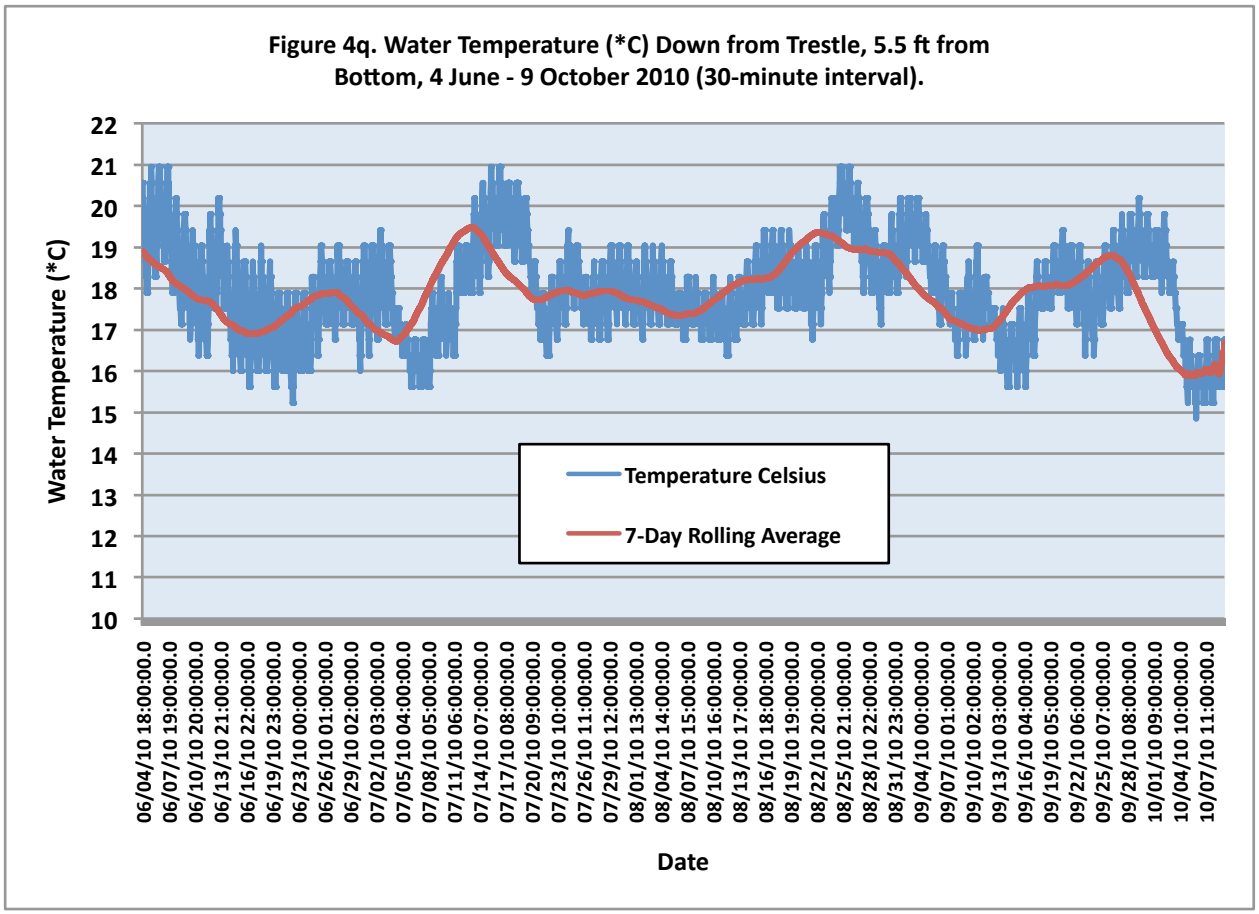


Figure 4q. Water Temperature (*C) Down from Trestle, 5.5 ft from Bottom, 4 June - 9 October 2010 (30-minute interval).

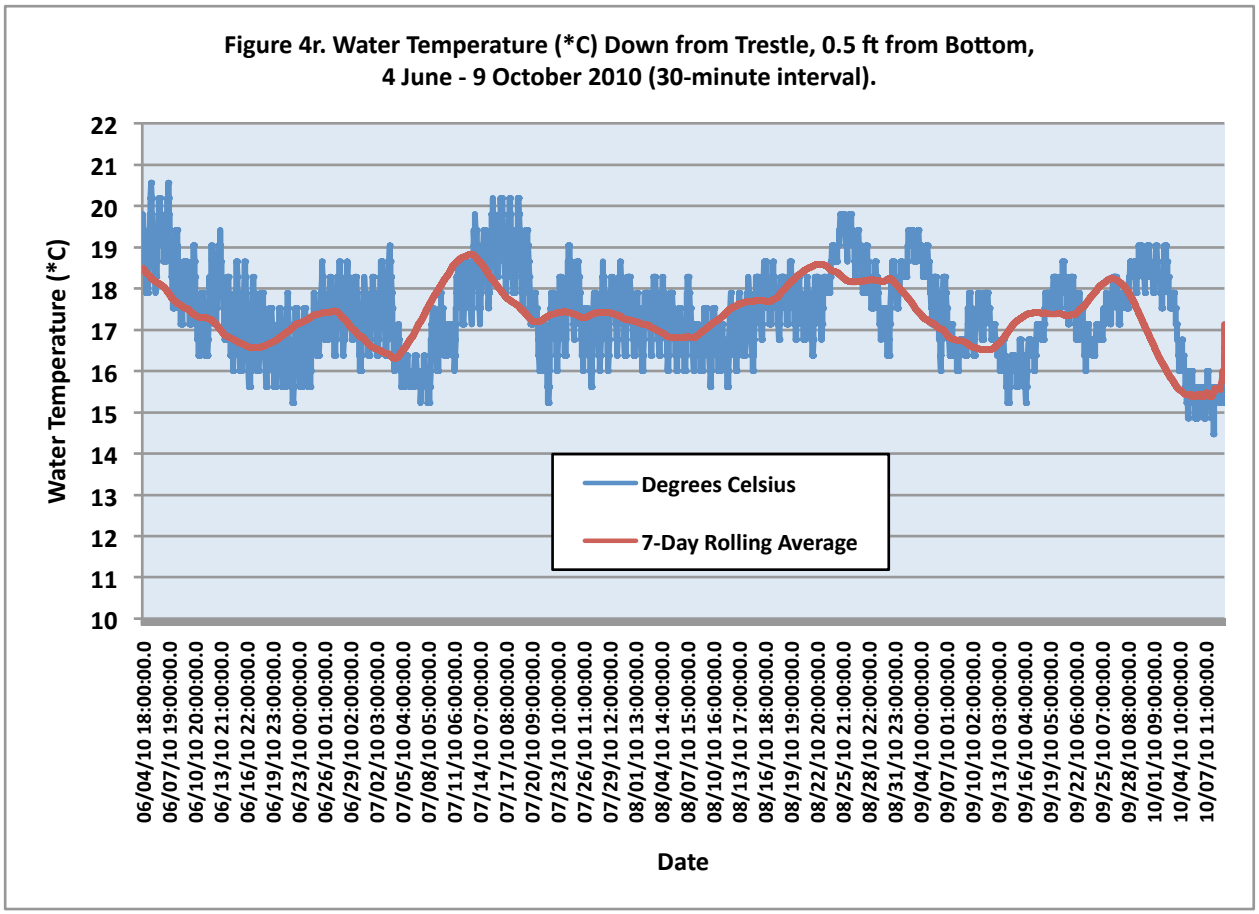


Figure 4r. Water Temperature (*C) Down from Trestle, 0.5 ft from Bottom, 4 June - 9 October 2010 (30-minute interval).

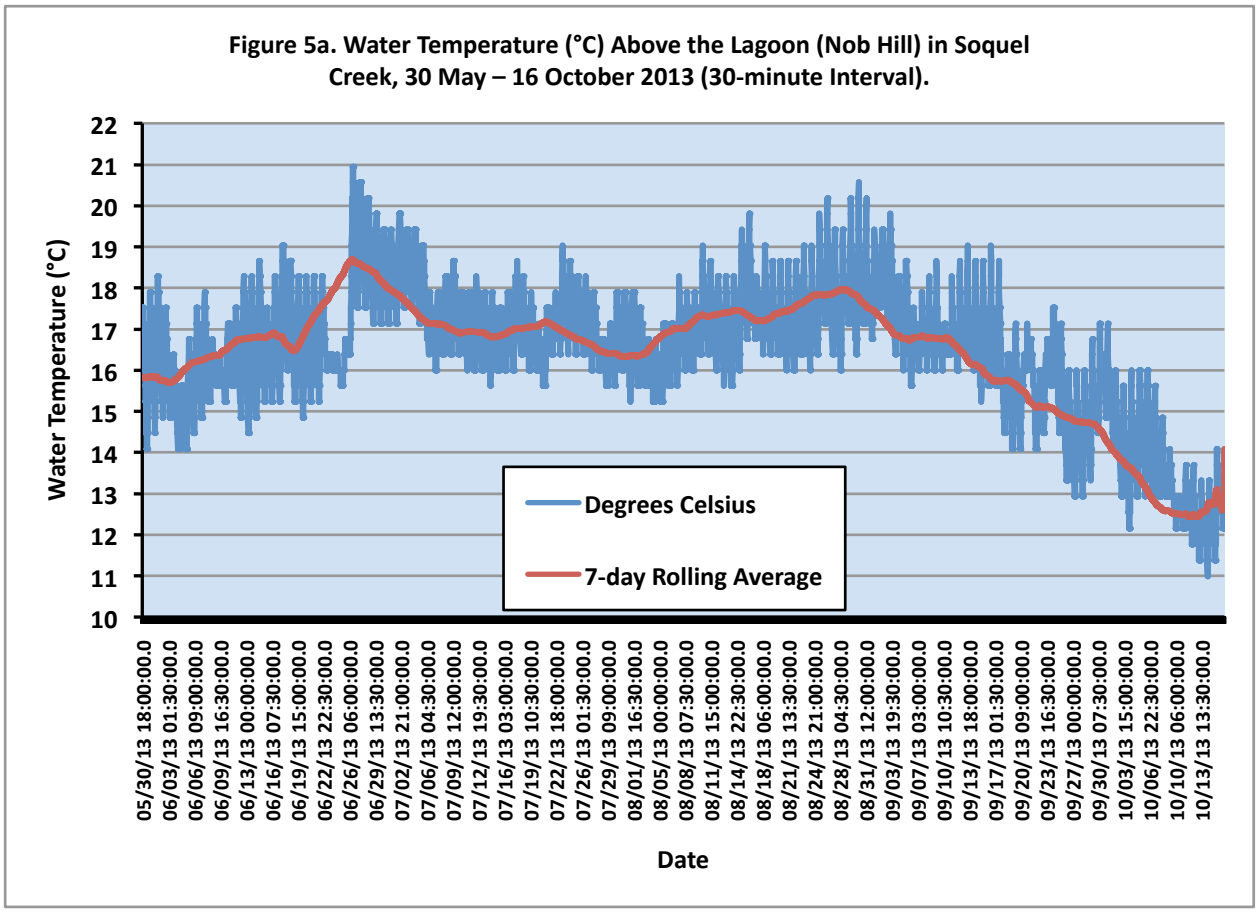


Figure 5a. Water Temperature (°C) Above the Lagoon (Nob Hill) in Soquel Creek, 30 May – 16 October 2013 (30-minute Interval).

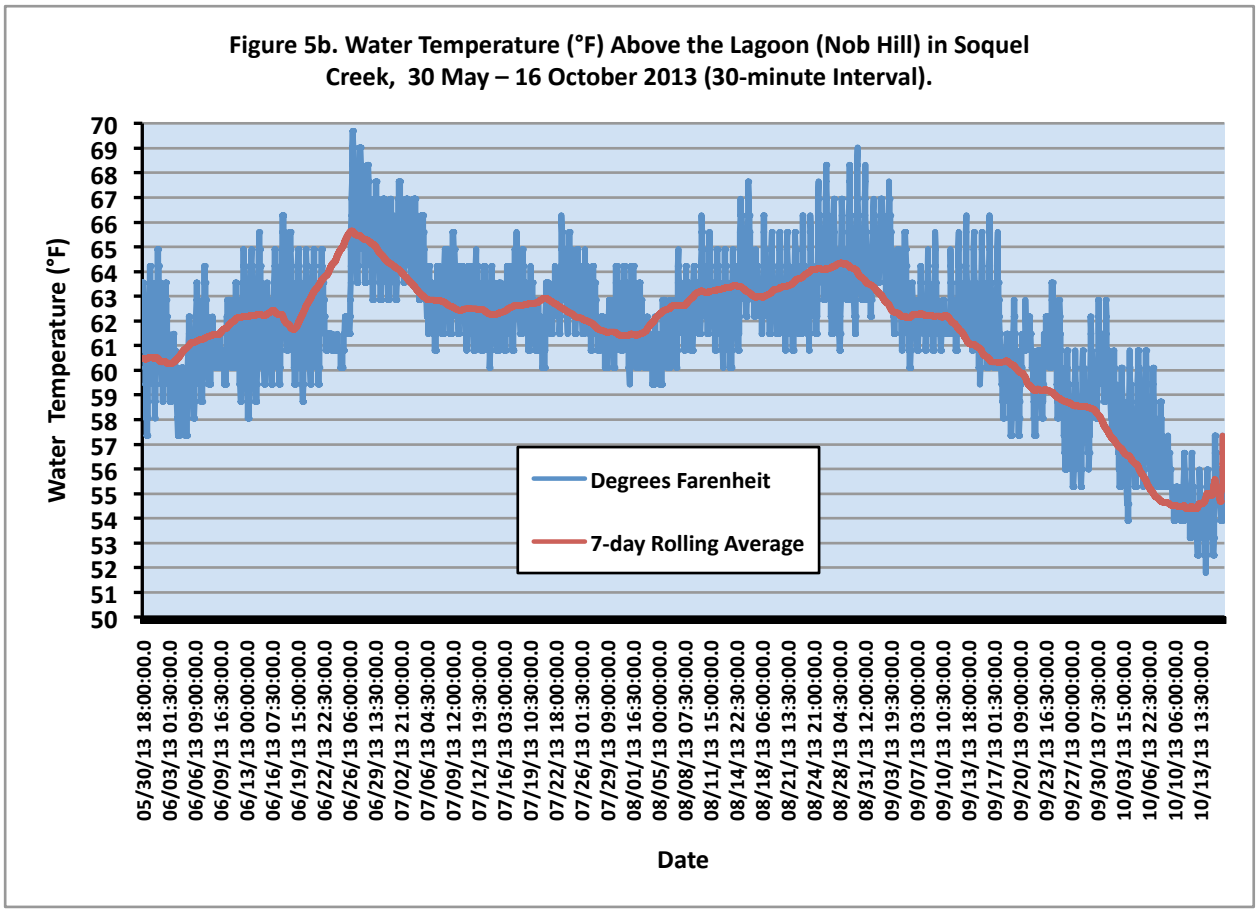


Figure 5b. Water Temperature (°F) Above the Lagoon (Nob Hill) in Soquel Creek, 30 May – 16 October 2013 (30-minute Interval).

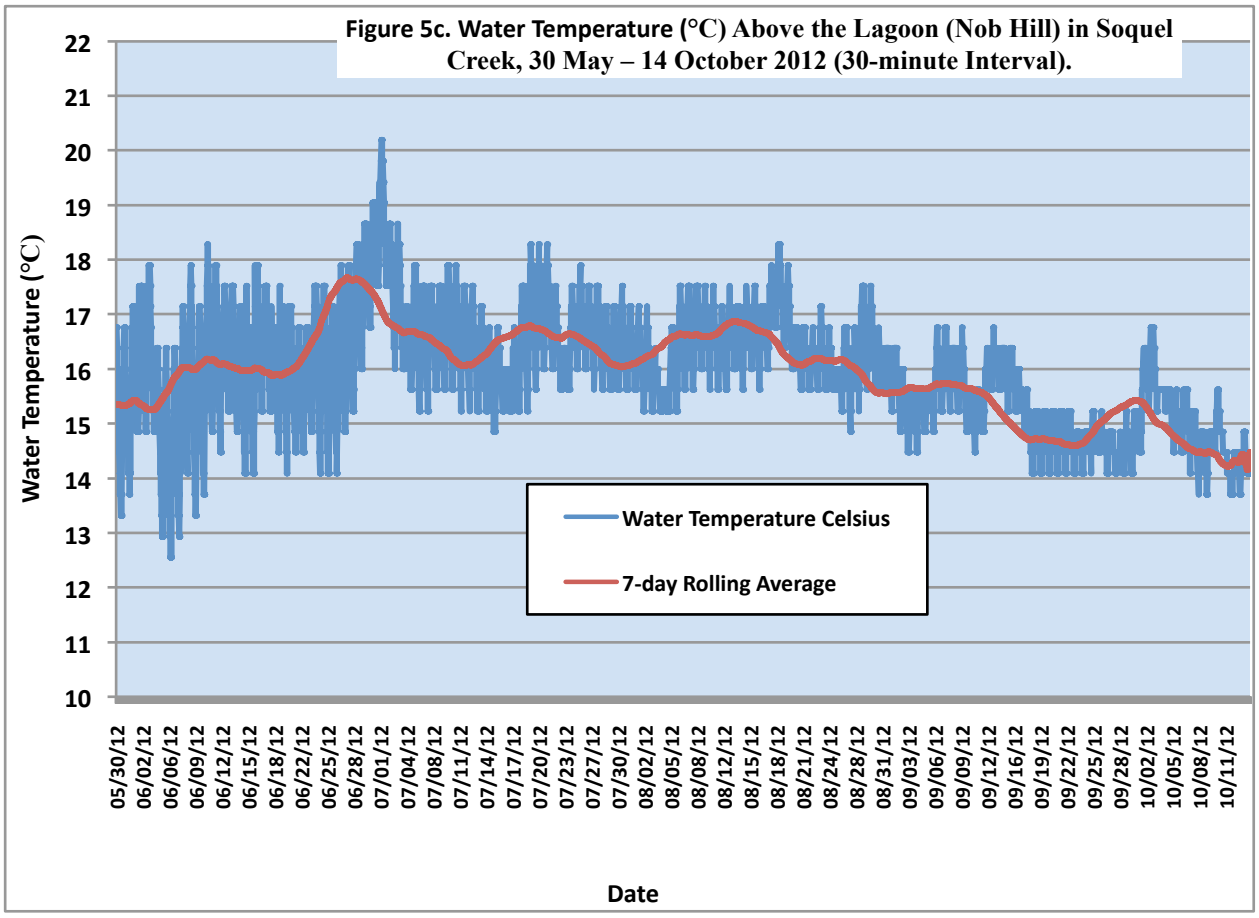


Figure 5c. Water Temperature (°C) Above the Lagoon (Nob Hill) in Soquel Creek, 30 May – 14 October 2012 (30-minute Interval).

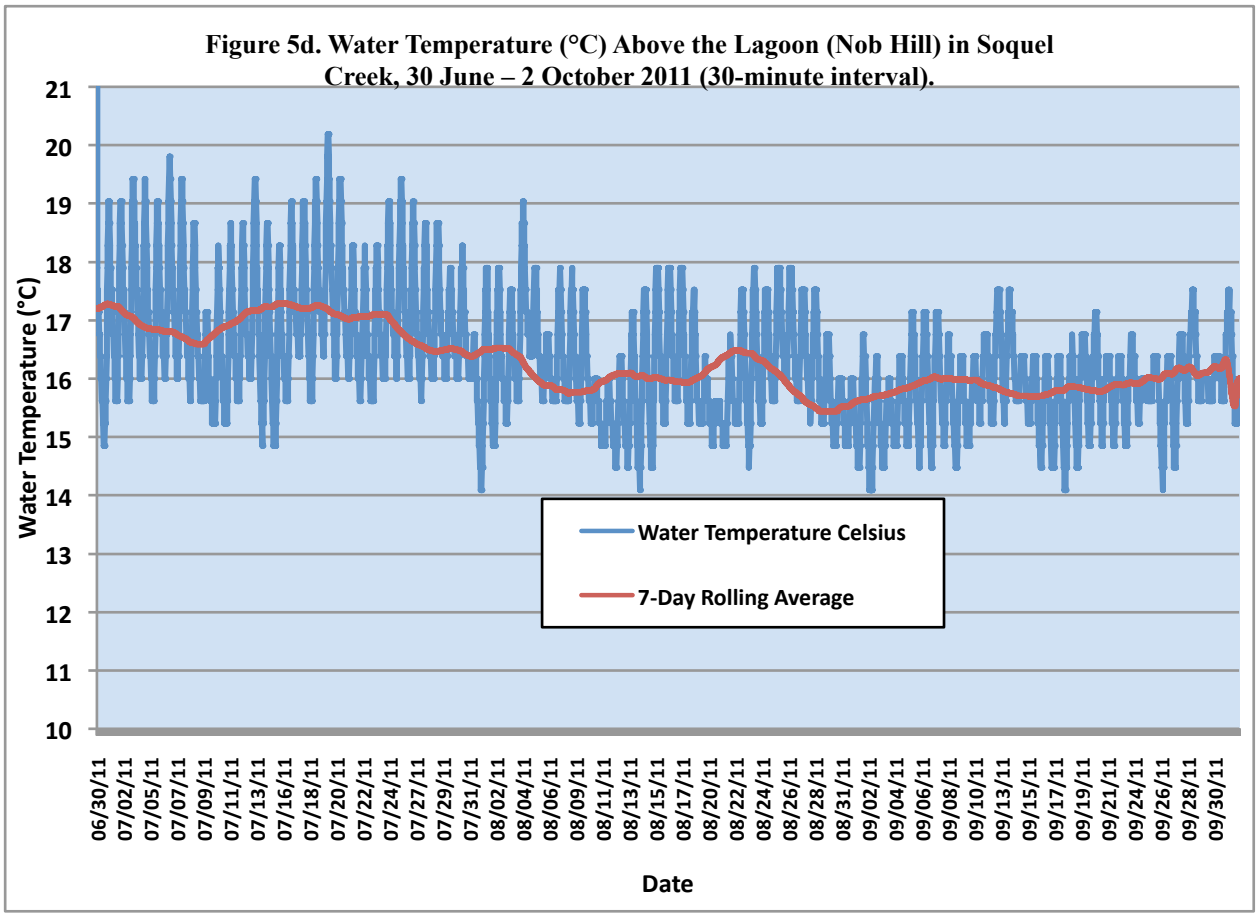


Figure 5d. Water Temperature (°C) Above the Lagoon (Nob Hill) in Soquel Creek, 30 June – 2 October 2011 (30-minute interval).

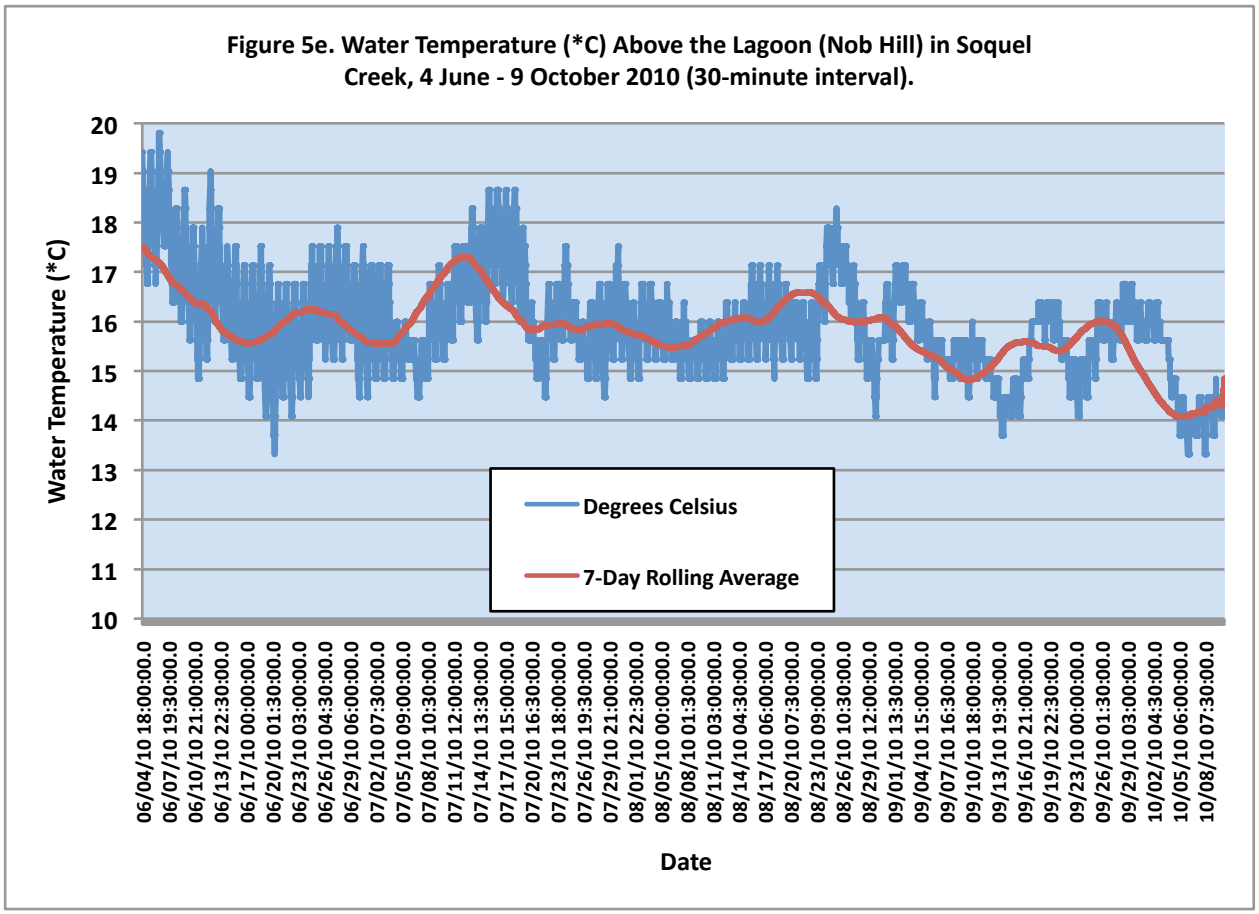


Figure 5e. Water Temperature (*C) Above the Lagoon (Nob Hill) in Soquel Creek, 4 June - 9 October 2010 (30-minute interval).

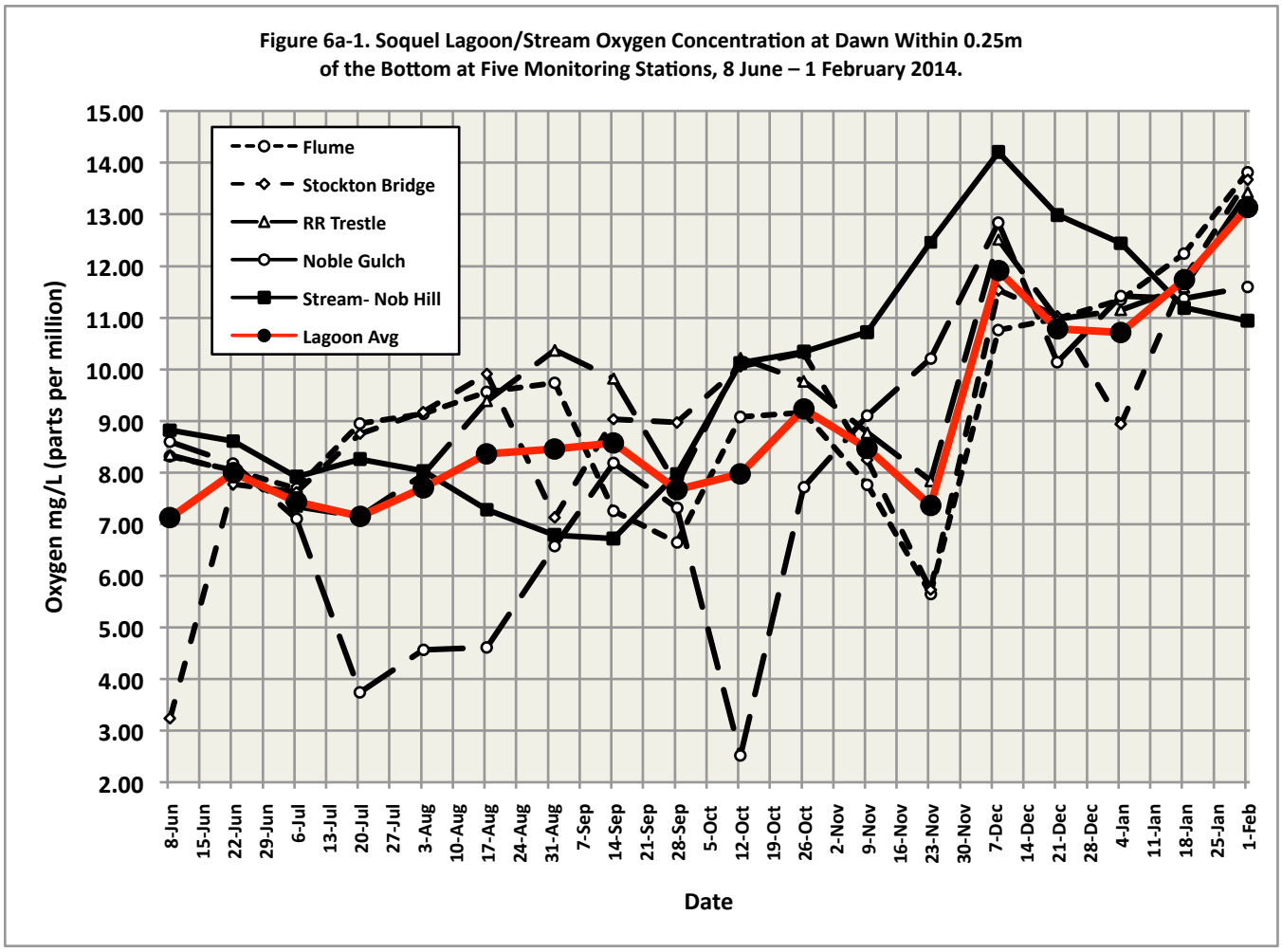


Figure 6a-1. Soquel Lagoon/Stream Oxygen Concentration at Dawn Within 0.25m of the Bottom at Five Monitoring Stations, 8 June – 1 February 2014.

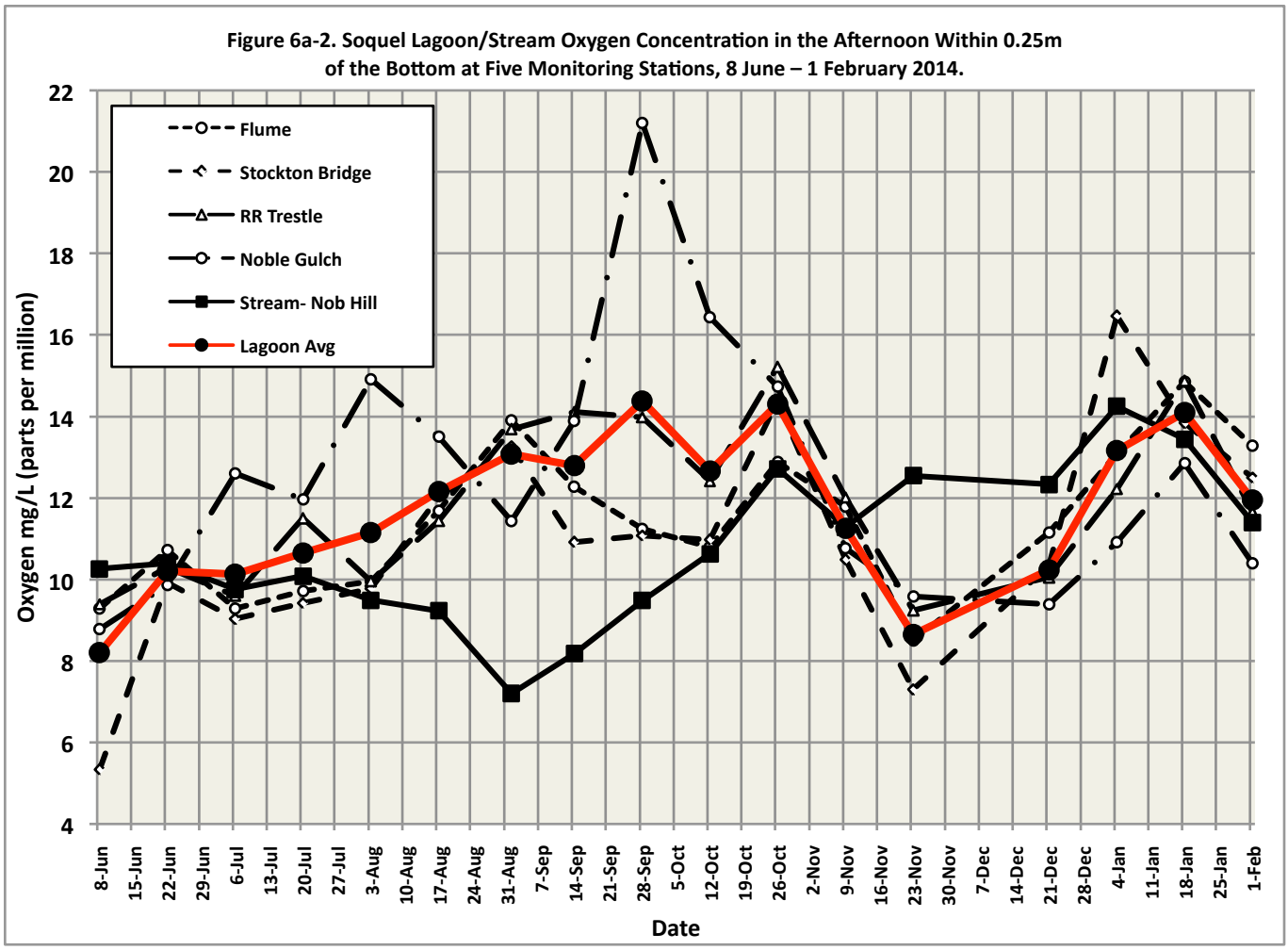


Figure 6a-2. Soquel Lagoon/Stream Oxygen Concentration in the Afternoon Within 0.25m of the Bottom at Five Monitoring Stations, 8 June – 1 February 2014.

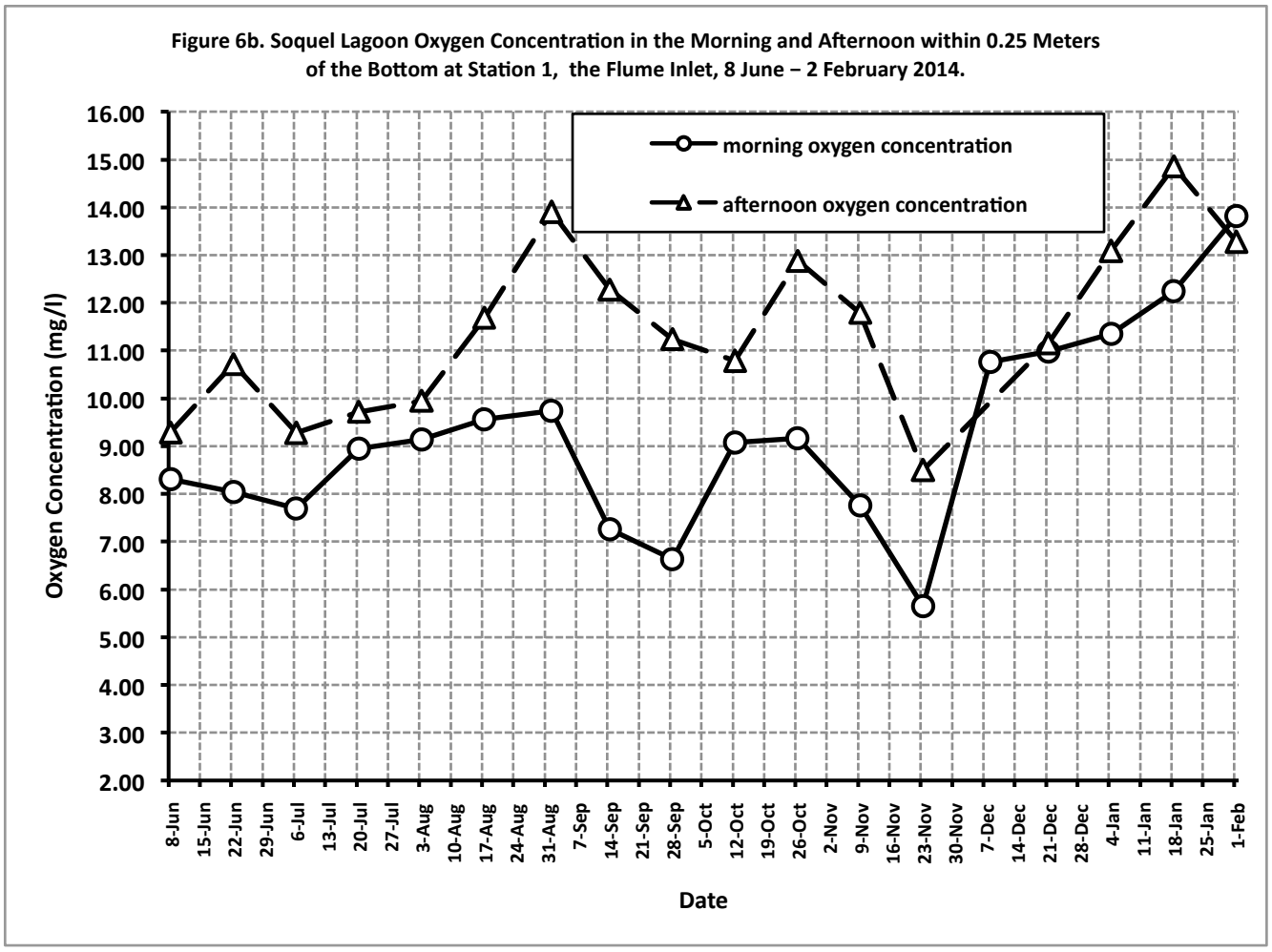


Figure 6b. Soquel Lagoon Oxygen Concentration in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 1, the Flume Inlet, 8 June − 2 February 2014.

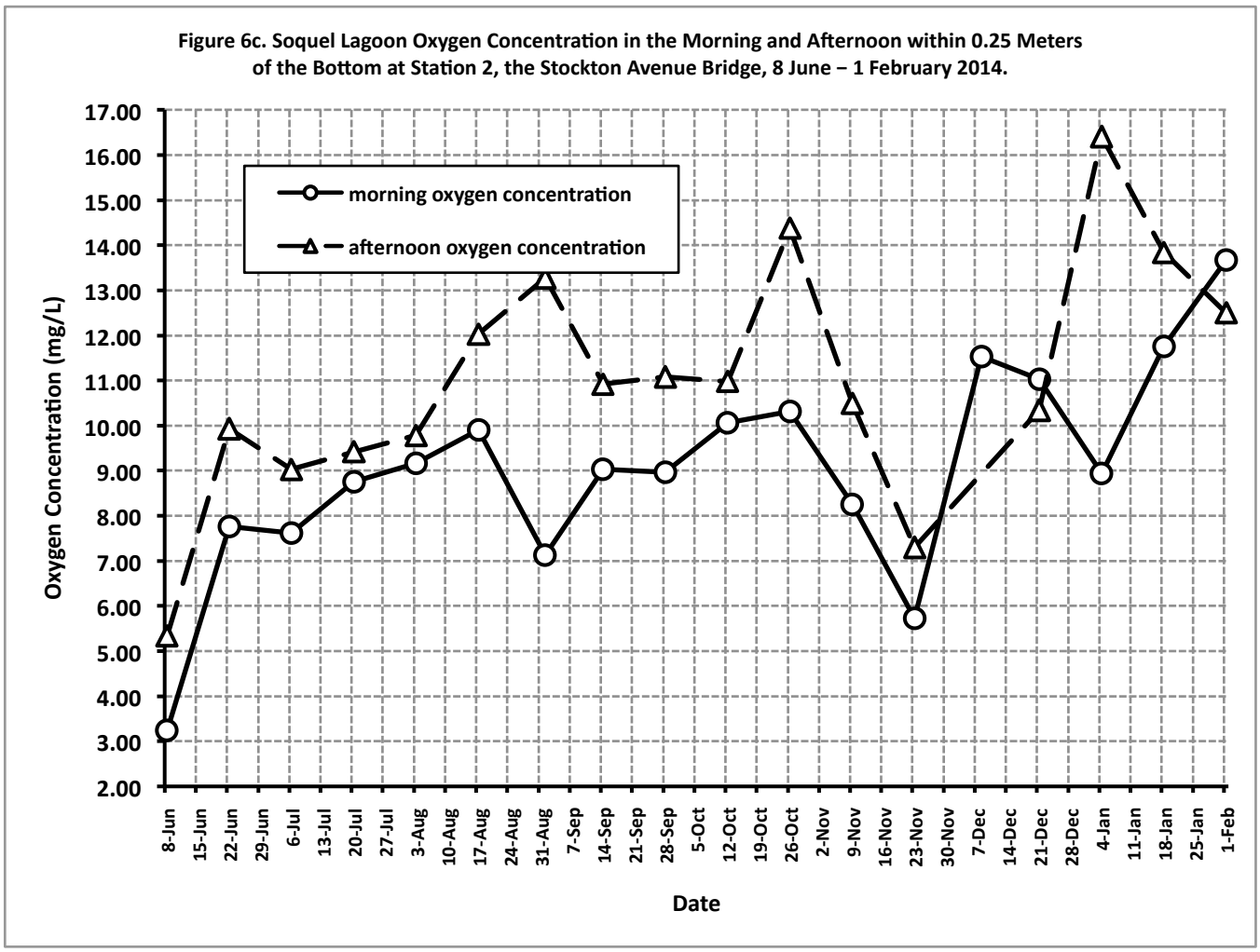


Figure 6c. Soquel Lagoon Oxygen Concentration in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 2, the Stockton Avenue Bridge, 8 June − 1 February 2014.

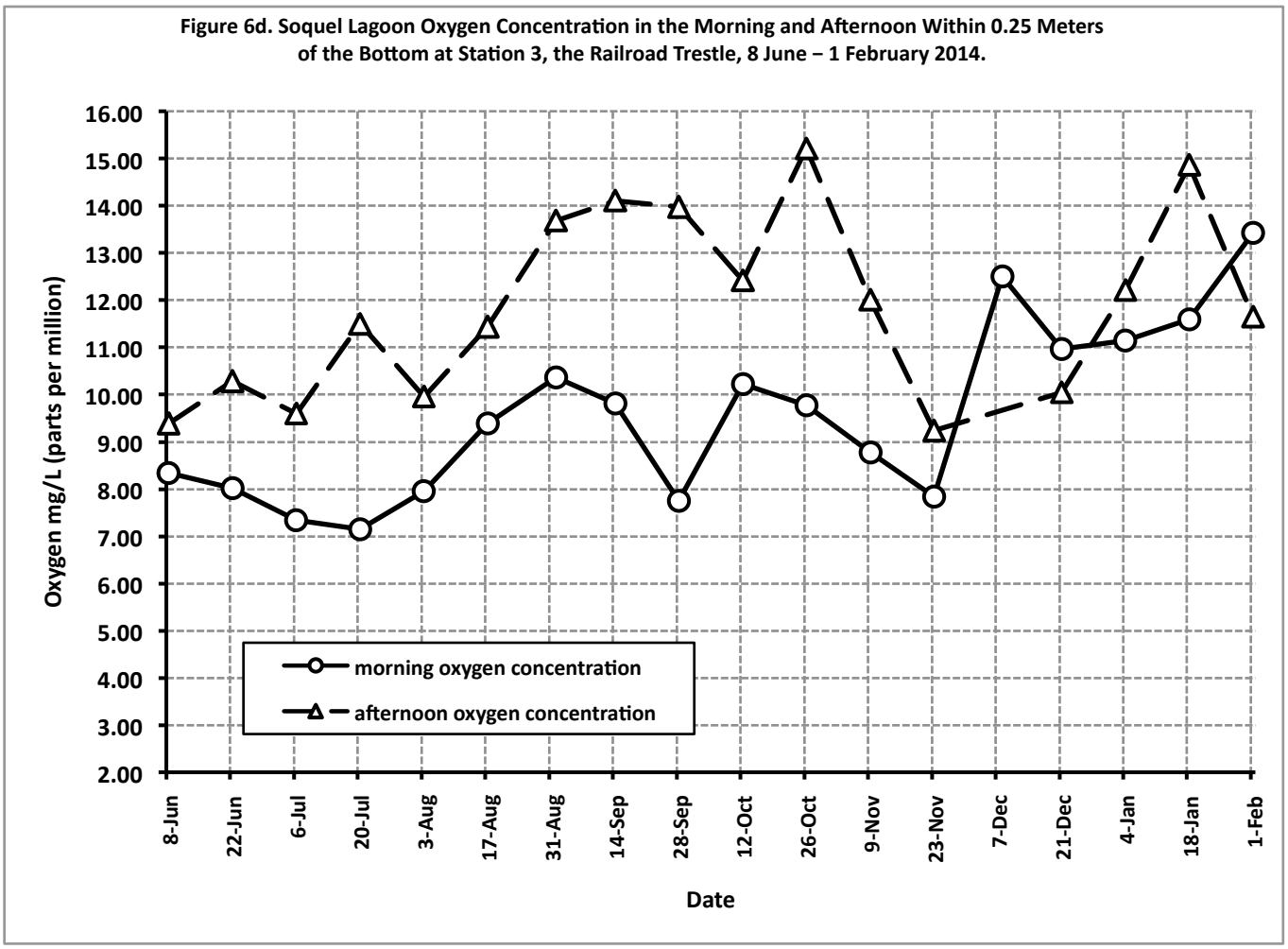


Figure 6d. Soquel Lagoon Oxygen Concentration in the Morning and Afternoon Within 0.25 Meters of the Bottom at Station 3, the Railroad Trestle, 8 June − 1 February 2014.

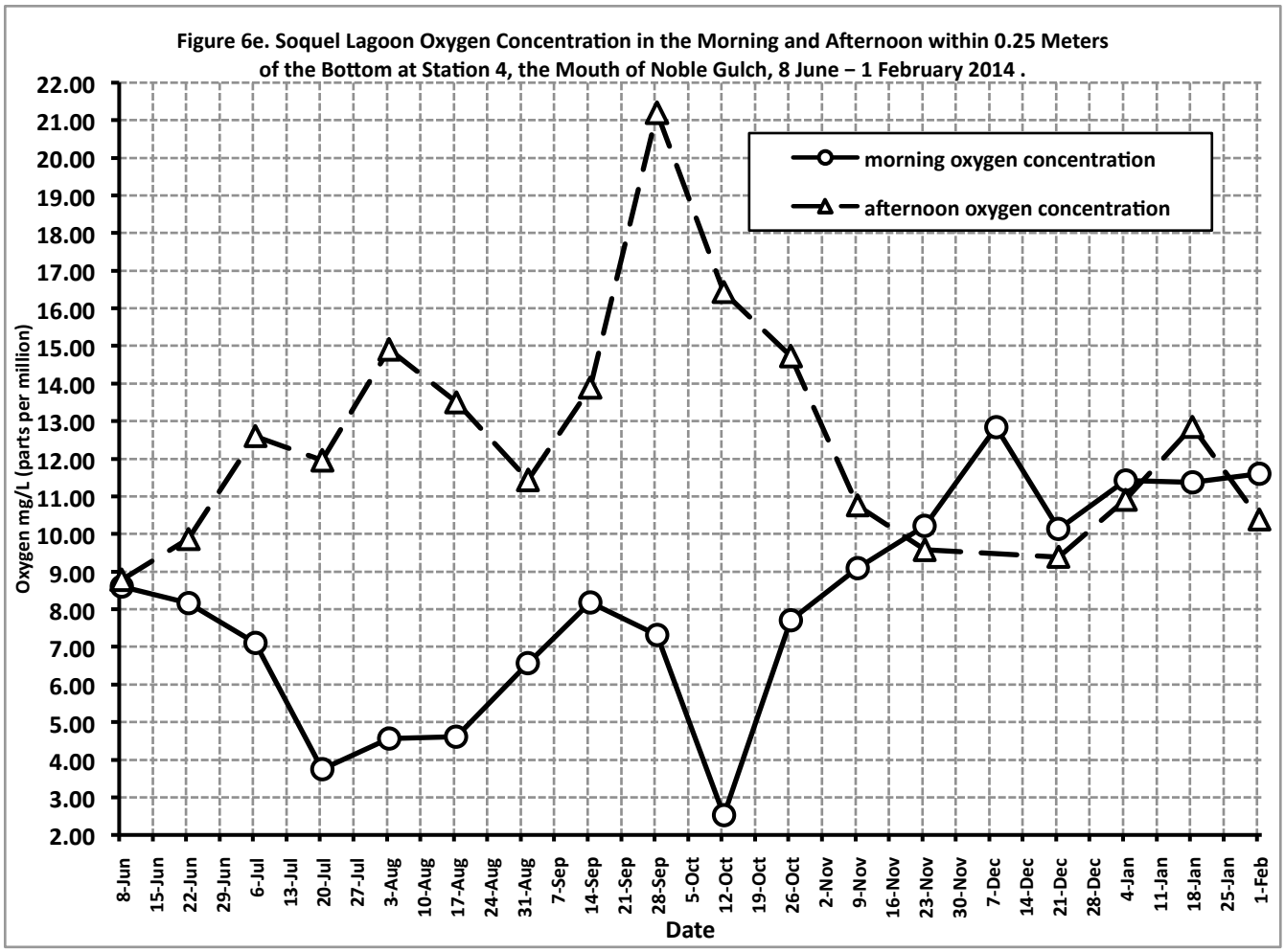


Figure 6e. Soquel Lagoon Oxygen Concentration in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 4, the Mouth of Noble Gulch, 8 June − 1 February 2014 .

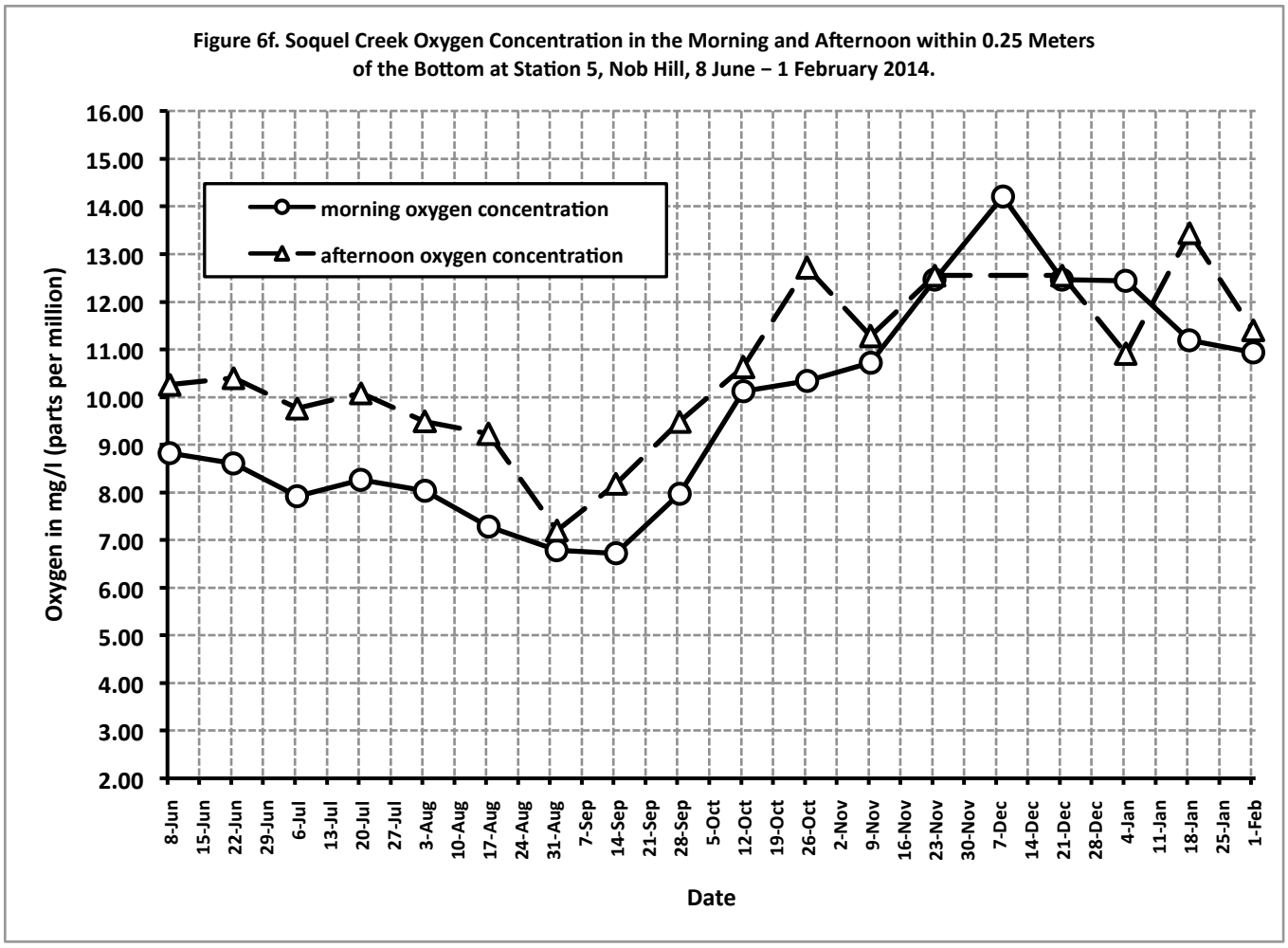


Figure 6f. Soquel Creek Oxygen Concentration in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 5, Nob Hill, 8 June − 1 February 2014.

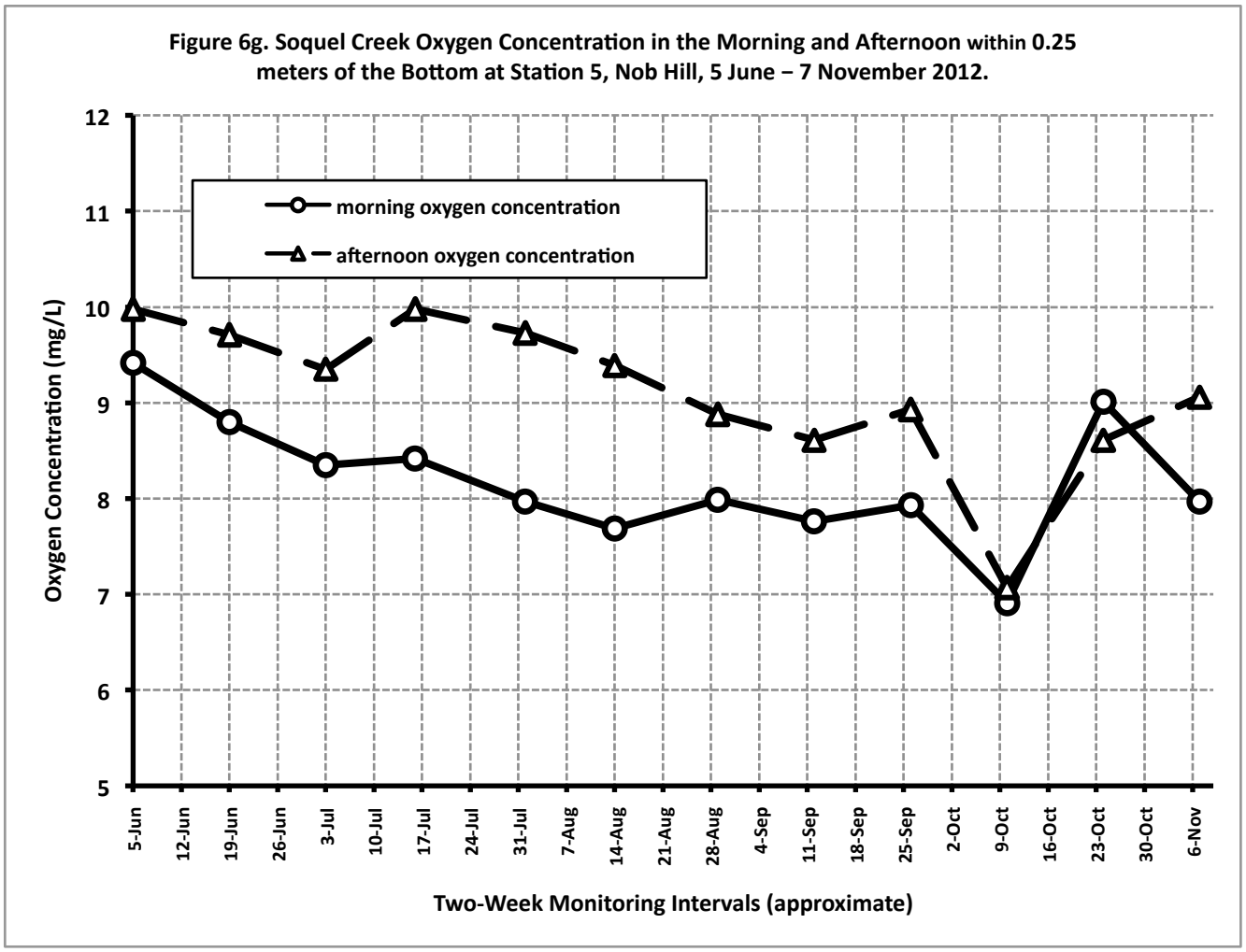


Figure 6g. Soquel Creek Oxygen Concentration in the Morning and Afternoon within 0.25 meters of the Bottom at Station 5, Nob Hill, 5 June − 7 November 2012.

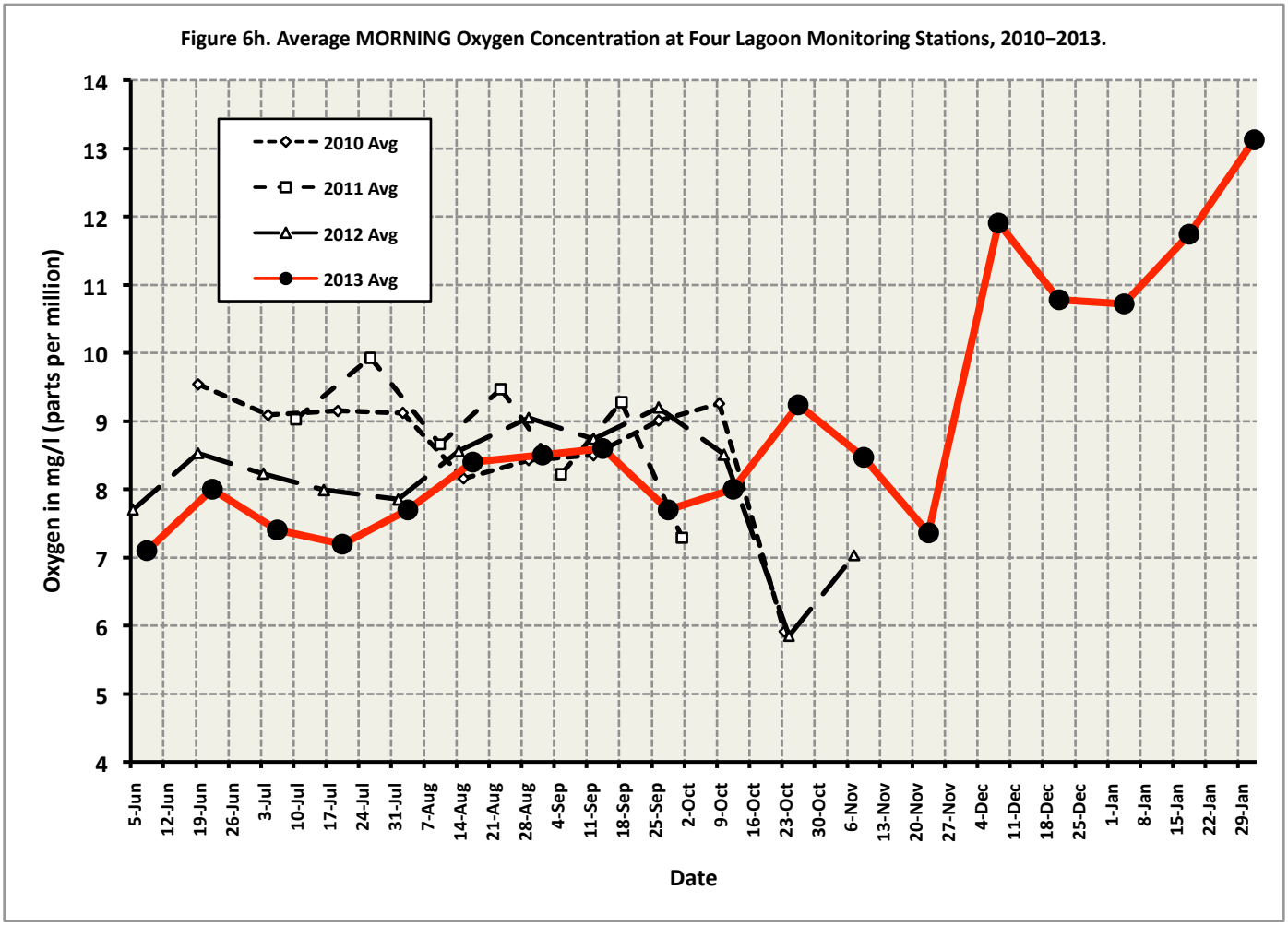


Figure 6h. Average MORNING Oxygen Concentration at Four Lagoon Monitoring Stations, 2010−2013.

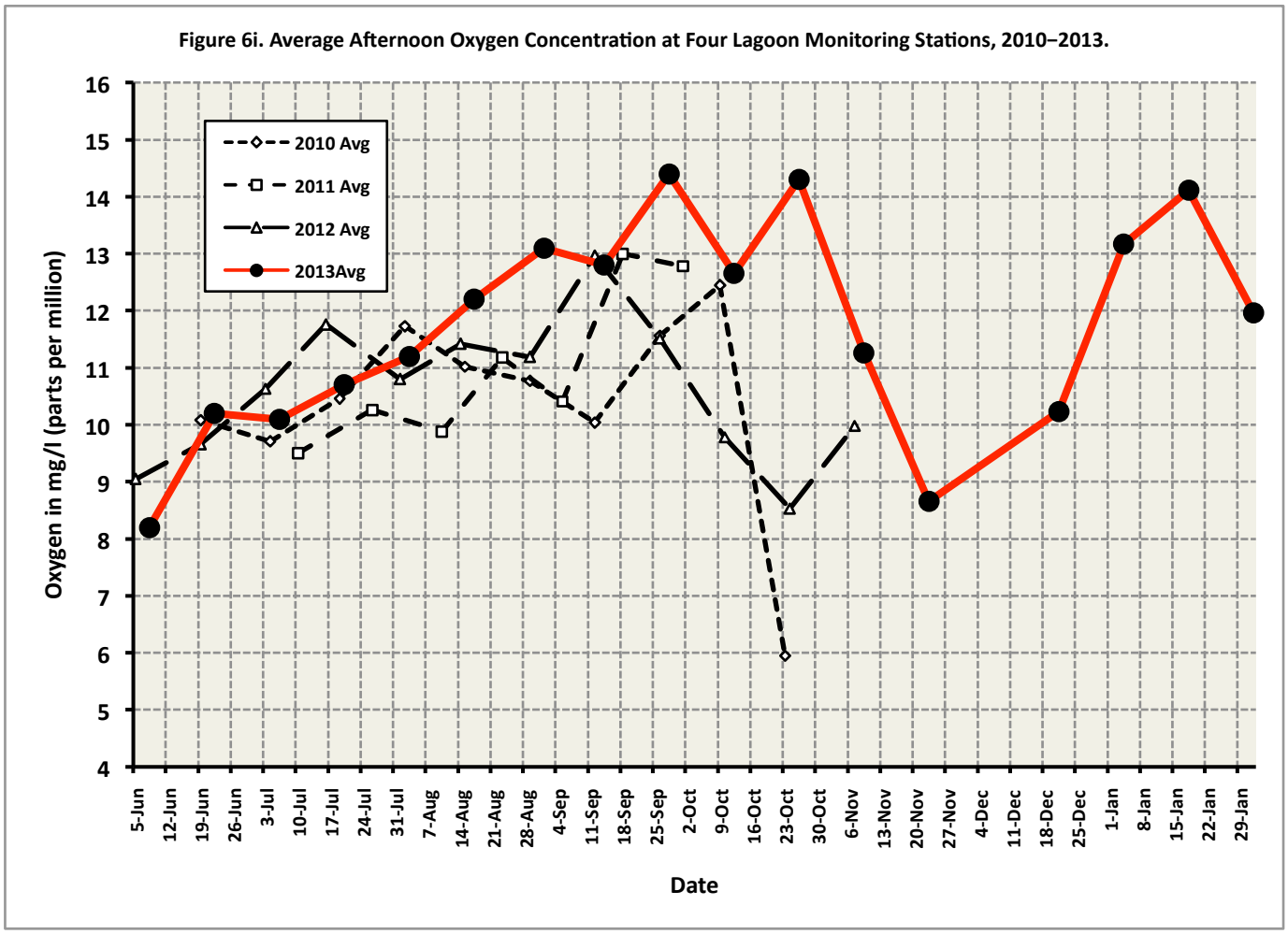


Figure 6i. Average Afternoon Oxygen Concentration at Four Lagoon Monitoring Stations, 2010−2013.

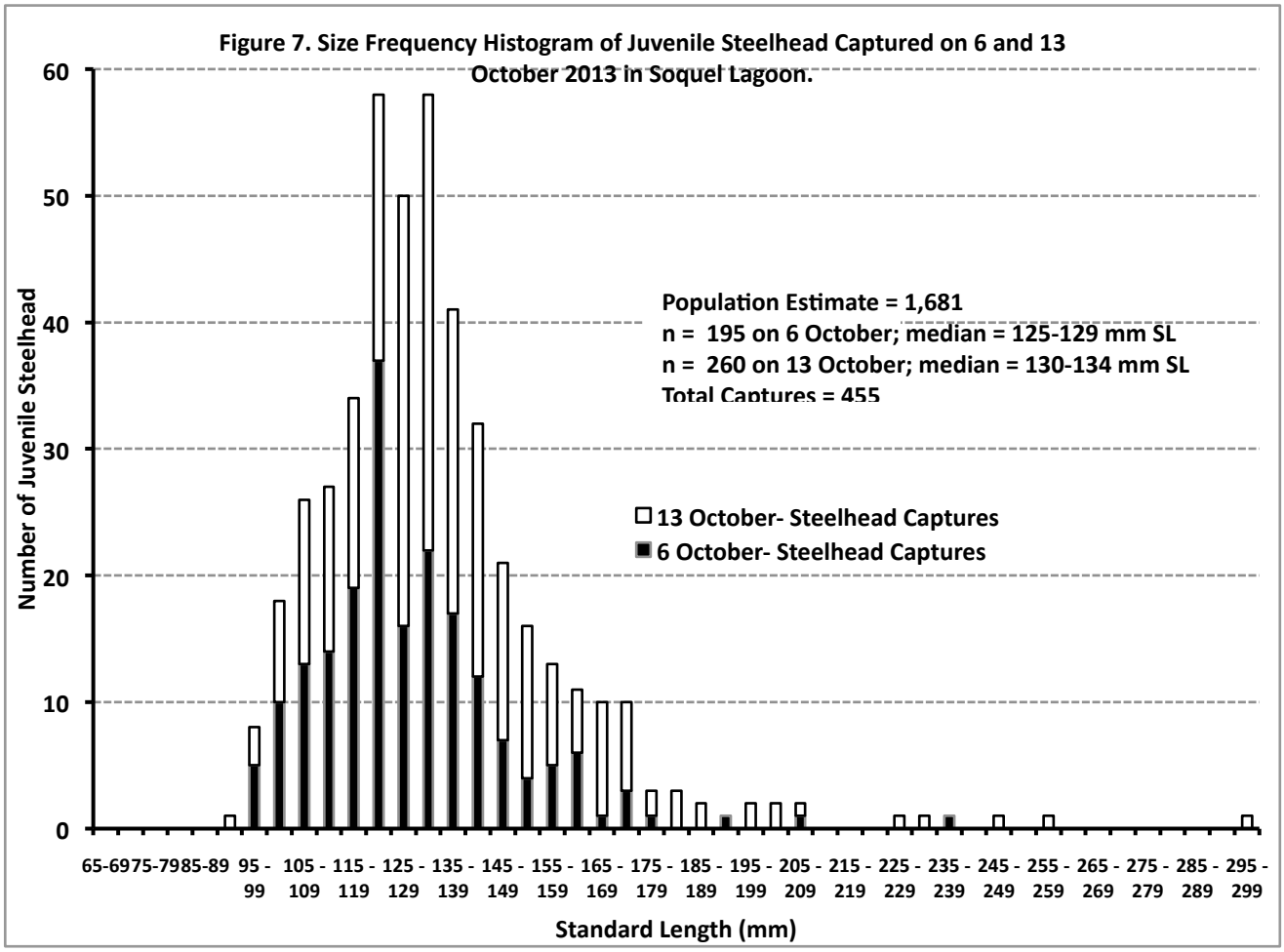


Figure 7. Size Frequency Histogram of Juvenile Steelhead Captured on 6 and 13 October 2013 in Soquel Lagoon.

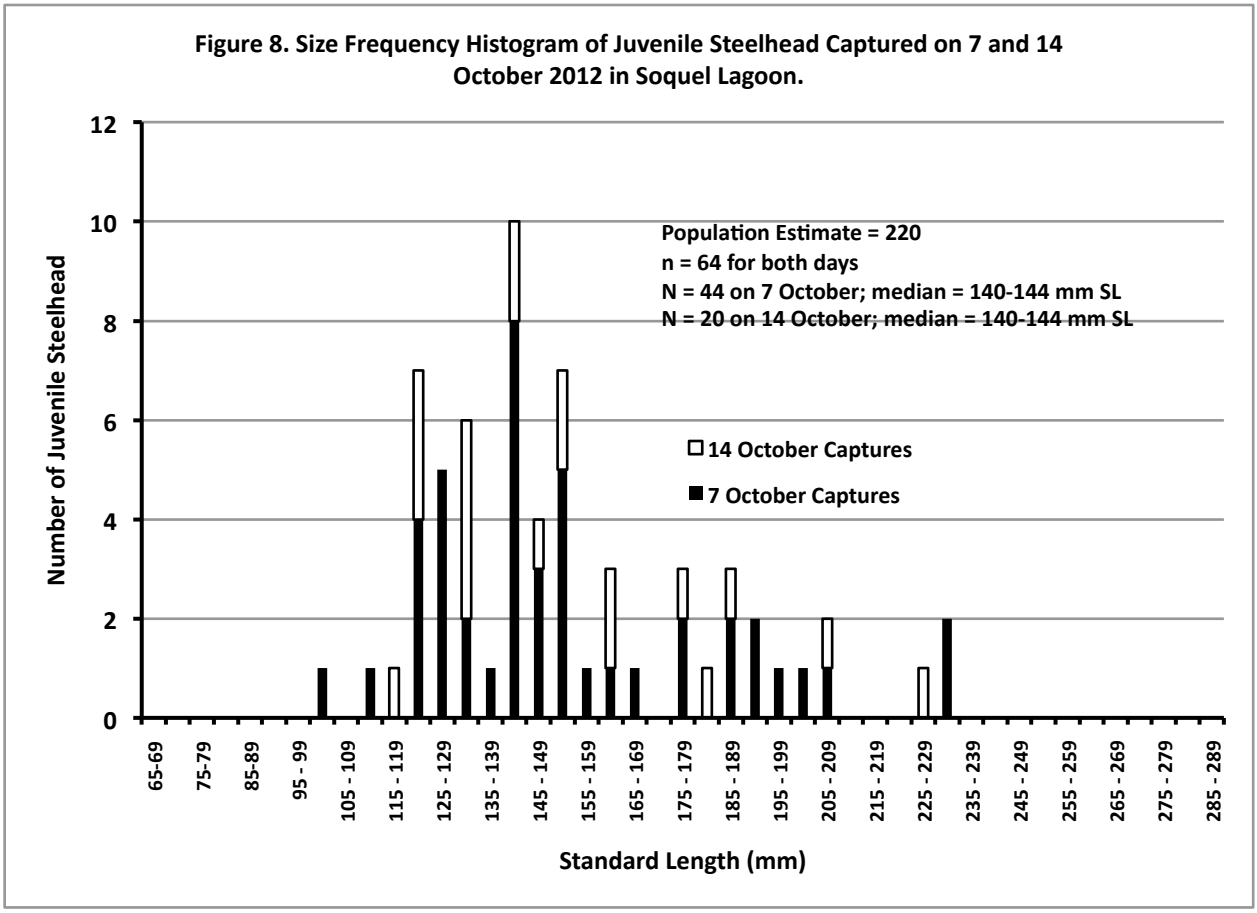


Figure 8. Size Frequency Histogram of Juvenile Steelhead Captured on 7 and 14 October 2012 in Soquel Lagoon.

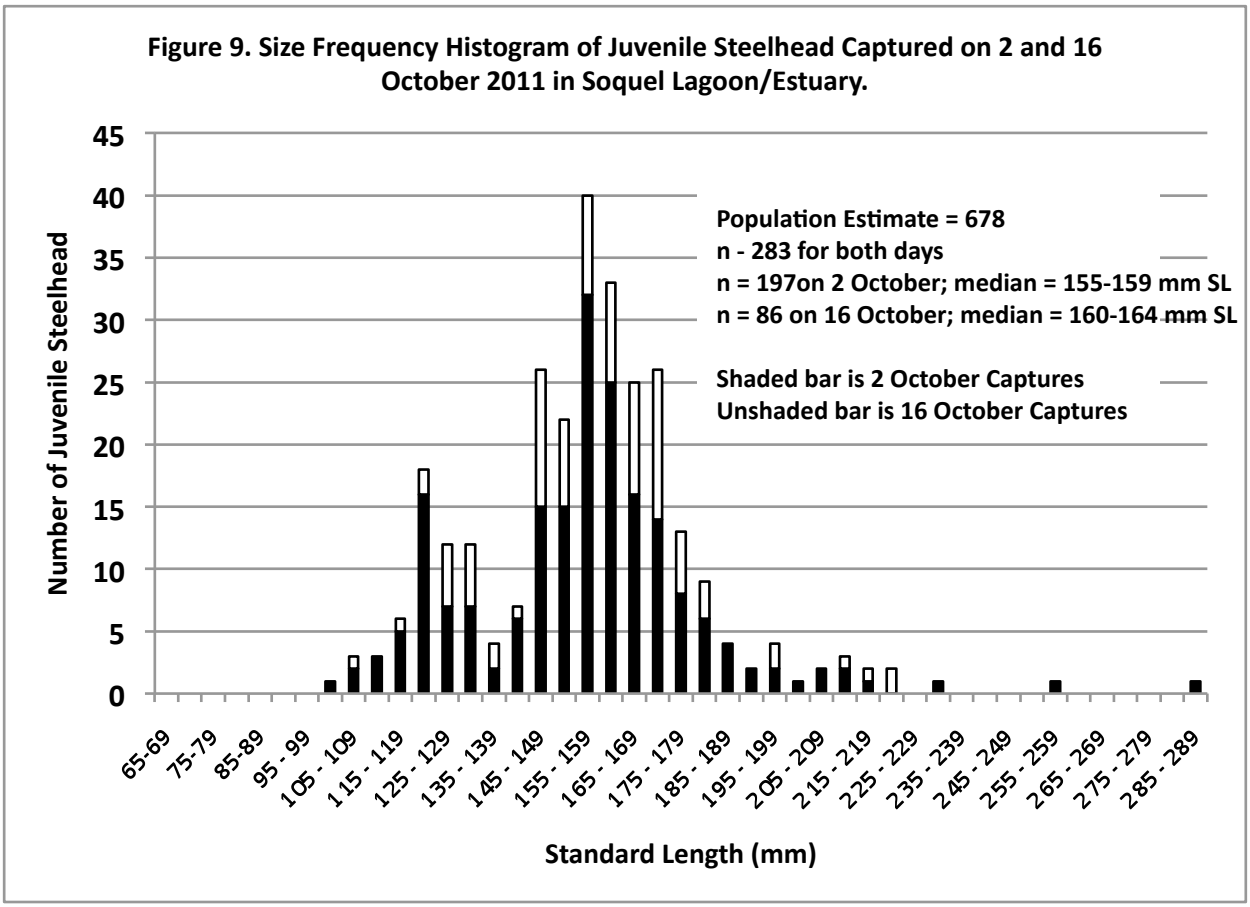


Figure 9. Size Frequency Histogram of Juvenile Steelhead Captured on 2 and 16 October 2011 in Soquel Lagoon/Estuary.

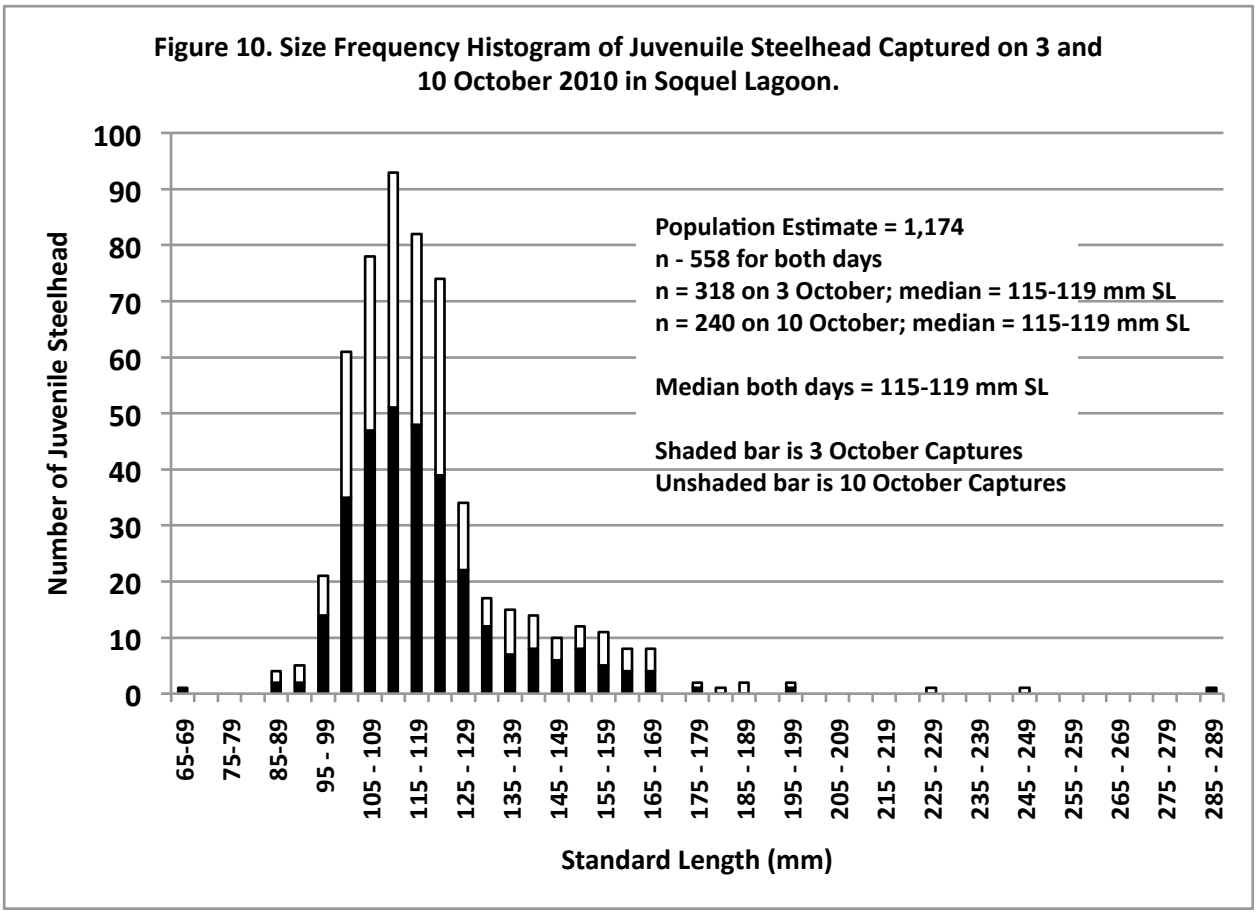


Figure 10. Size Frequency Histogram of Juvenuile Steelhead Captured on 3 and 10 October 2010 in Soquel Lagoon.

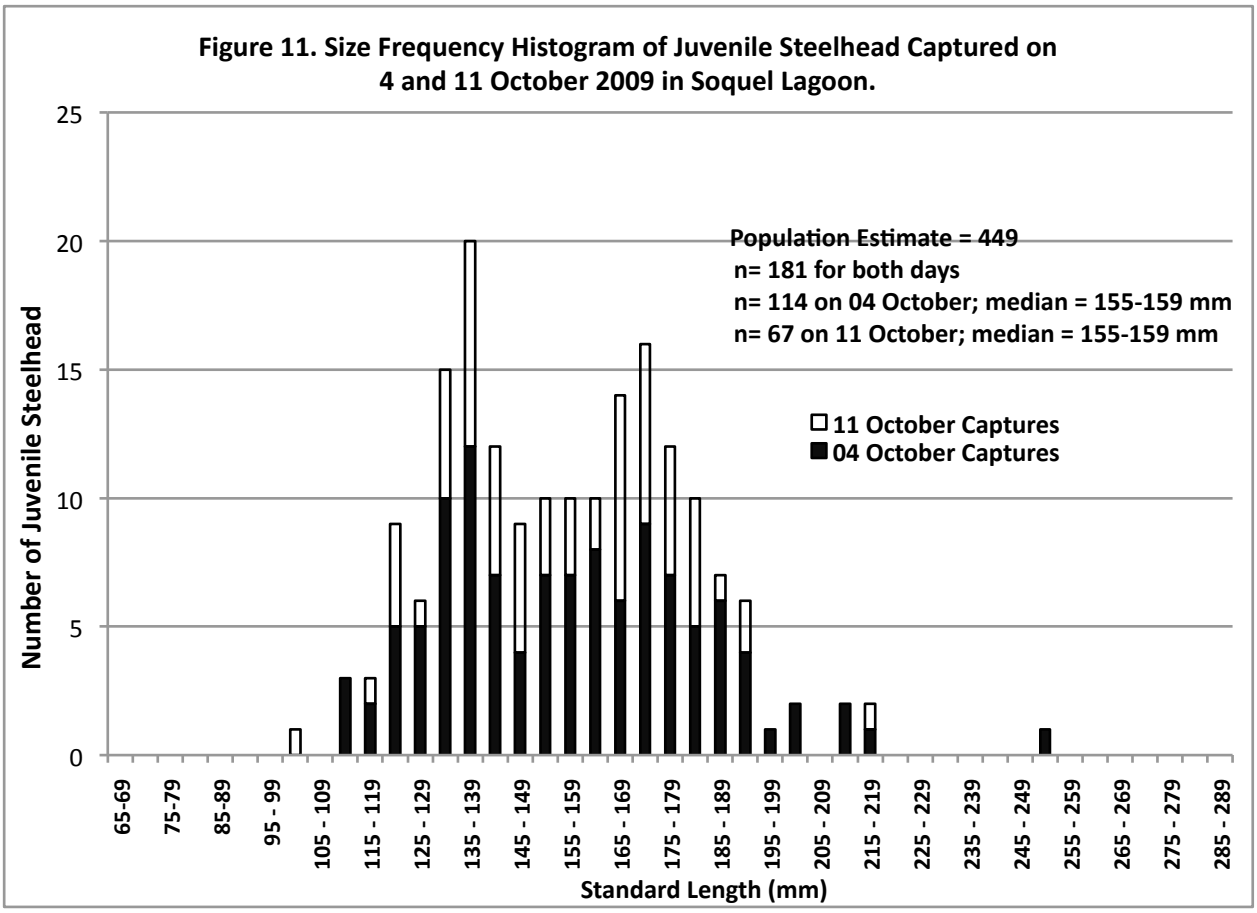


Figure 11. Size Frequency Histogram of Juvenile Steelhead Captured on 4 and 11 October 2009 in Soquel Lagoon.

Figure 12. Size Frequency Histogram of Juvenile Steelhead Captured on 27 September 2008 in the Soquel Lagoon.

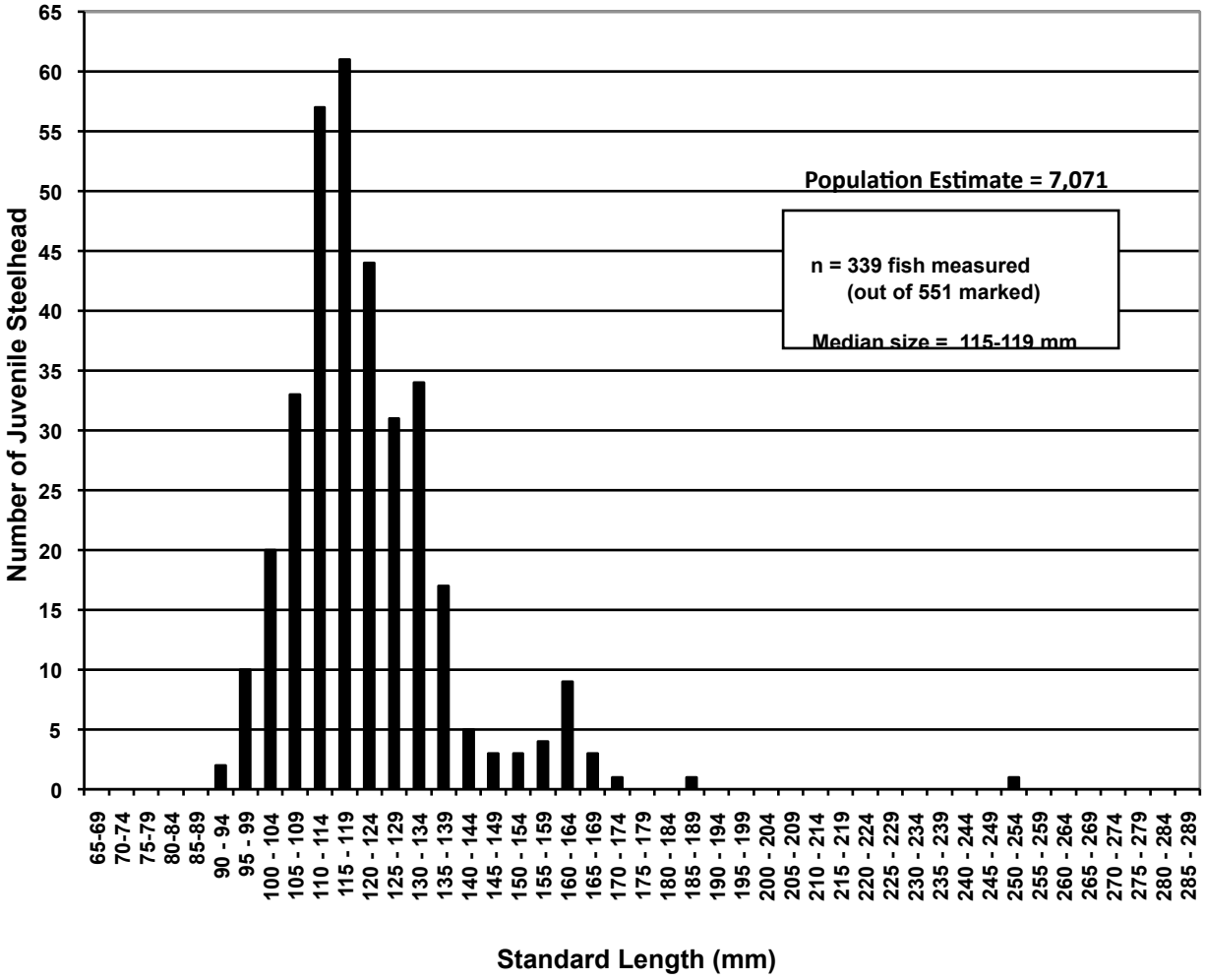


Figure 12. Size Frequency Histogram of Juvenile Steelhead Captured on 27 September 2008 in the Soquel Lagoon.

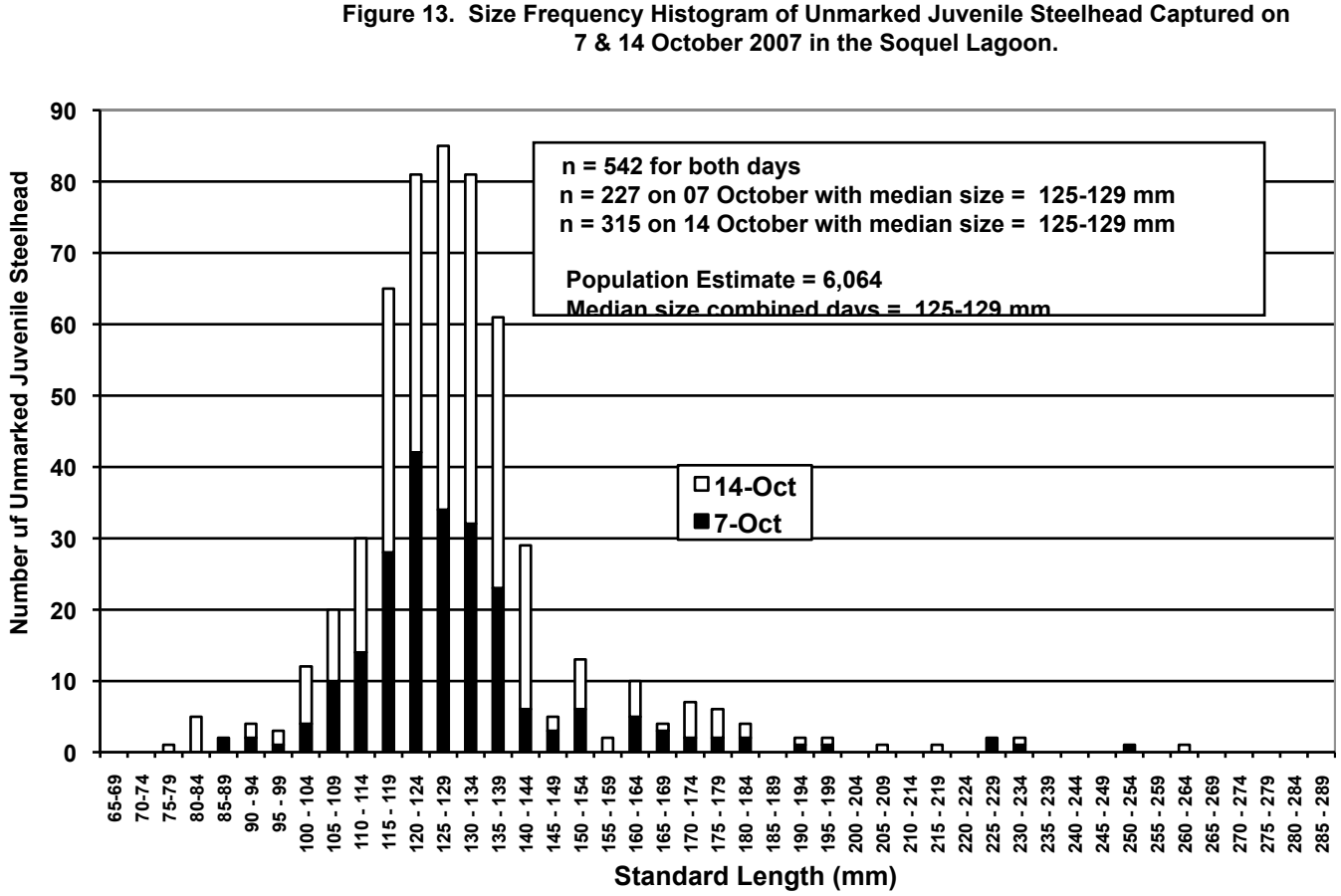


Figure 13. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 7 & 14 October 2007 in the Soquel Lagoon.

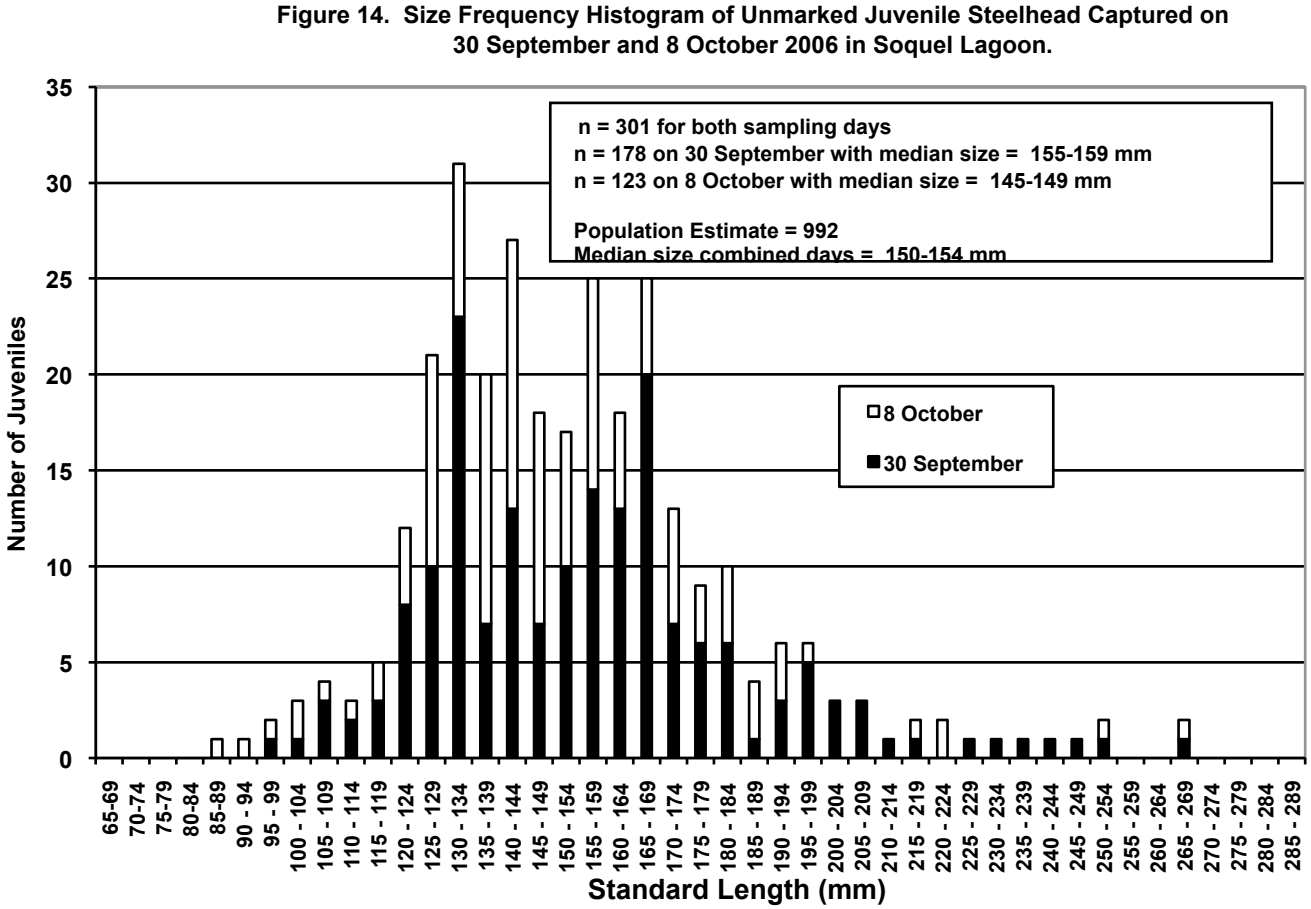


Figure 14. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 30 September and 8 October 2006 in Soquel Lagoon.

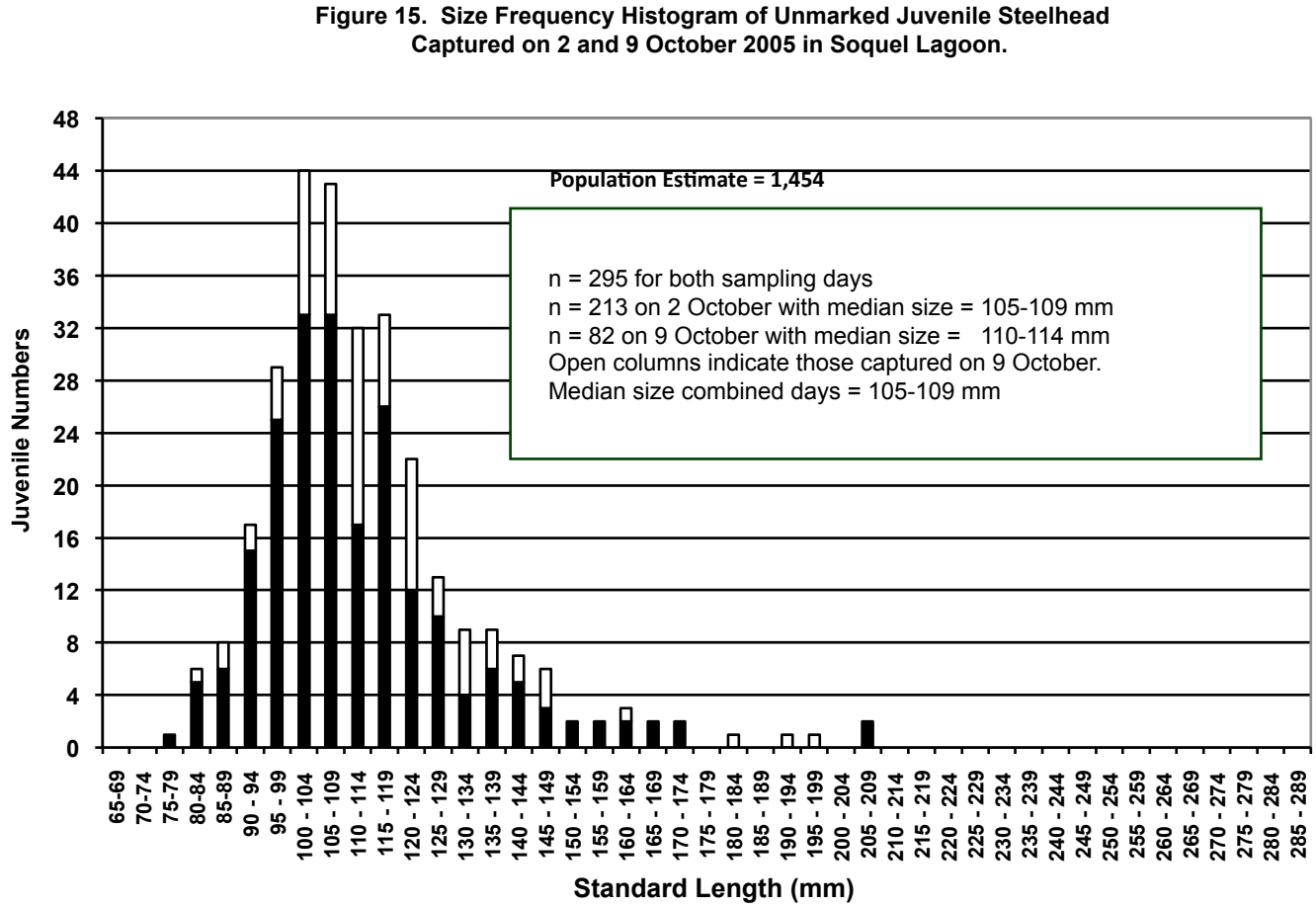


Figure 15. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 2 and 9 October 2005 in Soquel Lagoon.

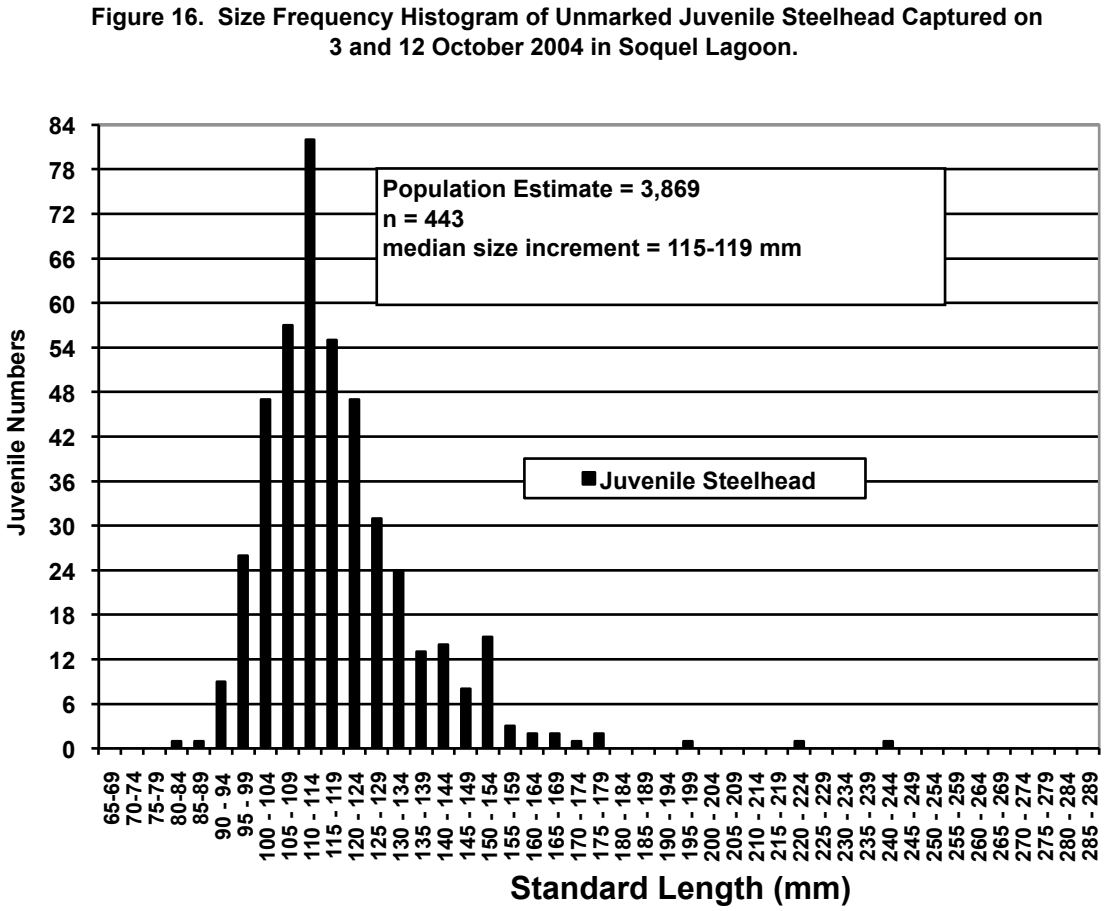


Figure 16. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 3 and 12 October 2004 in Soquel Lagoon.

Figure 17. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 5 and 12 October 2003 in Soquel Lagoon.

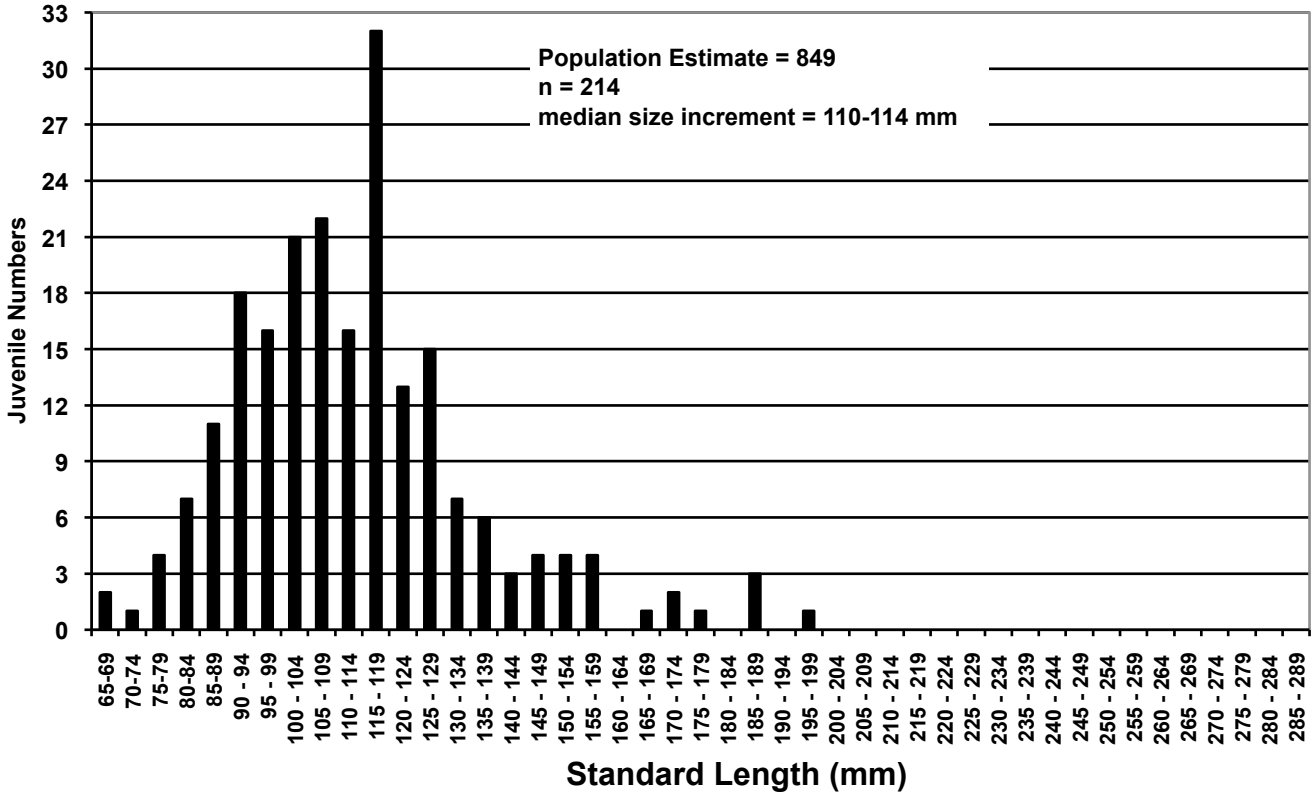


Figure 17. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 5 and 12 October 2003 in Soquel Lagoon.

Figure 18. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 6 October 2002 in Soquel Lagoon.

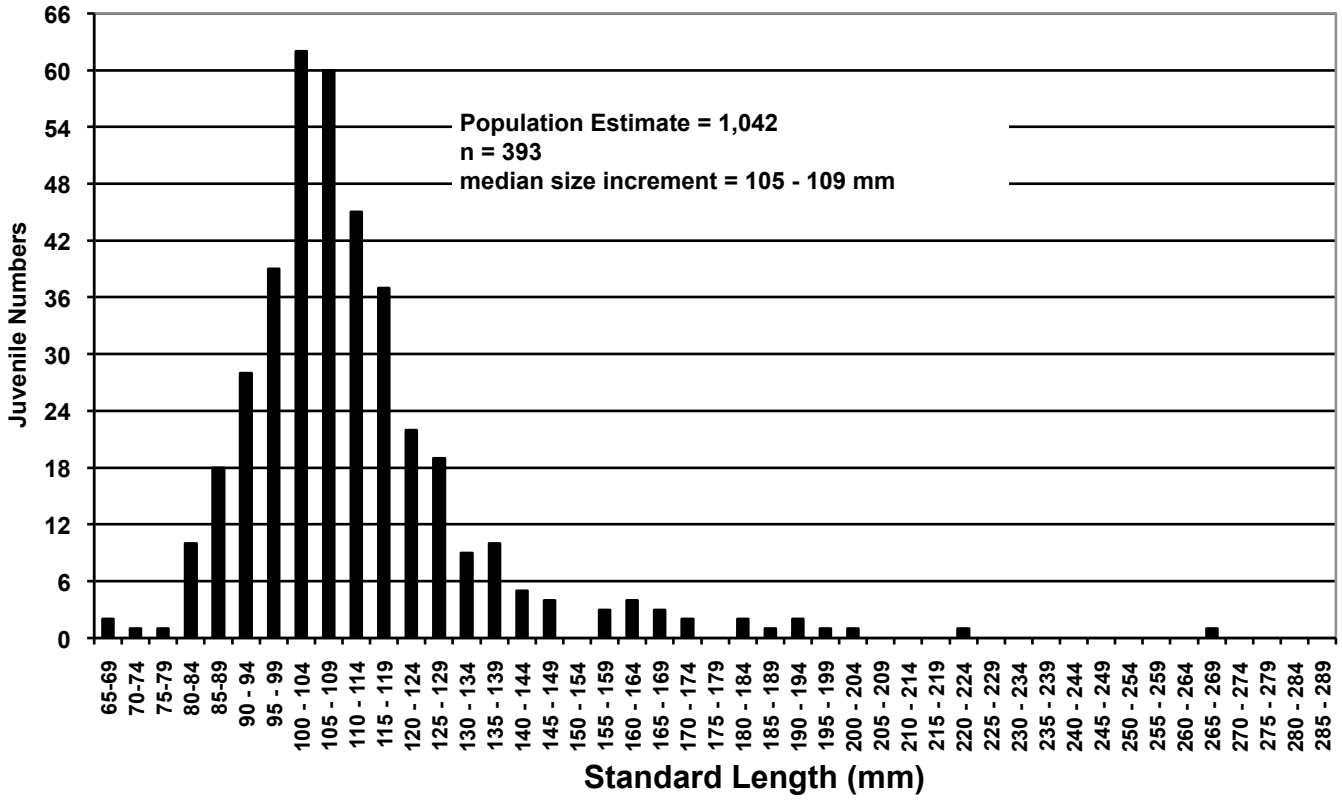


Figure 18. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 6 October 2002 in Soquel Lagoon.

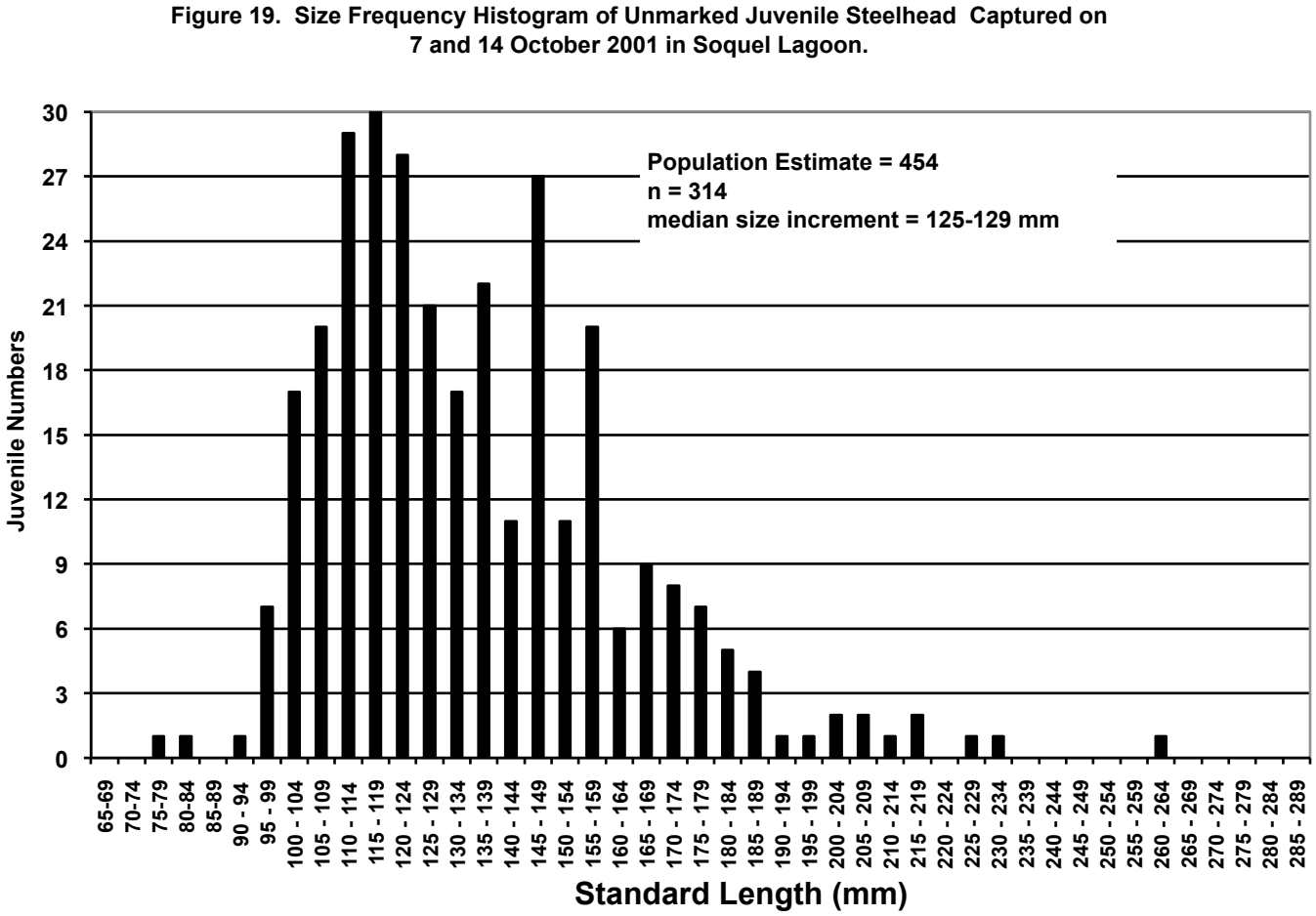


Figure 19. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 7 and 14 October 2001 in Soquel Lagoon.

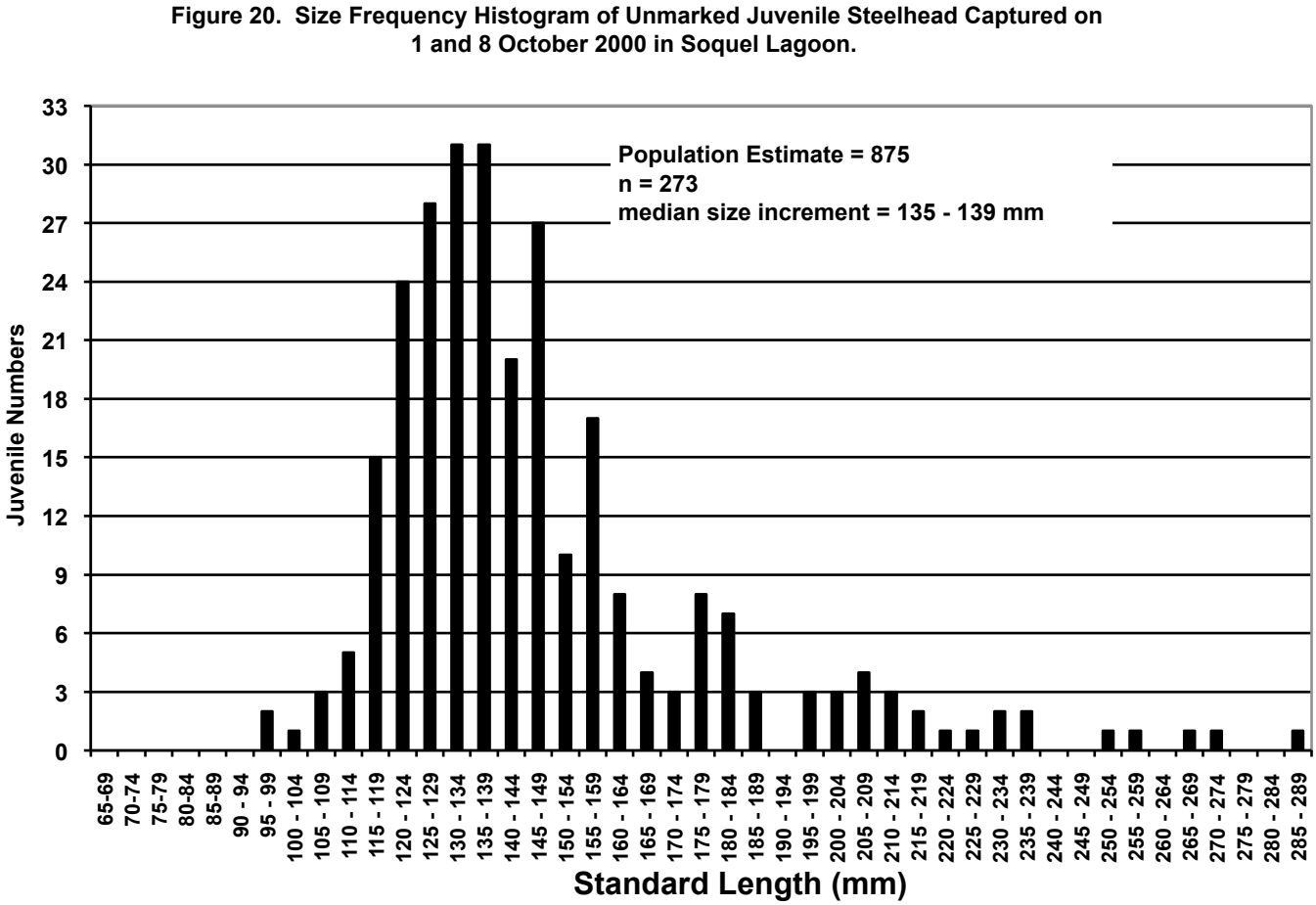


Figure 20. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 1 and 8 October 2000 in Soquel Lagoon.

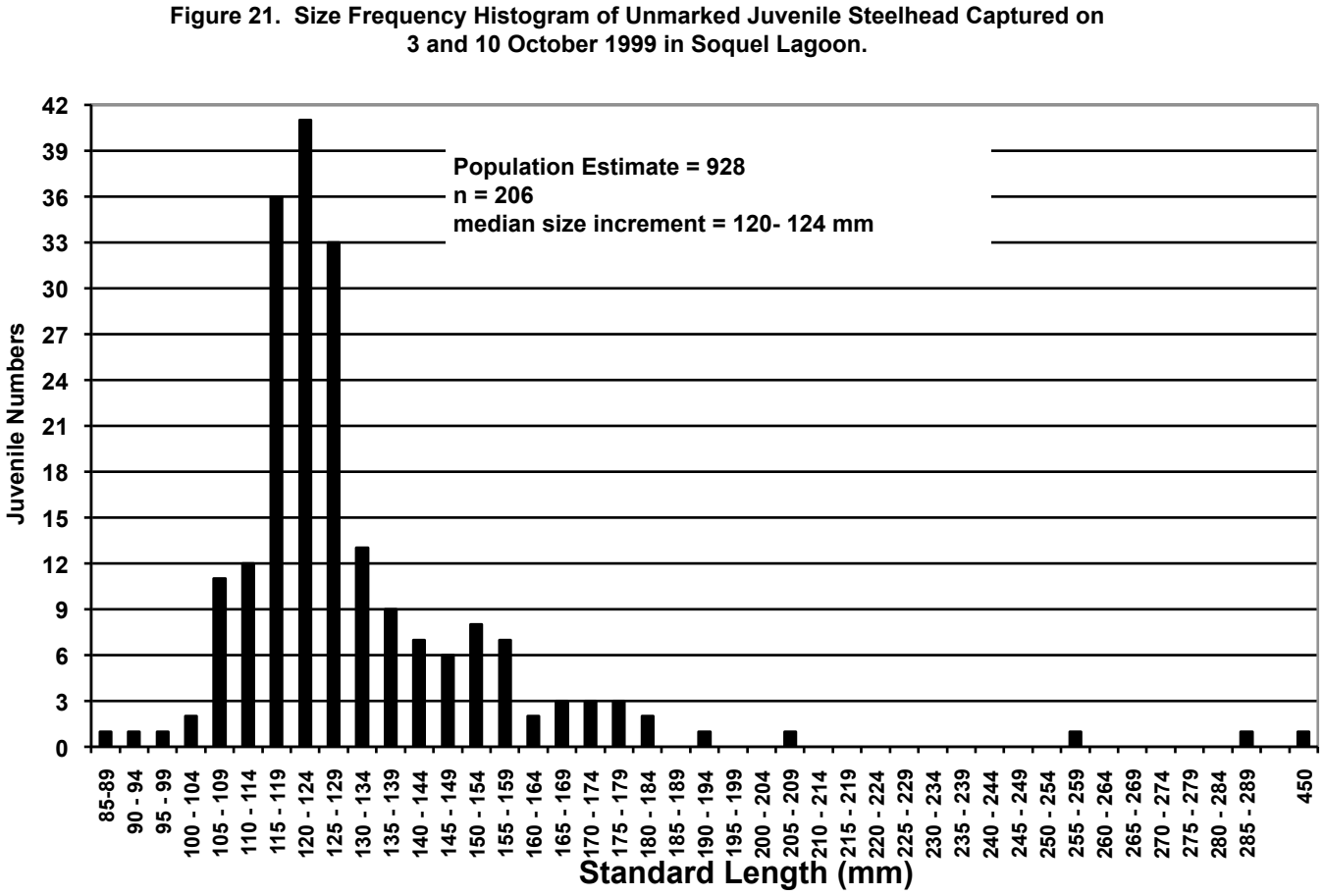


Figure 21. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 3 and 10 October 1999 in Soquel Lagoon.

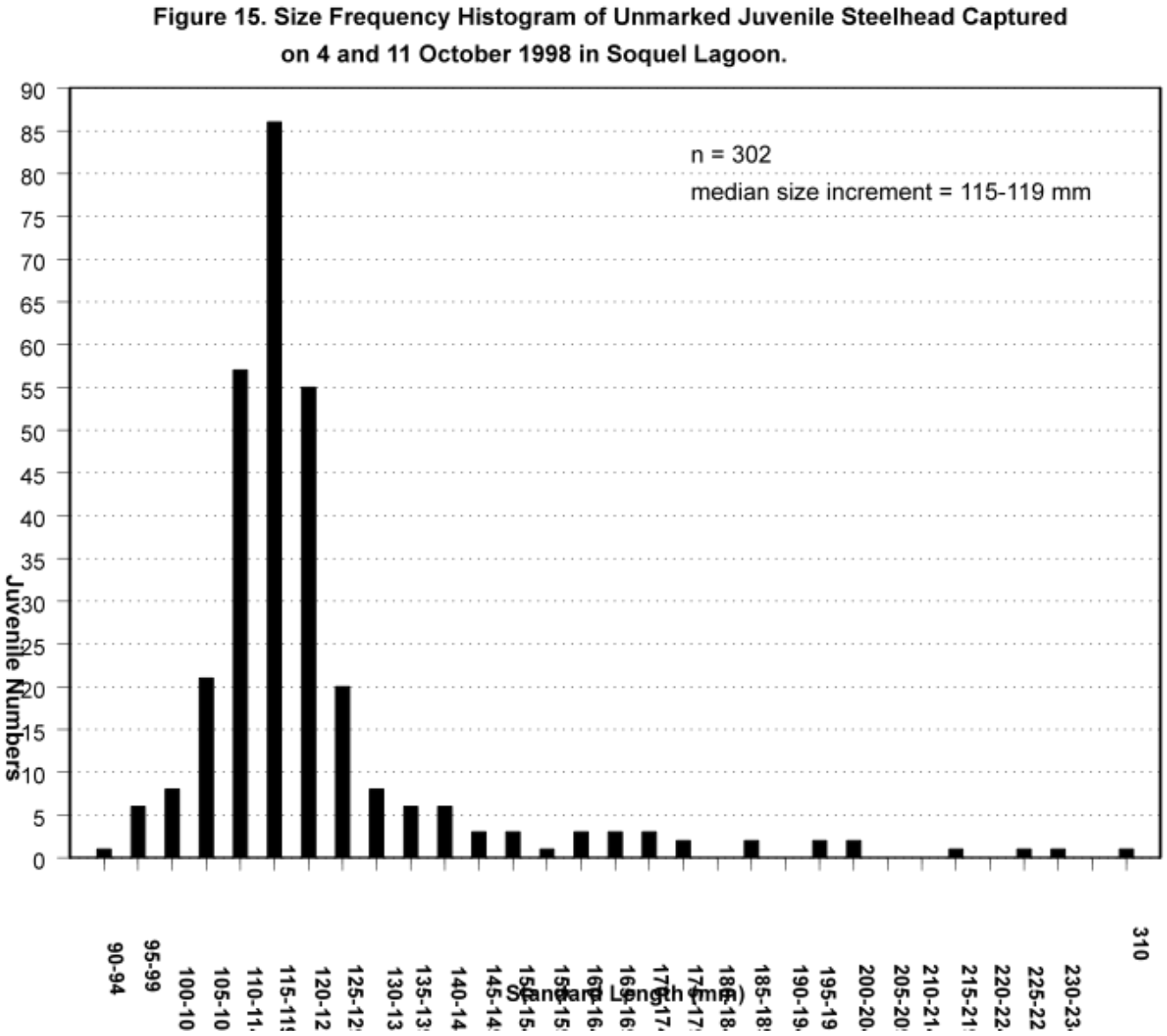


Figure 22. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 4 and 11 October 1998 in Soquel Lagoon.

Population Estimate = 671.

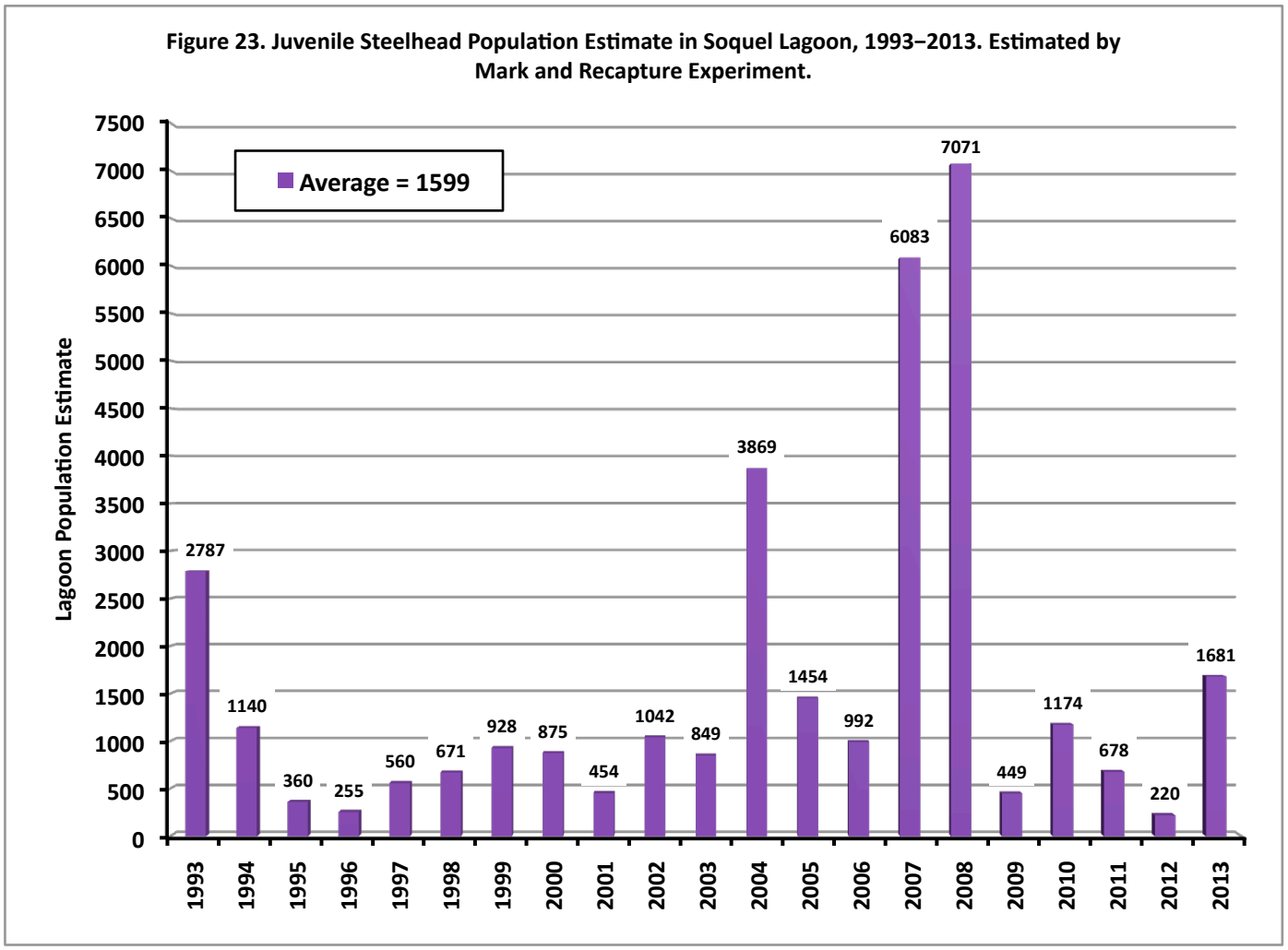


Figure 23. Juvenile Steelhead Population Estimate in Soquel Lagoon, 1993−2013. Estimated by Mark and Recapture Experiment.

Figure 24. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2013.

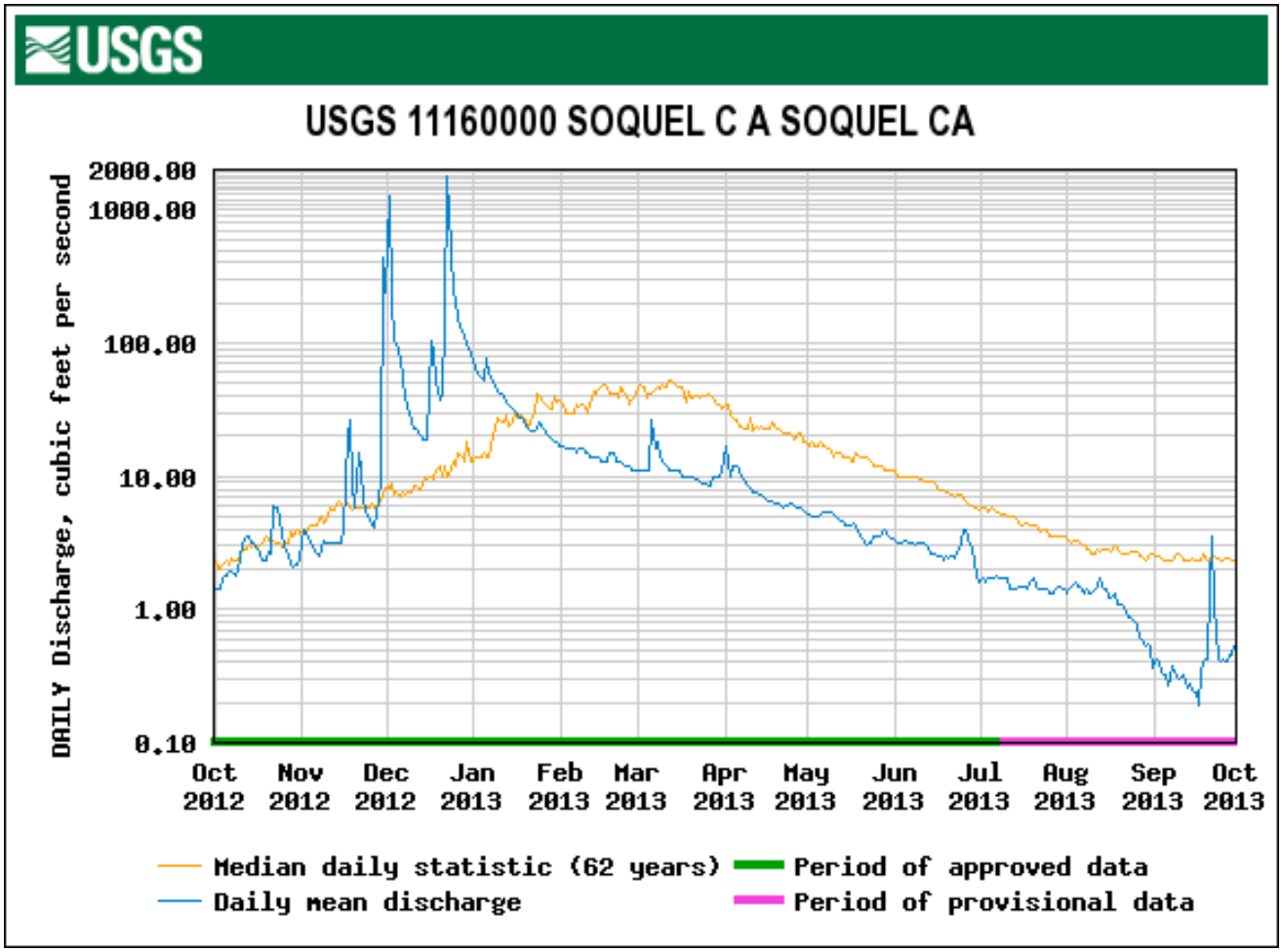


Figure 25. Soquel Creek Actual Streamflow Hydrograph for the USGS Gage in Soquel, CA, October 2012 – May 2013.

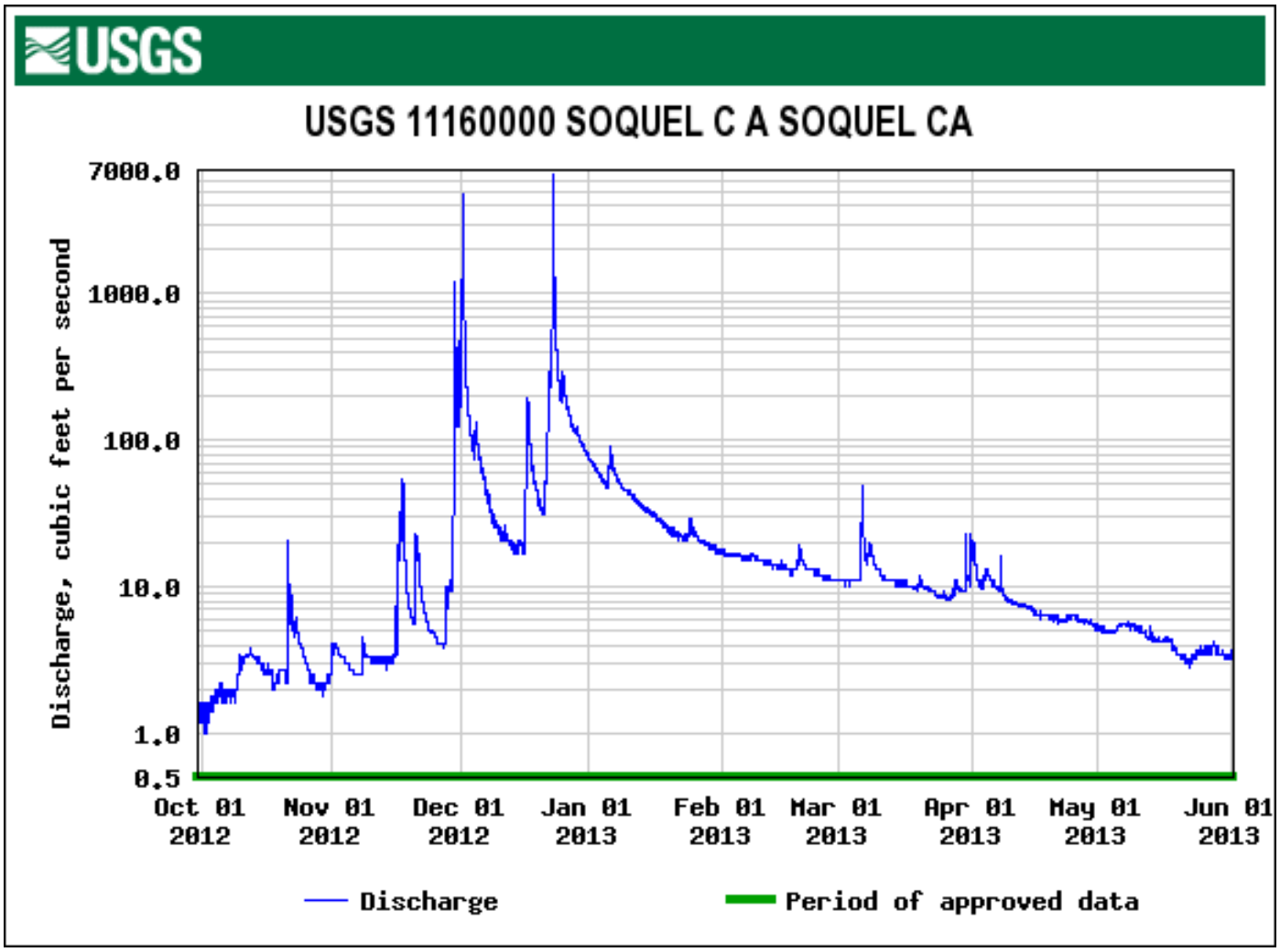


Figure 26. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, 15 May 2013 – 11 February 2014.

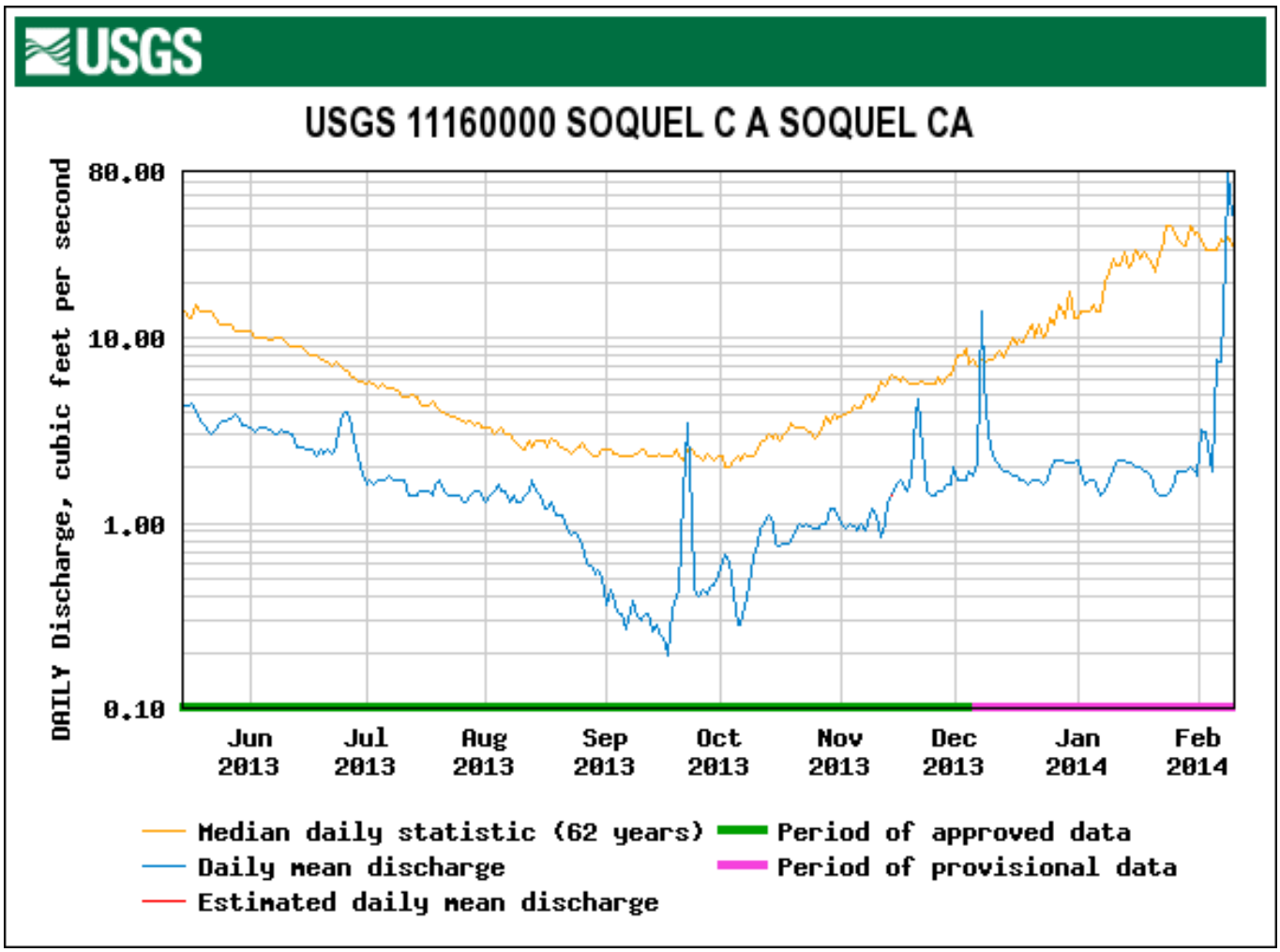


Figure 27. Soquel Creek Actual Streamflow Hydrograph for the USGS Gage in Soquel, CA, 15 May 2013 – 11 February 2014.

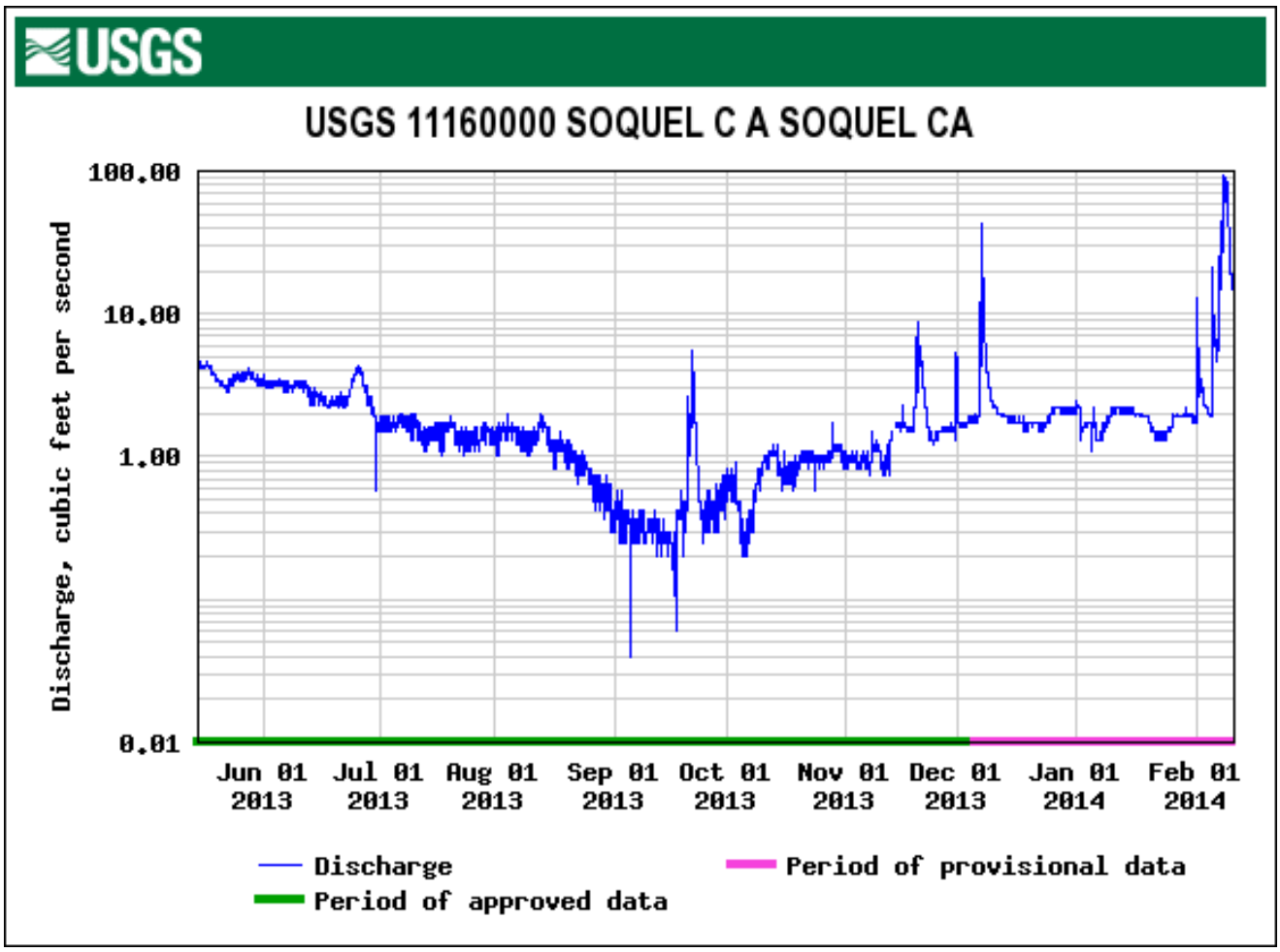


Figure 28. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2012.

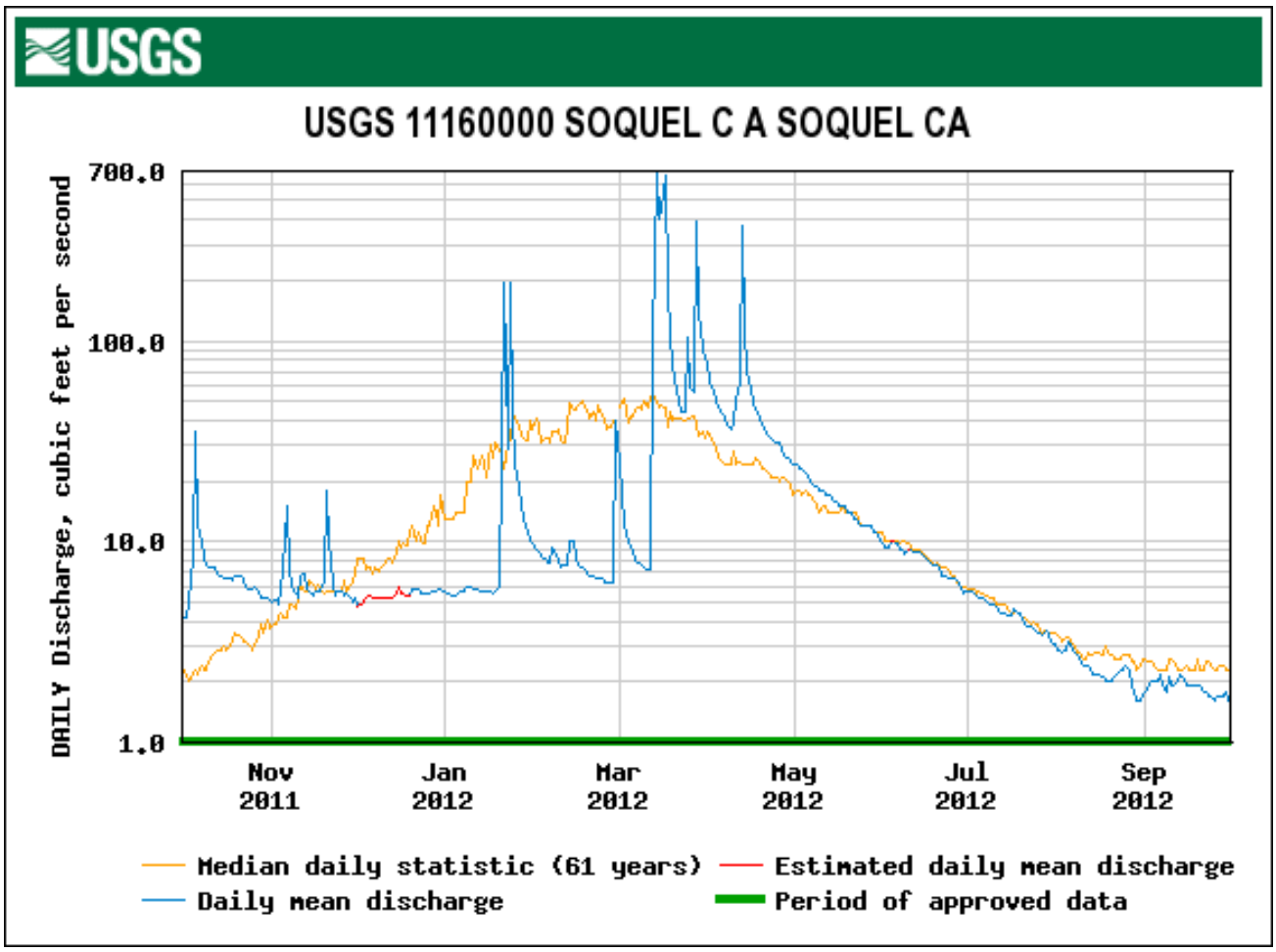


Figure 29. Soquel Creek Actual Measured Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2012.

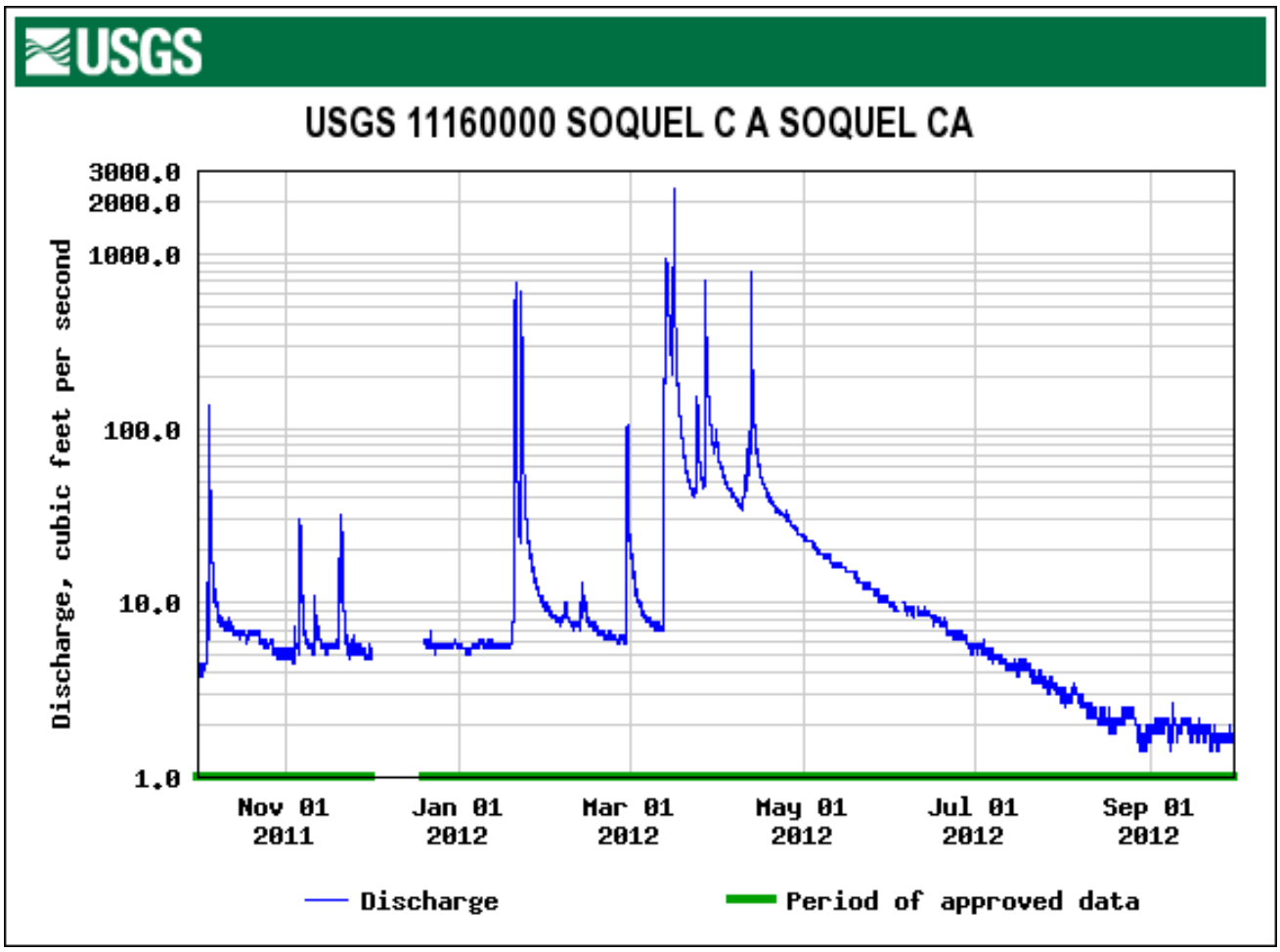


Figure 30. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, 15 May 2012 – 20 November 2012.

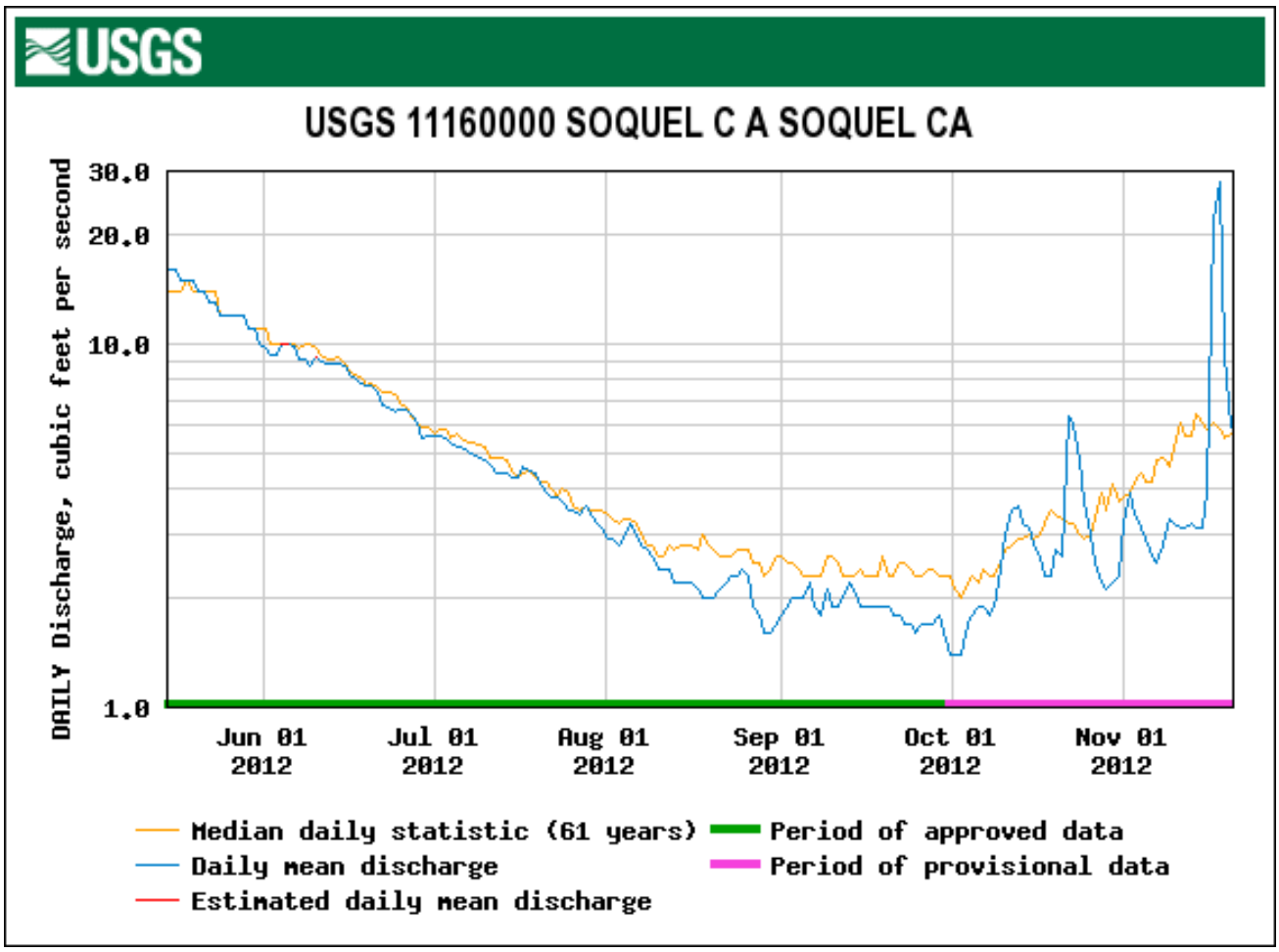


Figure 31. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2011.

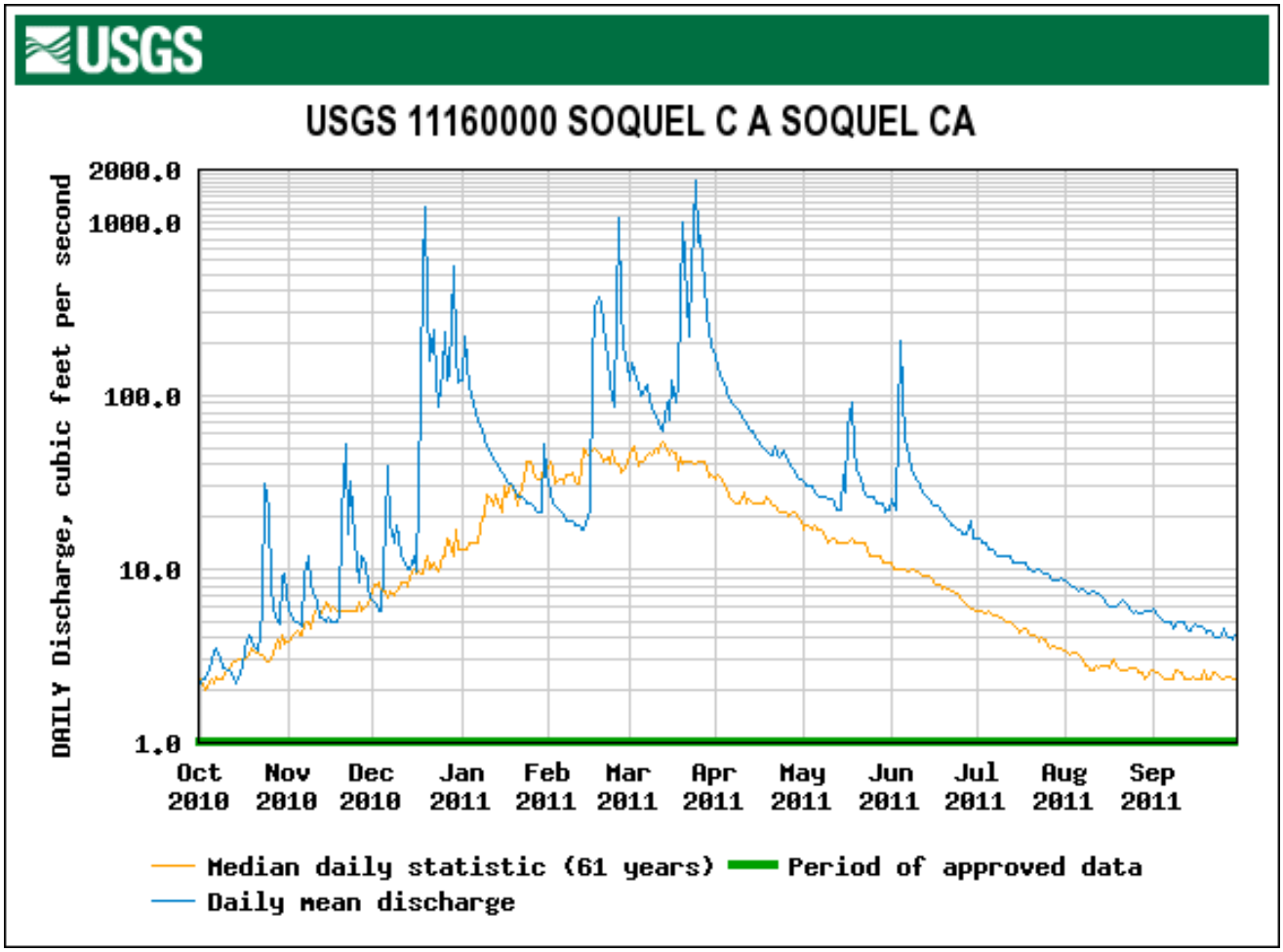


Figure 32. Soquel Creek Actual Measured Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2011.

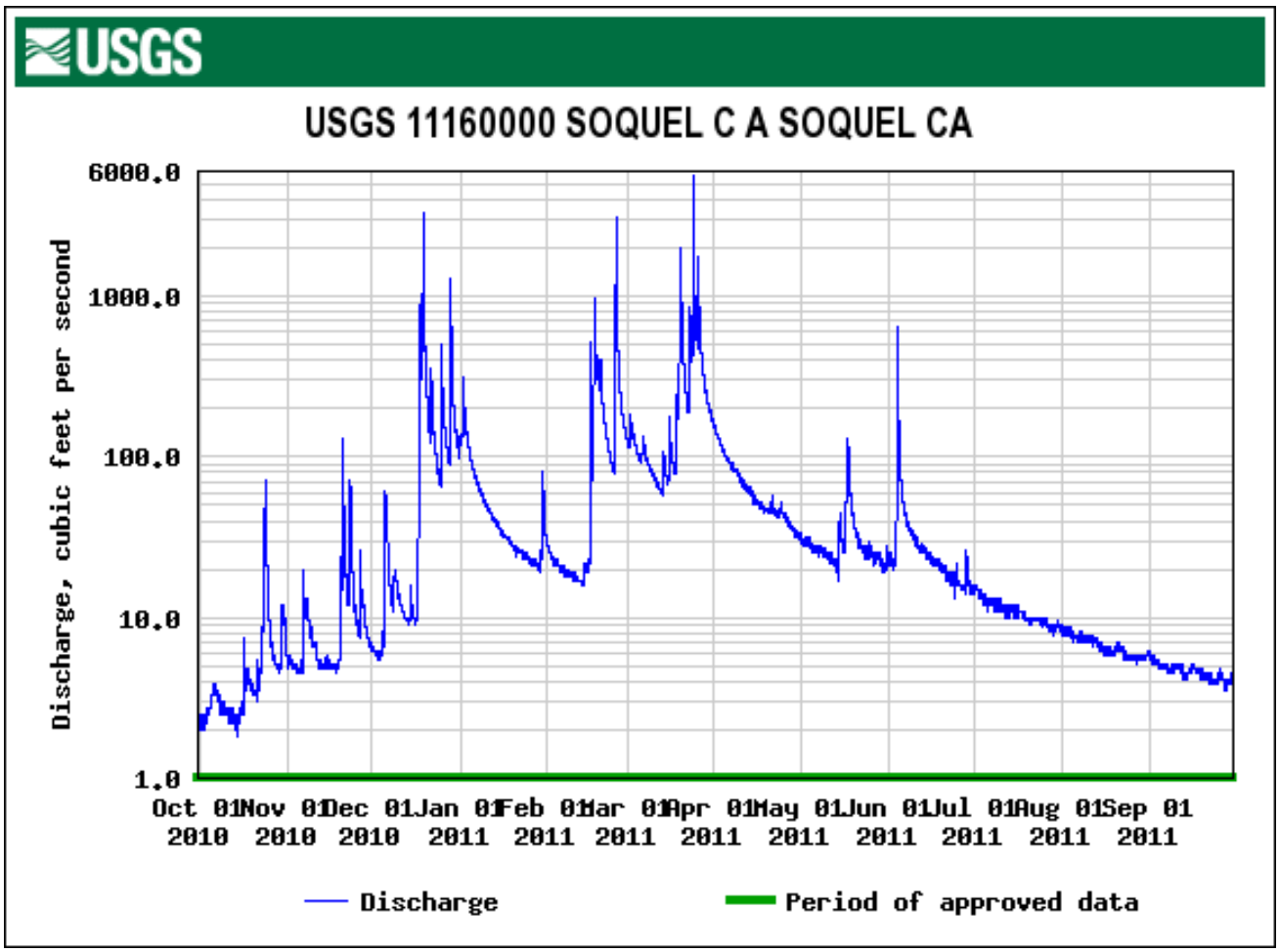


Figure 33. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2010.

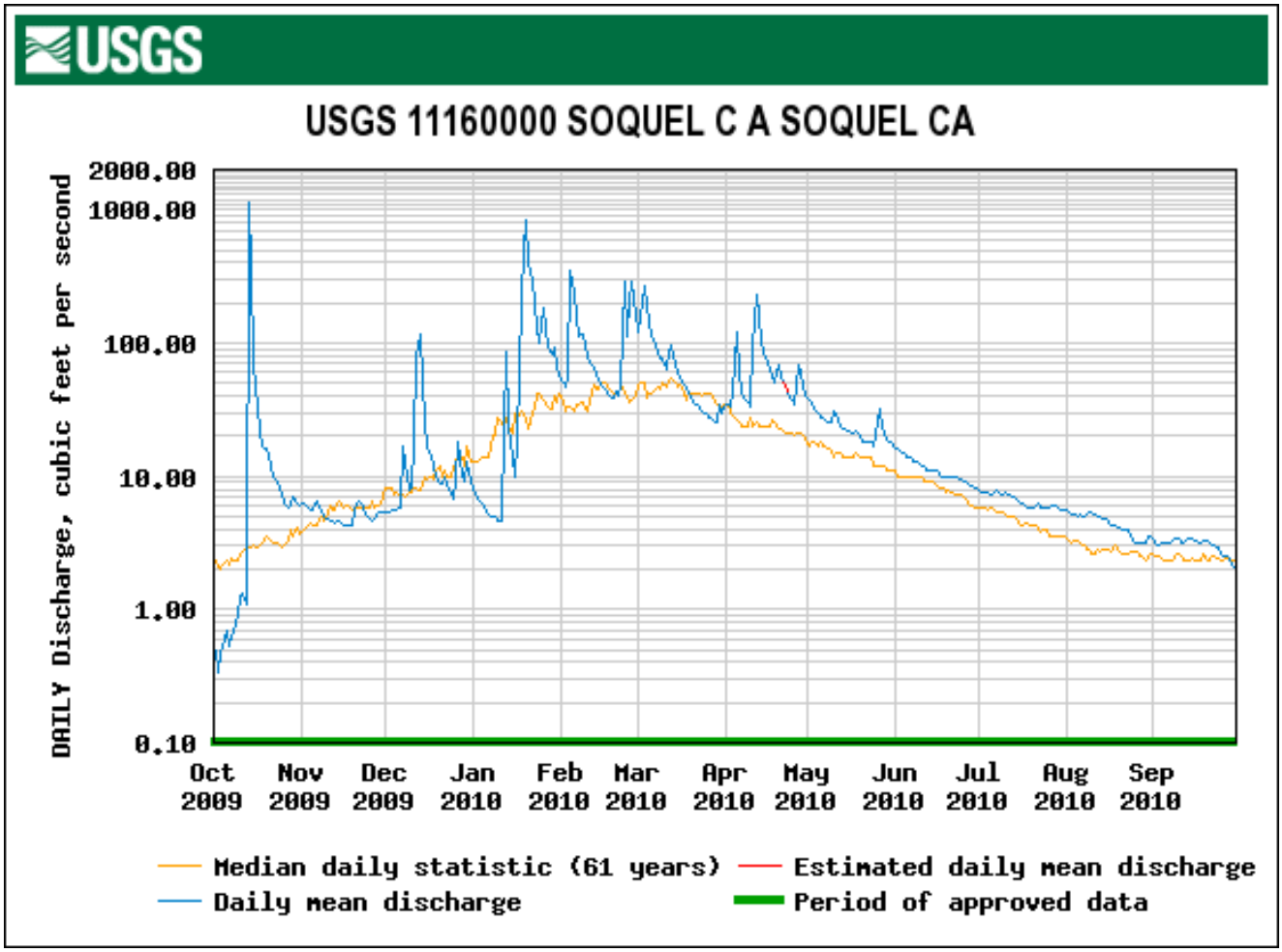


Figure 34. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2009.

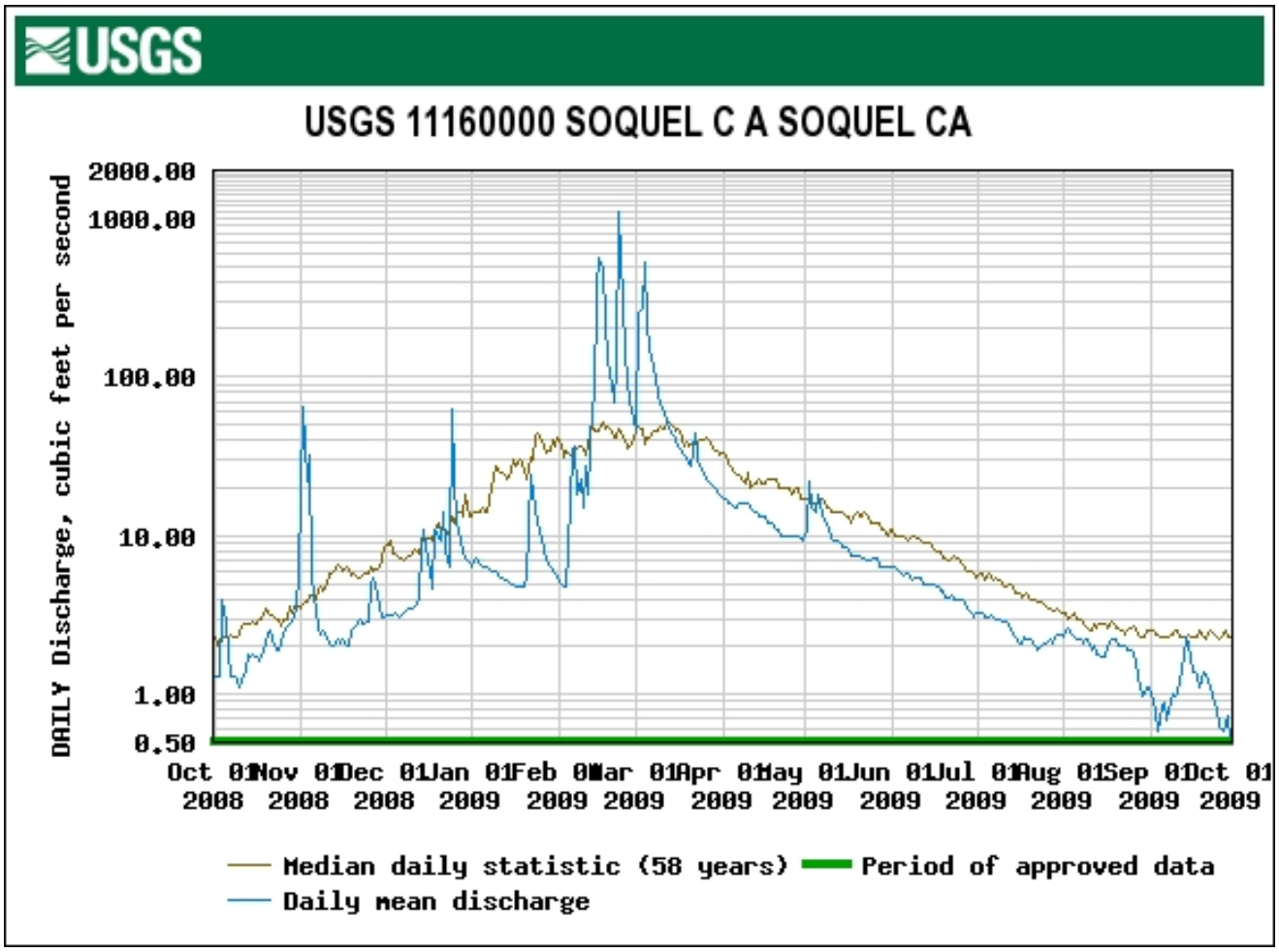


Figure 35. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2008.

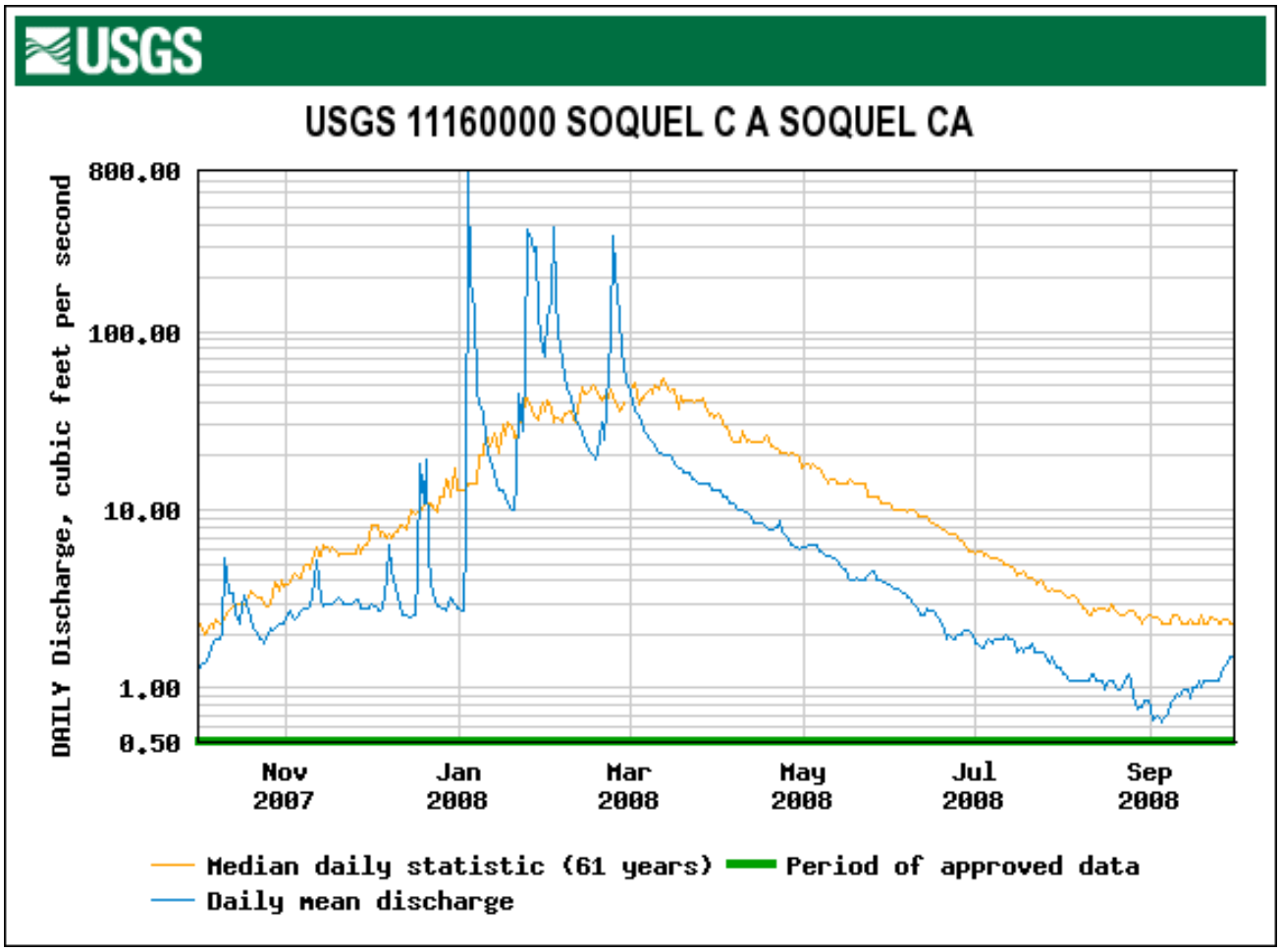
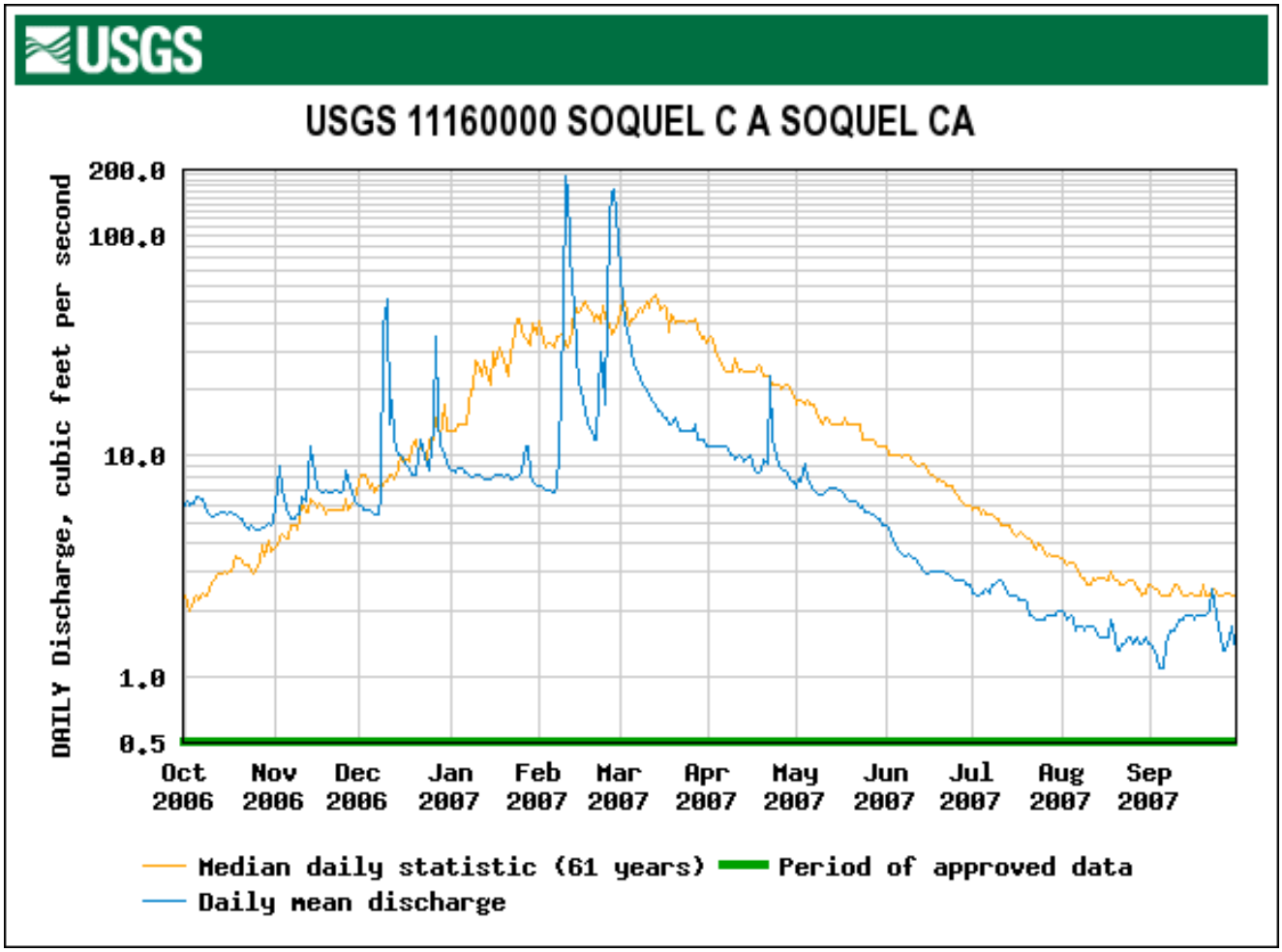


Figure 36. Soquel Creek Mean Daily Streamflow Hydrograph for the USGS Gage in Soquel, CA, Water Year 2007.



APPENDIX A. Water Quality Data and General Observations of Sandbar Management, Birds and Aquatic Vegetation.

28 May 2013. The sandbar had been closed since 23 May. Temperature probes were launched on 30 May in the lagoon and upstream. The lagoon was full to within an inch of the top of the flume at gage height 2.44, with the adult portal in place. Saltwater was detected under the Stockton Bridge and along the Venetian Court wall to a maximum of 6.8 ppt and a water temperature of 24.3° C at the bottom (18° C at the surface). Oxygen levels were supersaturated from 1.25 meters from the surface down to 2.25 meters in the Venetian Court scour hole.

			28-May 2013					
	Flume				**Stockton Bridge and Venetian Court Wall** 1242 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00					18.0	0.5	9.13	827
0.25					18.0	0.5	9.07	827
0.50					18.0	0.5	9.13	827
0.75					17.8	0.5	9.12	821
1.00					17.7	0.5	9.24	819
1.25					19.3	0.5	12.94	842
1.50 under bridge					20.8	1.8	14.90	3228
1.75and deeper-Venetian Court Wall					21.1	3.3	17.70	5800
2.00					23.9	5.2	22.06	9126
2.25b					24.3	6.8	15.15	11723
2.50								
2.75								
3.0								

30 May 2013. Temperature probes were launched in the lagoon and upstream. A shroud was placed over the flume inlet to help draw heavier saltwater off the bottom and through the flume.

			8-June 13					
	Flume		0706 hr		**Stockton Avenue Bridge**			0720 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.0	0.4	8.23	805	18.8	0.4	8.42	764
0.25	19.1	0.4	8.07	807	18.8	0.4	8.25	765
0.50	19.1	0.4	8.31 (89%)	807	18.8	0.4	8.15	765
0.75b	19.1	0.4	8.10	808	18.8	0.4	8.16	765
1.00					18.8	0.4	8.09	765
1.25					18.8	0.4	8.09	764
1.50					18.8	0.4	8.05	764
1.75					18.8	0.4	7.34 (79%)	759
2.0					19.6	0.4	3.24(33%)	768
2.25b					20.4	4.6	0.45 (5%)	7573
	Railroad Trestle			0751 hr	**Mouth of Noble Gulch**			0803 hr
Depth	**Temp 3**	**Salin 3**	**O2 3(sat.)**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	18.5	0.4	8.57	740	18.1	0.4	8.91	709
0.25	18.5	0.4	8.31	747	18.2	0.4	8.64	716
0.50	18.5	0.4	8.33	746	18.2	0.4	8.62	716
0.75	18.5	0.4	8.34	743	18.2	0.4	8.60	717
1.00b	18.4	0.4	8.32 (89%)	735	18.1	0.4	8.45	716
1.25	18.4	0.4	8.34	734				
1.35b	18.4	0.4	5.79	734				
1.50								
1.75								
2.00								

8 June 2013. The first complete water quality monitoring was completed. Water quality looked good and improving. Water temperature was below 20° C for the most part, morning and afternoon. Oxygen was about 90% full saturation in the morning and 100% full saturation in the afternoon at all stations except at greater depths under the Stockton Bridge. There, a dilute saline layer existed (5 ppt) on the bottom, with oxygen about 3 mg/l at 0.25 meters above the bottom and less than 1 mg/l at the bottom. Water temperature at the bottom was only about 20.5° C, which was cooler than the previous week. The biologist recommended that the shroud remain on the flume inlet. The saltwater concentration was going down slowly. The City did a good job of keeping saltwater out of the lagoon since sandbar closure and raising the gage height to 2.55.

Station 1: Flume at 0706 hr. Air temp. 11.9 C. Reach 1- 16 gulls bathing, 1 mallard in the water. Juvenile steelhead hitting the surface at 0700 in Reach 2. No surface algae.
Station 2: Stockton Avenue Bridge at 0720 hr. Secchi depth to bottom. Reach 2-no birds in water. Juvenile steelhead feeding- 40 surface hits/ minute at 0812 hr. No surface algae.
Station 3: Railroad Trestle at 0751 hr. Reach 3- 2 adult mallard ducks and 5 ducklings in water. No surface algae.

Station 4: Mouth of Noble Gulch at 0803 hr. No birds roosting on the downed cottonwood or elsewhere. Domestic ducks absent at lagoon.
Station 5: Nob Hill at 0829 hr. Water temp. = 15.5 C. Oxygen= 8.82 mg/L. (88% sat.), cond.= 616 umhos, salinity= 0.4 ppt. Streamflow - cfs (gage estimate + 0.5 cfs).

			8-June 2013					
	Flume		1545 hr		**Stockton Avenue Bridge**			1525 hr
Depth	**Temp 1**	**Salin 1**	**O2 1(sat.)**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2(sat.)**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.4	0.4	9.39	773	19.5	0.4	9.25	779
0.25	19.4	0.4	9.40	775	19.5	0.4	9.14	781
0.50	19.4	0.4	9.29 (101)	786	19.5	0.4	9.07	781
0.75b	19.5	0.4	9.23	792	19.4	0.4	9.14	774
1.00					19.2	0.4	9.19	767
1.25					19.1	0.4	9.18	749
1.50					19.1	0.4	9.16	751
1.75					19.0	0.4	9.19 (99)	752
2.00					20.3	1.4	5.34 (16)	1252
2.25b					20.5	4.7	1.35	7598
	Railroad Trestle			1510 hr	**Mouth of Noble Gulch**			1500 hr
Depth	**Temp 3**	**Salin 3**	**O2 3(sat.)**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4(sat.)**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.5	0.4	9.19	779	19.4	0.4	9.12	750
0.25	19.5	0.4	9.07	781	19.3	0.4	8.89	748
0.50	19.5	0.4	9.11	780	19.2	0.4	8.94	748
0.75	19.5	0.4	9.20	774	19.0	0.4	8.78 (95)	740
1.00b	19.3	0.4	9.32 (102)	759	18.3	0.4	9.32	701
1.25	18.9	0.4	9.39 (101)	742				
1.35b	18.8	0.4	8.46	730				

8 June 2013. Gage height of 2.53 in afternoon. Inlet shroud in place. Underwater portal present for adults. Flume inlet depth = 1.1 ft. Outlet depth = 1 ft. 2 4"x4" boards in outlet. Overcast.
Station 1: Flume at 1545 hr. Air temp. 16.8 C. No surface algae. Reach 1- 16 gulls bathing.
Station 2: Stockton Avenue Bridge at 1525 hr. Secchi depth to bottom. No surface algae. Reach 2- 2 adult mallards, 1 duckling.
Station 3: Railroad Trestle at 1515 hr. Reach 3- 1 coot, one isolated mallard duckling, 2 mallard ducklings near downed cottonwood. No surface algae.
Station 4: Mouth of Noble Gulch at 1500 hr. No birds on cottonwood. Bottom invisible due to plankton bloom.
Station 5: Nob Hill at 1610 hr. Water temp. =16.8. Oxygen= 10.26 mg/L (106% saturation), cond. = 630 umhos. Salinity =0.4 ppt.

10 June 2013. City staff and Morrison cabled drift wood under the Stockton Bridge to provide cover for tidewater goby and steelhead.

14 June 2013. Adult portal made smaller to bring lagoon up 3 inches.

15 June 2013. Lagoon level back up to top of flume inlet.

			22-June-2013					
	Flume			0705 hr	**Stockton Avenue Bridge**			0720 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.7	0.4	8.08	763	19.9	0.4	8.10	769
0.25	19.7	0.4	8.02	772	19.9	0.4	7.96	771
0.50	19.7	0.4	8.04 (88)	772	19.9	0.4	7.92	772
0.70b	19.7	0.4	7.99	772				
0.75					19.9	0.4	7.89	772
1.00					19.9	0.4	7.87	772
1.25					19.9	0.4	7.82	772
1.50					19.9	0.4	7.87	772
1.75					19.9	0.4	7.82 (82)	772
2.00					19.9	0.4	7.77	772
2.25b					19.9	0.4	4.32	776
	Railroad Trestle			0745 hr	**Mouth of Noble Gulch**			0757 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.6	0.4	8.42	762	19.3	0.4	8.50	748
0.25	19.6	0.4	8.27	764	19.3	0.4	8.34	750
0.50	19.6	0.4	8.24	764	19.3	0.4	8.26	750
0.75	19.6	0.4	8.18	764	19.3	0.4	8.17 (89)	750
1.00b	19.6	0.4	8.11	764	19.3	0.4	8.07	750
1.25	19.6	0.4	8.02 (88)	764				
1.38b	19.6	0.4	7.47	764				

22 June 2013. Gage height of 2.57 in morning. Fog burned off early but back at 0745. Air temperature of 12.2^{o}C at 0705 hr.
Station 1: Flume 0705 hr. Reach 1- 22 gulls bathing. No surface algae.
Station 2: Stockton Bridge 0720 hr. Reach 2 no waterfowl; no surface algae.
Station 3: Railroad trestle 0745 hr. Reach 3- 1 female mallard with 3 ducklings. 1 female mallard with 4 ducklings. No surface algae. Steelhead hitting surface at 22 hits/ minute
Station 4: Noble Gulch 0757 hr. No waterfowl on cottonwood. Domestic ducks absent at lagoon. No surface algae.
Station 5: Nob Hill at 0825 hr. Water temperature 15.8^{o}C. Conductivity 618 umhos. Salinity 0.4 ppt. Oxygen 8.61 mg/l (86% saturation). - cfs (gage estimate + 0.5 cfs).

			22 June 2013					
	Flume			1547 hr	**Stockton Avenue Bridge**			1520 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.1	0.4	10.32	788	21.2	0.4	9.96	791
0.25	21.1	0.4	10.53	789	21.2	0.4	10.13	792
0.50	21.1	0.4	10.72 (121)	790	21.2	0.4	10.16	792
0.70b	20.9	0.4	10.82	787				
0.75					21.2	0.4	10.24	793
1.00					21.2	0.4	10.28	792
1.25					21.1	0.4	10.25	791
1.50					21.0	0.4	10.25	787
1.75					20.9	0.4	10.17	785
2.00					20.9	0.4	9.93 (111)	785
2.25b					20.8	0.4	9.30	784
	Railroad Trestle			1512 hr	**Mouth of Noble Gulch**			1500 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.7	0.4	9.61	799	22.0	0.4	9.40	804
0.25	21.7	0.4	9.68	799	22.0	0.4	9.48	803
0.50	21.6	0.4	9.78	797	21.8	0.4	9.38	800
0.75	21.5	0.4	9.75	796	21.7	0.4	9.36	797
1.00	20.9	0.4	10.14 (114)	787	19.6	0.4	9.87 (107)	747
1.05b					19.7	0.4	10.24	756
1.25	20.6	0.4	10.29 (114)	776				
1.40b	20.6	0.4	10.32	775				

22 June 2013. Gage height of 2.59 in afternoon. Clear and breezy. Air temperature of 18.6^{o}C at 1547 hr. Flume inlet = 1.0 ft. Flume outlet = 0.8 ft

Station 1: Flume 1547 hr. Reach 1- 41 gulls bathing. Cannot see bottom due to plankton bloom. No surface algae.

Station 2: Stockton Bridge 1520 hr. Reach 2- Bottom algae 20% coverage; avg. thickness = 0.3 ft; range of 0.3 - 1.0 ft; no surface algae.

Station 3: Railroad trestle 1512 hr. Reach 3- 4 female mallards with 7, 4, 3 and 1 ducklings, respectively. One male mallard. Bottom algae 15% coverage; avg thickness = 0.8 ft; range of 0.3 to 1.2 ft. No surface algae.

Station 4: Noble Gulch 1500 hr. 2 mallards on cottonwood. Bottom algae 30% coverage; avg. thickness = 0.2 ft.

Station 5: Nob Hill at 1618 hr. Water temperature 18.4^{o} C. Conductivity 651 umhos. Salinity 0.4 ppt. Oxygen 10.40 mg/l.

			6 July 2013					
	Flume 0709 hr				**Stockton Avenue Bridge** 0725hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.5	0.4	7.73	808	21.8	0.4	8.02	8.06
0.25	21.6	0.4	7.67	810	21.8	0.4	7.98	799
0.50	21.7	0.4	7.69 (81)	810	21.8	0.4	8.02	810
0.75b	21.7	0.4	7.50	810	21.8	0.4	7.95	810
1.00					21.8	0.4	7.91	811
1.25					21.8	0.4	7.71	810
1.50					21.8	0.4	7.76	810
1.75					21.8	0.4	7.75 (88)	810
2.00					21.8	0.4	7.62 (87)	811
2.20b					21.8	0.4	7.34	811
	Railroad Trestle 0745hr				**Mouth of Noble Gulch**			0805hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.5	0.4	8.13	797	21.1	0.4	8.18	790
0.25	21.5	0.4	7.95	803	21.1	0.4	7.85	794
0.50	21.5	0.4	7.86	802	21.1	0.4	7.82	794
0.75	21.5	0.4	7.83	802	21.1	0.4	7.80	794
1.00	21.4	0.4	7.67	802	21.1	0.4	7.10 (80)	794
1.05b					21.1	0.4	6.64	793
1.25	21.4	0.4	7.34 (83)	802				
1.40b	21.4	0.4	6.74	802				

6 July 2013. Gage height of 2.58 in morning. Overcast, misty. Air temp. = 15.1° C at 0709 hr.
Station 1: Flume 0709 hr. Reach 1- 2 female mallards with 3 and 4 ducklings, respectively. 21 gulls bathing. No surface algae.
Station 2: Stockton Bridge 0725 hr. Reach 2- 4 mallards. Occasional steelhead surface hit.
Station 3: Railroad trestle 0745 hr. Reach 3- 11 adult mallards and 1 coot. Mother and daughter feeding the ducks. No surface algae.
Station 4: Noble Gulch 0805 hr. 1 green back heron roosting on dock at Noble Gulch. 6 previously dabbling mallards roosted on cottonwood. Domestic ducks absent at lagoon. A man was fishing beyond Noble Gulch. The biologist told him to stop, which he did after saying he thought you could fish on national holiday weekends……
Station 5: Nob Hill at 0839 hr. Water temperature 17.1° C. Conductivity 639 umhos. Salinity 0.4 ppt. Oxygen 7.92 mg/l (82% saturation). - estimate (gage estimate + 0.5 cfs).

			6 July 2013					
	Flume			1551 hr	**Stockton Avenue Bridge**			1530 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	22.3	0.4	9.17	815	22.3	0.4	9.27	818
0.25	22.3	0.4	9.21	817	22.3	0.4	9.32	818
0.50	22.3	0.4	9.28	817	22.3	0.4	9.31	818
0.75b	22.3	0.4	9.03	817	22.3	0.4	9.32	818
1.00					22.2	0.4	9.28	818
1.25					22.2	0.4	9.23	816
1.50					22.2	0.4	9.19	816
1.75					22.1	0.4	9.16	815
2.00					22.1	0.4	9.03 (104)	816
2.25b					22.1	0.4	8.75	815
	Railroad Trestle			1518 hr	**Mouth of Noble Gulch**			1500 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	22.2	0.4	9.23	815	22.1	0.4	8.62	812
0.25	22.1	0.4	9.37	815	22.1	0.4	8.55	813
0.50	22.1	0.4	9.40	814	22.0	0.4	8.38	811
0.75	22.0	0.4	9.56	813	21.7	0.4	8.42	804
1.00	22.0	0.4	9.57 (110)	812	21.2	0.4	12.6 (142)	832
1.05b					21.5	0.4	12.71	832
1.25b	22.0	0.4	9.60 (110)	811				
1.42b	22.0	0.4	9.35	811				
1.50								

6 July 2013. Gage height of 2.60 in afternoon. Sunny and breezy. Air temperature of 16.7^{o}C at 1551 hr. Flume inlet approx. 1.0 ft depth. Flume exit depth 1.0 ft. Adult portal covered loosely with some leakage. Approximately 1-2 cfs at Soquel Avenue Bridge at 1700 hr.
Station 1: Flume at 1551 hr. Reach 1- Bottom invisible due to plankton bloom. 9 gulls bathing. No surface algae.
Station 2: Stockton Avenue Bridge at 1530 hr. Secchi depth to bottom. Reach- No surface algae, 100% of bottom covered with algae, 0.2- 3.0 ft thick, averaging 0.8 ft. Thick plankton bloom.
Station 3: Railroad Trestle at 1518 hr. Reach 3- No surface algae, 100% of bottom covered with algae. 0.5-3.0 ft thick, averaging 1.0 ft. Thick plankton bloom. 1 female mallard and 3 ducklings. **Station 4:** Mouth of Noble Gulch at 1500 hr. No waterfowl on downed cottonwood. Bottom algae 0.2-2.0 ft thick, averaging 0.5 ft. Thick plankton bloom.
Station 5: Nob Hill at 1637 hr. Water temperature 18.3^{o}C. Conductivity 648 umhos. Salinity 0.4 ppt. Oxygen 9.76 mg/l.

			20-July-13					
	Flume 0703 hr				**Stockton Avenue Bridge** 0712 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**mg/l (% sat.)**	**umhos**	**(C)**	**(ppt)**	**mg/l (% sat.)**	**Umhos**
0.00	20.3	0.4	8.88	774	20.4	0.4	9.08	771
0.25	20.3	0.4	8.94	776	20.4	0.4	9.02	777
0.50	20.4	0.4	8.95 (100)	776	20.4	0.4	9.08	777
0.75b	20.4	0.4	8.67	776	20.4	0.4	9.07	777
1.00					20.4	0.4	9.07	777
1.25					20.4	0.4	9.08	777
1.50					20.4	0.4	9.11	777
1.75					20.4	0.4	9.06	777
2.00					20.4	0.4	8.75 (97)	776
2.25					20.4	0.4	4.74	777
			20-July-13					
	Railroad Trestle 0736 hr				**Mouth of Noble Gulch**			0747 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**mg/l (% sat.)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**Umhos**
0.00	20.1	0.4	8.47	769	19.7	0.4	8.92	761
0.25	20.1	0.4	8.27	770	29.7	0.4	8.79	761
0.50	20.2	0.4	8.13	770	19.7	0.4	8.76	761
0.75	20.2	0.4	8.02	770	19.7	0.4	8.43 (92)	761
1.00	20.1	0.4	7.37	769	20.0	0.4	3.94 (42)	763
1.05b					20.1	0.4	1.46	784 (662 @ Noble G. outlet @ bottom)
1.25	20.1	0.4	7.15 (79)	767				
1.45b	20.1	0.4	6.57	766				

20 July 2013. Gage height of 2.61 in morning. Overcast/misty/breezy. Air temperature of 12.9°C at 0703 hr.

Station 1: Flume at 0703 hr. Reach 1- 5gulls bathing, 6 mergansers, 1 mallard in water, 3 mallards on Venetian Court marginal sand. No surface algae.

Station 2: Stockton Avenue Bridge at 0712 hr. Secchi depth to bottom. Reach 2- 5 mallards. No surface algae.

Station 3: Railroad Trestle at 0736 hr. Reach 3- 5 adult mallards, 3 ducklings without mother, 1 gull in water. 2 gulls roosting on Golino wood. Mergansers from Reach 1 had moved into Reach 3. No surface algae.

Station 4: Mouth of Noble Gulch at 0747 hr. No waterfowl on downed cottonwood. No surface algae. Domestic ducks absent at lagoon.

Station 5: Nob Hill at 0825 hr. Water temperature 16.4° C. Conductivity 614 umhos. Oxygen 8.26 mg/l (85% saturation). Salinity 0.4 ppt.

			20-July-13					
	Flume 1603 hr				**Stockton Avenue Bridge** 1547 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**mg/l (% sat.)**	**umhos**	**(C)**	**(ppt)**	**mg/l (% sat.)**	**Umhos**
0.00	20.8	0.4	9.43	782	20.7	0.4	9.87	779
0.25	20.8	0.4	9.60	782	20.8	0.4	9.95	779
0.50	20.8	0.4	9.72 (109)	781	20.7	0.4	9.95	779
0.75b	20.8	0.4	9.46	782	20.7	0.4	10.01	779
1.00					20.7	0.4	9.96	779
1.25					20.7	0.4	9.88	779
1.50					20.6	0.4	9.72	778
1.75					20.6	0.4	9.56 (107)	778
2.00					20.6	0.4	9.42 (105)	778
2.25b					20.6	0.4	9.06	778
			20-July-13					
	Railroad Trestle 1534 hr				**Mouth of Noble Gulch** 1515 hr			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**mg/l (% sat.)**	**umhos**	**(C)**	**(ppt)**	**mg/l (% sat.)**	**Umhos**
0.00	20.5	0.4	9.65	775	20.3	0.4	9.06	767
0.25	20.5	0.4	9.74	775	20.3	0.4	8.85	768
0.50	20.5	0.4	9.87	774	20.2	0.4	8.86	767
0.75	20.5	0.4	10.42	774	20.2	0.4	8.86	767
1.00	20.4	0.4	11.15	772	20.0	0.4	11.96 (132)	764
1.05b					20.1	0.4	11.70	797
1.25	20.4	0.4	11.50 (128)	770				
1.50b	20.4	0.4	11.92	768				

20 July 2013. Gage height of 2.62 in afternoon. Overcast/ breezy. Air temp. = 16.9° C at 1603 hr.
Station 1: Flume at 1603 hr. Reach 1- 33 gulls. No surface algae. Could not see bottom to estimate plant abundance.
Station 2: Stockton Avenue Bridge at 1547 hr. Secchi depth to bottom. Reach 2- No surface algae. 100% of the bottom algae 0.2 – 2.0 ft thick, averaging 1.0 ft. 1 female mallard and 4 large ducklings.
Station 3: Railroad Trestle at 1534 hr. Reach 3- No surface algae. Bottom invisible due to overcast and surface ripples. 8 mallards in water.
Station 4: Mouth of Noble Gulch at 1515 hr. 100% of the bottom algae 0.2 – 2.5 ft thick, averaging 1.2 ft. No surface algae. 3 mallards and 1 coot on downed cottonwood
Station 5: Nob Hill at 1646 hr. Water temperature 17.5 ° C. Conductivity 627 umhos. Oxygen 10.08 mg/l. Salinity 0.4 ppt.

			3-Aug-13					
	Flume 0706 hr				**Stockton Avenue Bridge** 0720 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	20.3	0.4	8.89	776	20.5	0.4	9.44	780
0.25	20.4	0.4	9.05	778	20.6	0.4	9.43	780
0.50	20.4	0.4	9.74	778	20.6	0.4	9.49	781
0.75b	20.4	0.4	8.91	778	20.5	0.4	9.45	781
1.00					20.6	0.4	9.44	781
1.25					20.6	0.4	9.54	781
1.50					20.6	0.4	9.34	781
1.75					20.6	0.4	9.36 (102%)	781
2.00					20.5	0.4	9.17	782
2.25b					20.6	0.4	7.48	782
			3-Aug-13					
	Railroad Trestle 0745 hr				**Mouth of Noble Gulch** 0756 hr			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	20.2	0.4	8.68	778	19.6	0.4	8.62	771
0.25	20.2	0.4	8.55	779	19.6	0.4	8.52	774
0.50	20.3	0.4	8.33	780	19.6	0.4	8.50	774
0.75	20.2	0.4	8.06	781	19.6	0.4	8.49	774
1.00	20.2	0.4	7.97	781	19.6	0.4	4.56 (56%)	775
1.05b					19.9	0.4	1.12	789
1.25	20.2	0.4	7.96 (88%)	780				
1.50b	20.2	0.4	5.14	781				

3 August 2013. Gage height of 2.60 (morning) and 2.60 (afternoon). Overcast/ misty/ breezy at 0706 hr with air temperature of 13.2 °C. Air temperature 16.2º C at 1603 hr and clear/breezy. Flume inlet 1.0 ft. Flume outlet 0.8 ft in afternoon.

Station 1: Flume at 0706 hr. Reach 1- 11 gulls bathing, 1 mallard in water, 4 mallards on Venetian beach. No surface algae. Visitor saw steelhead hitting surface at 0600 hr.

Station 2: Stockton Avenue Bridge at 0720 hr. Secchi depth to the bottom. Reach 2-no waterfowl, no surface algae.

Station 3: Railroad trestle at 0745 hr. Reach 3- 10 mallards in water. Surface algae < 1%.

Station 4: Mouth of Noble Gulch at 0756 hr. No surface algae. 1 mallard on downed cottonwood and 2 mallards on Golino wood. Domestic ducks absent at lagoon.

Station 5: Nob Hill at 0824 hr. Water temperature at 16.1°C. Conductivity 603 umhos, Oxygen 8.03 mg/l (81% saturation). Salinity 0.4 ppt.

1603 hr			3-Aug-13					1535 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**Umhos**
0.00	20.9	0.4	9.69		20.9	0.4	11.07	787
0.25	21.0	0.4	9.85		21.0	0.4	1-.20	787
0.50	21.0	0.4	9.95 (112%)		20.9	0.4	10.23	787
0.75b	21.0	0.4	9.95		20.9	0.4	10.22	787
1.00					20.9	0.4	10.19	786
1.25					20.8	0.4	10.20	786
1.50					20.8	0.4	10.14	785
1.75					20.7	0.4	9.92	784
2.00					20.6	0.4	9.78 (109%)	783
2.25b					20.6	0.4	6.91	783
1522hr			3-Aug-13					1507 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	20.9	0.4	9.35	789	20.5	0.4	8.73	783
0.25	20.9	0.4	9.44	790	20.4	0.4	8.60	782
0.50	20.8	0.4	9.58	788	20.3	0.4	8.63	777
0.75	20.7	0.4	9.64	788	20.1	0.4	9.20	781
1.00	20.7	0.4	9.63	788	20.3	0.4	14.91 (166%)	787
1.05b					20.3	0.4	14.47	784
1.25	20.6	0.4	9.96 (111%)	787				
1.50b	20.6	0.4	9.96	782				

Station 1: Flume at 1603 hr. Reach 1- 71 gulls and 2 brown pelicans. No surface algae. 100% bottom algal coverage- 1- 4 ft thick, avg. = 2.0 ft. 6 mallards moved down from Reach 3.
Station 2: Stockton Avenue Bridge at 1535 hr. Secchi depth to the bottom. Reach 2- No surface algae. 100% of bottom covered by algae 0.2 – 4 ft thick, averaging 1.5 ft. 6 mallards moved down from Reach 3.
Station 3: Railroad trestle at 1522 hr. Reach 3- No surface algae. 100% of bottom covered by algae 0.2-3 ft thick, averaging 0.5 ft. <1% pondweed + algae 1 ft thick near trestle. 14 mallards dabbling near Noble Gulch, 1 coot, 1 merganser.
Station 4: Mouth of Noble Gulch at 1507 hr. No surface algae. 60% of bottom covered by algae 1 – 2.5 ft thick, averaging 2 ft. 3 mallards on downed cottonwood.
Station 5: Nob Hill at 1638 hr. Water temperature at 17.1°C. Conductivity 617 umhos, Oxygen 9.49 mg/l. Salinity 0.4 ppt. 2 boys were fishing. They were told to cease, and they did.

			17-Aug-13					
	Flume 0700 hr				**Stockton Avenue Bridge** 0713 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.5	0.4	9.34	811	21.6	0.4	10.15	796
0.25	21.5	0.4	9.45	810	21.6	0.4	10.25	811
0.50	21.5	0.4	9.56	810	21.6	0.4	10.30	811
0.75b	21.5	0.4	9.24	810	21.6	0.4	10.28	811
1.00					21.6	0.4	10.30	811
1.25					21.7	0.4	10.20	812
1.50					21.6	0.4	10.15	812
1.75					21.6	0.4	9.98 (114%)	812
2.00					21.6	0.4	9.91 (113%)	812
2.25b					21.6	0.4	9.36	812
			17-Aug-13					
	Railroad Trestle 0735 hr				**Mouth of Noble Gulch** 0746 hr			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	21.5	0.4	9.48	811	21.1	0.4	9.16	812
0.25	21.5	0.4	9.48	814	21.1	0.4	8.99	813
0.50	21.5	0.4	9.45	814	21.1	0.4	9.02	813
0.75	21.5	0.4	9.42	814	21.1	0.4	8.94 (101%)	813
1.00	21.5	0.4	9.38	814	21.3	0.4	4.61 (52%)	824
1.08b					21.3	0.4	1.43	845
1.25	21.5	0.4	9.39 (107%)	814				
1.50b	21.5	0.4	7.23	814				

17 August 2013. Gage height of 2.60 (morning) and 2.60 (afternoon). Overcast at 0700 hr with air temperature of 15.6 °C. Air temperature 18.0º C at 1547 hr and clear. Flume inlet 0.8 ft. Flume outlet 0.5 ft in afternoon.

Station 1: Flume at 0700 hr. Reach 1- 18 gulls bathing, 4 mallards in water. 3 mallards and 1 merganser on Venetian beach. Later there were 10 mallards and 1 cormorant in water. No surface algae.

Station 2: Stockton Avenue Bridge at 0713 hr. Secchi depth to the bottom. Reach 2- Greenback heron in willows. 23 steelhead surface hits/ min. No surface algae.

Station 3: Railroad trestle at 0735 hr. Reach 3- 5 mallards in water. Surface algae < 1%.

Station 4: Mouth of Noble Gulch at 0746 hr. 2% surface algae. No waterfowl. Domestic ducks absent at lagoon.

Station 5: Nob Hill at 0837 hr. Water temperature at 17.4°C. Conductivity 623 umhos, Oxygen 7.28 mg/l (76% saturation). Salinity 0.4 ppt.

1547 hr			17-Aug-13					1526 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**Umhos**
0.00	22.3	0.4	11.20	818	22.2	0.4	11.06	817
0.25	22.3	0.4	11.52	818	22.3	0.4	11.23	820
0.50	22.3	0.4	11.69 (135%)	818	22.2	0.4	11.34	820
0.75b	22.3	0.4	11.56	818	22.2	0.4	11.31	819
1.00					22.2	0.4	11.26	819
1.25					22.1	0.4	11.06	818
1.50					22.1	0.4	11.12	818
1.75					22.1	0.4	10.97	818
2.00					22.0	0.4	12.03 (138%)	817
2.25b					22.0	0.4	7.55	818
1512hr			17-Aug-13					1500 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	22.2	0.4	10.75	819	22.3	0.4	10.25	843
0.25	22.2	0.4	10.97	823	22.2	0.4	10.32	835
0.50	22.2	0.4	11.05	823	22.1	0.4	11.00	832
0.75	22.2	0.4	11.19	823	21.8	0.4	11.13	840
1.00	22.2	0.4	11.33	822	22.1	0.4	13.50 (145%)	846
1.25b	22.1	0.4	11.44 (131%)	821	22.0	0.4	11.36	846
1.50b	22.0	0.4	10.55	820				

Station 1: Flume at 1547 hr. Reach 1- 54 gulls. 6 mallards near restaurant waiting for handouts. No surface algae. 100% bottom algal coverage 1 − 6 ft thick, avg. = 2 ft. 10%.
Station 2: Stockton Avenue Bridge at 1526 hr. Secchi depth to the bottom. Reach 2- No surface algae. 100% of bottom covered by algae 0.2 – 4 ft thick, averaging 1 ft. No waterfowl.
Station 3: Railroad trestle at 1512 hr. Reach 3- No surface algae. 99% of bottom covered by algae 0.2- 3 ft thick, averaging 0.5 ft. 1% pondweed + algae 2.0 ft thick. 5 mallards in water.
Station 4: Mouth of Noble Gulch at 1500 hr. No surface algae. 100% of bottom covered by algae 0.5 - 3 ft thick, averaging 1.5 ft. 4 mallards and 1 merganser on downed cottonwood; 1 merganser on Golino wood. Domestic ducks absent at lagoon.
Station 5: Nob Hill at 1625 hr. Water temperature at 18.7°C. Conductivity 641 umhos, Oxygen 9.23 mg/l (99% saturation). Salinity 0.4 ppt.

			1-Sep-13					
	Flume 0731 hr				**Stockton Avenue Bridge** 0745 hr			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	22.0	0.4	9.55	842	22.1	0.4	10.65	843
0.25	22.0	0.4	9.72	845	22.2	0.4	10.97	847
0.50	22.0	0.4	9.74 (112%)	845	22.2	0.4	11.03	847
0.75b	22.0	0.4	9.52	844	22.2	0.4	11.05	847
1.00					22.2	0.4	11.00	847
1.25					22.2	0.4	10.86	846
1.50					22.2	0.4	10.93	846
1.75					22.2	0.4	10.71	846
2.00					22.2	0.4	7.13 (83%)	845
2.25b					22.3	0.4	4.30	852
			1-Sep-13					
	Railroad Trestle 0800 hr				**Mouth of Noble Gulch** 0819 hr			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	22.1	0.4	10.09	848	21.6	0.4	9.00	864
0.25	22.1	0.4	10.23	848	21.6	0.4	8.97	864
0.50	22.1	0.4	10.37	849	21.6	0.4	9.23	863
0.75	22.1	0.4	10.46	849	21.6	0.4	9.11	860
1.00	22.1	0.4	10.45	849	21.6	0.4	6.57 (87%)	860
1.05b					21.7	0.4	3.88	915
1.25	22.1	0.4	10.37 (119%)	849				
1.50b	22.1	0.4	7.63	850				

1 September 2013. **Begonia Festival Day.** Gage height of 2.62 (morning) and 2.61 (afternoon). Clear in morning. At 0731 hr- air temperature of 17.1 ^{o}C. Air temperature 20.8º C at 1610 hr and clear/breezy. Flume inlet 0.8 ft. Flume outlet 0.2 ft in afternoon.

Station 1: Flume at 0731 hr. Reach 1- no gulls. No surface algae.

Station 2: Stockton Avenue Bridge at 0745 hr. Secchi depth to the bottom. Reach 2-2 mallards. Bottom algae 78% coverage 0.5 – 1.5 ft. thick, avg. 1.0. Pondweed 20% coverage 1 – 4 ft. thick, 2 ft average. No surface algae.

Station 3: Railroad trestle at 0800 hr. Reach 3- 12 mallards in water. Surface algae 1% along western margin.

Station 4: Mouth of Noble Gulch at 0819 hr. 6 mallards on downed cottonwood; 6 mallards and 1 merganser on Golino redwood stump.

Station 5: Nob Hill at 0840 hr. Water temperature at 17.5°C. Conductivity 615 umhos, Oxygen 6.79 mg/l (71 % saturated). Salinity 0.4 ppt. Estimated streamflow = - cfs.

1610 hr			1 September 13					1540 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**Umhos**
0.00	23.5	0.4	13.74	862	23.6	0.4	12.82	866
0.25	23.4	0.4	13.8	862	23.6	0.4	12.97	867
0.50	23.5	0.4	13.91	862	23.5	0.4	13.02	867
0.75b	23.4	0.4	13.79	860	23.4	0.4	12.98	865
1.00					23.4	0.4	12.92	864
1.25					23.3	0.4	12.78	864
1.50					23.3	0.4	12.75	864
1.75					23.2	0.4	12.44	864
2.00					23.1	0.4	13.27 (155%)	861
2.25b					23.1	0.4	7.97	862
1517 hr			1-Sep-13					1500 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	23.6	0.4	13.53	870	23.7	0.4	12.90	904
0.25	23.6	0.4	14.06	871	23.6	0.4	13.10	904
0.50	23.5	0.4	14.15	870	23.5	0.4	13.16	901
0.75	23.5	0.4	14.07	870	23.4	0.4	13.02 (152%)	898
1.00	23.4	0.4	13.82	869	23.0	0.4	11.44	893
1.15b					22.4	0.4	4.65 (55%)	886
1.25	23.2	0.4	13.69 (163%)	867				
1.50b	23.1	0.4	12.84	864				

Station 1: Flume at 1610 hr. Reach 1- 24 gulls. No surface algae. 85% bottom algal coverage at 1 - 5 ft thick, avg. = 3 ft. 15% pondweed + algae at 3 - 5 ft thick; averaging 4 ft.
Station 2: Stockton Avenue Bridge at 1540 hr. Secchi depth to the bottom. Reach 2- No surface algae. 1 mallard in water.
Station 3: Railroad trestle at 1517 hr. Reach 3- No surface algae. No waterfowl.
Station 4: Mouth of Noble Gulch at 1500 hr. 30% surface algae. 100% of bottom covered by algae 1.5 – 3.5 ft thick, averaging 2 ft.
Station 5: Nob Hill at 1635 hr. Water temperature at 19.1°C. Conductivity 646 umhos, Oxygen 7.20 mg/l (77% saturated). Salinity 0.4 ppt.
There were 6 floats, 19 other boats, kayaks and surf boarders. All floats were electric motor-powered. 2 paddle surfboarders collided and fell into the lagoon and disturbed bottom for 20 seconds.

			14-Sep-13					
	Flume			0708hr	**Stockton Avenue Bridge**			0720 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	20.6	0.4	7.36	877	20.6	0.4	9.58	867
0.25	20.6	0.4	7.25	875	20.7	0.4	9.66	871
0.50	20.6	0.4	7.26	878	20.7	0.4	9.64	872
0.75b	20.6	0.4	7.07	878	20.7	0.4	9.65	872
1.00					20.7	0.4	9.75	872
1.25					20.7	0.4	9.64	871
1.50					20.7	0.4	9.73	871
1.75					20.7	0.4	9.76	871
2.00					20.7	0.4	9.03	871
2.25b					20.8	0.4	4.92	888
	Railroad Trestle			0745 hr	**Mouth of Noble Gulch**			0810 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	20.5	0.4	9.69	860	19.8	0.4	8.11	827
0.25	20.4	0.4	9.67	861	19.8	0.4	8.02	834
0.50	20.5	0.4	9.88	861	29.8	0.4	8.10	835
0.75	20.6	0.4	9.84	861	19.8	0.4	8.18 (90%)	834
1.00b	20.5	0.4	9.85	861	19.8	0.4	6.48	866
1.25	20.5	0.4	9.82 (109%)	861				
1.50b	20.5	0.4	9.25	861				

14 September 2013. Gage height of 2.62 (morning) and 2.61 (afternoon). Overcast/breezy in morning and sunny in afternoon. Air temperature of 13.6° C at 0708 hr and 17.8ºC at 1625 hr.
Station 1: Flume at 0708 hr- Reach 1- 100+ gulls bathing, 1 mallard. 2% surface algae with feathers. Flume at 1625 hr- Reach 1- 100+ gulls bathing, 1 brown pelican in water and one on Venetian beach. No surface algae. Secchi depth to bottom. 85% of bottom with algae 2 - 5 ft thick, averaging 3 ft thick; 15% pondweed + algae 3 - 5 ft thick; averaging 4.0 ft.
Station 2: Stockton Avenue Bridge at 0720 hr- Reach 2- no waterfowl. 2% surface algae. Reach 2 at 1555 hr- . Secchi depth to bottom. No surface algae. 85% of bottom covered with algae 1 - 4 ft thick, averaging 2 ft. 15% pondweed + algae 3 - 5 ft thick, averaging 4 ft.
Station 3: Railroad trestle at 0745 hr- Reach 3- 2 mallards dabbling. 7% surface algae below Shadowbrook Restaurant and 10% surface algae above. At 1513 hr- 10 mallards and 1 pied-billed grebe in water. 10% surface algae. 85% of bottom covered with algae 1 - 3 ft thick, averaging 2 ft. 15% pondweed + algae 2- 5 ft thick, averaging 3 ft.
Station 4: Mouth of Noble Gulch at 0810 hr- 9 mallards and 1 coot on downed cottonwood and Golino wood. No surface algae. At 1500 hr- 10 mallards and 1 pied-billed grebe in water. 100% algae coverage 1- 3 ft, averaging 2 ft. 1% surface algae. Pondweed beyond 25-foot radius from Noble Gulch confluence. Domestic ducks absent at lagoon.
Station 5: Nob Hill at 0835hr. Water temperature at 16.6°C. Conductivity 589 umhos, Oxygen 6.72 mg/l. Salinity 0.3 ppt. Nob Hill at 1658 hr. Water temperature 17.7° C. Oxygen 8.18 mg/l.

Conductivity 624 umhos. Salinity 0.4 ppt.

			14-Sep-13					
	Flume			1625 hr	**Stockton Avenue Bridge**			1555 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.7	0.4	12.03	889	22.0	0.4	12.17	893
0.25	21.8	0.4	12.20	889	22.0	0.4	12.07	893
0.50	21.7	0.4	12.28 (140%)	889	21.7	0.4	11.80	890
0.75b	21.7	0.4	11.87	889	21.5	0.4	11.82	885
1.0					21.4	0.4	13.69	885
1.25					21.3	0.4	16.02	871
1.50					21.2	0.4	12.90	870
1.75					21.1	0.4	11.70	876
2.00					20.9	0.4	10.92 (123%)	873
2.25b					21.0	0.4	7.62	877
			14-Sep-13					
	Railroad Trestle			1513hr	**Mouth of Noble Gulch**			1500hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	21.9	0.4	11.04	892	22.1	0.4	10.88	894
0.25	21.9	0.4	11.28	892	22.0	0.4	10.61	892
0.50	21.9	0.4	11.86	891	21.5	0.4	11.04	885
0.75	21.3	0.4	13.58	878	21.0	0.4	13.89 (156%)	879
1.00b	21.1	0.4	14.41 (163%)	867	20.5	0.4	6.86	889
1.25	20.9	0.4	14.11 (159%)	867				
1.45b	20.9	0.4	12.98	864				

			28-Sep-13					
	Flume			0722 hr	**Stockton Avenue Bridge**			0735 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	17.2	0.4	6.83	738	27.4	0.4	9.32	730
0.25	17.2	0.4	6.64	737	17.5	0.4	9.09	736
0.50	17.1	0.4	6.64 (69%)	737	17.5	0.4	9.05	737
0.70b	17.1	0.4	6.35	736				
0.75					17.5	0.4	9.04	737
1.00					17.5	0.4	9.05	737
1.25					17.5	0.4	9.05	737
1.50					17.5	0.4	9.04	737
1.75					17.5	0.4	9.02	737
2.00					17.5	0.4	8.97 (94%)	737
2.25b					17.6	0.4	6.64	737
			28-Sep-13					
	Railroad Trestle			0753 hr	**Mouth of Noble Gulch**			0808 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	17.1	0.4	8.63	721	16.8	0.4	8.10	720
0.25	17.1	0.4	8.09	728	16.8	0.4	7.99	728
0.50	17.1	0.4	7.97	729	16.8	0.4	8.02	725
0.75	17.2	0.4	7.95	729	16.8	0.4	7.98	723
1.00	17.2	0.4	7.83	728	16.9	0.4	7.32 (76%)	726
1.07b					17.0	0.4	7.00	729
1.25	17.2	0.4	7.75 (81%)	729				
1.45b	17.2	0.4	7.35	729				

28 September 2013. Gage height of 2.62 (morning) and 2.61 (afternoon). Clear in morning and afternoon. Air temperature of 9.5° C at 0722 hr and 20 ºC at 1600 hr.

Station 1: Flume at 0722 hr- Reach 1- 54 gulls bathing. 3% surface algae accumulating adjacent Margaritaville. Flume at 1600 hr- Reach 1- 100-200 gulls bathing, 1 merganser. No surface algae. 80% bottom algae 0.5- 3.0 ft thick, averaging 2 ft thick; 20% pondweed + algae 4-6 ft thick, averaging 5 ft. Sand berm artificially increased around lagoon margin to prevent tidal overwash.

Station 2: Stockton Avenue Bridge at 0735 hr- Reach 2- 2 mallards in water, 2 mallards on log raft under bridge. No surface algae. Reach 2 at 1540 hr- Secchi depth to bottom. No waterfowl. No surface algae. 80% bottom algae 1 – 3 ft thick, averaging 1 ft. 20% bottom pondweed + algae 2 – 5 ft thick, averaging 4 ft.

Station 3: Railroad trestle at 0753 hr- Reach 3- 15 mallards dabbling, 11 coots, 1 pied-billed grebe, 2 black-crowned night herons on Golino wood. At 1526 hr 1 mallard, 8 coots, 2 pied-billed grebes in water. No surface algae; 75% bottom algae 0.5 - 3.0 ft thick, averaging 2 ft; 25% pondweed with algae 1 - 5 ft thick, averaging 3 ft.

Station 4: Mouth of Noble Gulch at 0808 hr- 4 mallards and 1 coot dabbling from Reach 3 moved onto the downed cottonwood. No surface algae. At 1506 hr- 5 mallards on cottonwood. 75% bottom algae 0.5-1.5 ft thick; averaging 1 ft. 25% bottom pondweed + algae 3-4 ft thick, averaging 3.5 ft. No surface algae.

Domestic ducks absent at lagoon.
Station 5: Nob Hill at 0836 hr- Water temperature at 13.6°C. Conductivity 587 umhos, Oxygen 7.97 mg/l (76% saturation). Salinity 0.4 ppt. Nob Hill at 1640 hr- Water temperature 15.6° C. Oxygen 9.48 mg/l. Conductivity 620 umhos. Salinity 0.4 ppt. Streamflow - cfs.

			28-Sep-13					
	Flume			1600 hr	**Stockton Avenue Bridge**			1540 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	18.7	0.4	10.82	759	19.0	0.4	10.98	763
0.25	18.7	0.4	11.03	757	18.9	0.4	11.08	761
0.50	18.7	0.4	11.24 (124%)	757	18.6	0.4	11.27	754
0.70b	18.7	0.4	11.87	757				
0.75					18.4	0.4	11.60	750
1.00					18.4	0.4	11.42	748
1.25					18.2	0.4	13.03	741
1.50					18.0	0.4	12.15	740
1.75					17.7	0.4	11.16	737
2.00					17.7	0.4	11.08 (116%)	736
2.25b					17.7	0.4	6.73	735
			28-Sep-13					
	Railroad Trestle			1526 hr	**Mouth of Noble Gulch**			1506 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	19.2	0.4	10.77	770	20.4	0.4	9.62	792
0.25	19.2	0.4	10.75	764	19.7	0.4	9.42	774
0.50	19.0	0.4	10.91	761	19.2	0.4	9.45	766
0.75	18.5	0.4	12.24	756	18.1	0.4	18.26 (193%)	718
1.00	18.0	0.4	13.78	737	18.0	0.4	21.20 (225%)	733
1.25b	17.9	0.4	13.98 (146%)	735	18.0	0.4	20.14	750
1.45b	17.9	0.4	12.41	734				

			6-Oct-13					0832 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00					16.8	0.4	9.58	740
0.25					16.9	0.4	9.55	738
0.50					16.9	0.4	9.55	739
0.75					16.9	0.4	9.55	738
1.00					16.9	0.4	9.59	738
1.25					16.9	0.4	9.49	738
1.50					16.9	0.4	9.37	738
1.75					16.9	0.4	9.53	738
2.00					17.1	0.4	7.40 (77%)	740
2.25b					17.2	0.4	5.00	742
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00								
0.25								
0.50								
0.75								
1.00								
1.05b								
1.18b								
1.25								

6 October 2013. Fish sampling day.

0731 hr			12-Oct-13					0750 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	15.4	0.4	9.14	727	15.3	0.4	10.41	722
0.25	15.5	0.4	9.07	728	15.7	0.4	10.04	729
0.50	15.5	0.4	9.08 (91%)	728	15.6	0.4	10.00	730
0.70b	15.5	0.4	8.14	728				
0.75					15.6	0.4	10.04	730
1.00					15.6	0.4	10.06	730
1.25					15.6	0.4	10.04	730
1.50					15.6	0.4	10.03	730
1.75					15.6	0.4	10.05	730
2.00					15.6	0.4	10.06 (101%)	730
2.25b					15.6	0.4	8.06	730
0813 hr			12-Oct-13					0826 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	15.3	0.4	10.35	723	14.6	0.4	10.43	679
0.25	15.4	0.4	10.27	726	14.8	0.4	10.04	701
0.50	15.4	0.4	10.22	727	14.8	0.4	9.93	713
0.75	15.4	0.4	10.26	727	14.9	0.4	9.87 (96%)	716
1.00	15.4	0.4	10.24	727	15.8	0.4	2.52	801
1.07b					15.9	0.4	1.50	862
1.25	15.4	0.4	10.22 (103%)	727				
1.45b	15.4	0.4	9.95	728				

12 October 2013. Gage height of 2.64 (morning) and 2.68 (afternoon). Overcast in morning. Clear in afternoon. Air temperature of 8.3° C at 0731 hr and 14ºC at 1556 hr.
Station 1: Flume at 0731 hr. Reach 1- 98 gulls bathing, 14 mallards, 45 coots. No surface algae. Flume at 1556 hr. Reach 1- 5% surface algae in Margaritaville cover. Bottom to dark for vegetation observations. 125+ gulls bathing, 4 coots.
Station 2: Stockton Avenue Bridge at 0750 hr. Secchi depth to bottom. Reach 2- <1% surface algae; no waterfowl. Reach 2 at 1540 hr. No surface algae. 80% of bottom covered with algae 0.5- 1.5 ft thick, averaging 1.0 ft thick. 20% pondweed + algae 1.5 – 4 ft thick, averaging 3 ft. Remainder algal film. 21 mallards, 9 coots, 1 cormorant.
Station 3: Railroad trestle at 0813 hr. Reach 3- 2% surface algae; 2 coots in water, 1 pied-billed grebe, 1 mallard on Golino wood. At 1525 hr, Reach 3- No surface algae; 80% bottom covered with algae 0.5 – 1.5 ft thick, averaging 1 ft. 20% pondweed with attached algae 2.5- 4 ft, avg. = 3.0 ft. 17 coots in water.
Station 4: Mouth of Noble Gulch at 0826 hr. 2% surface algae. No waterfowl on cottonwood. At 1506 hr. <1% surface algae. 80% bottom algae 2 – 3 ft thick, averaging 2.5 ft. 20% pondweed + algae 2 – 3 ft thick, averaging 2.5 ft. Domestic ducks absent at lagoon.

Station 5: Nob Hill at 0850 hr. Water temperature 12.5° C. Oxygen 10.12 mg/l ((95% saturation). Conductivity 550 umhos. Salinity 0.4 ppt. Nob Hill at 1632 hr. Water temperature 13.4° C. Oxygen 10.63 mg/l. Conductivity 565 umhos. Salinity 0.4 ppt. Streamflow - cfs.

1556 hr			12-Oct-13					1540 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	16.5	0.4	10.85	748	16.5	0.4	11.50	746
0.25	16.5	0.4	10.83	747	16.5	0.4	11.52	743
0.50	16.5	0.4	10.74 (111%)	746	16.5	0.4	11.50	743
0.70b	16.5	0.4	10.67	745				
0.75					16.5	0.4	11.43	743
1.00					16.4	0.4	11.40	742
1.25					16.3	0.4	11.27	741
1.50					16.2	0.4	10.77	740
1.75					16.1	0.4	10.84	738
2.00					16.1	0.4	10.98 (112%)	737
2.25b					16.1	0.4	9.04	724
1525 hr			12-Oct-13					1506 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	16.8	0.4	10.95	748	16.9	0.4	10.15	740
0.25	16.7	0.4	11.01	748	16.7	0.4	9.96	740
0.50	16.6	0.4	11.19	746	16.4	0.4	10.09	731
0.75	16.4	0.4	11.28	744	16.0	0.4	14.29 (145%)	694
1.00	16.2	0.4	11.46	738	15.9	0.4	16.43	738
1.05b					16.1	0.4	10.12	788
1.25	16.0	0.4	12.42 (126%)	734				
1.45b	16.0	0.4	12.55	732				

0720hr			26-Oct-13					0730 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	13.9	0.4	9.25	689	13.9	0.4	10.30	680
0.25	13.9	0.4	9.15	692	14.0	0.4	10.30	685
0.50	13.9	0.4	9.16	691	14.1	0.4	10.35	687
0.75b	13.9	0.4	8.76	691	14.1	0.4	10.42	687
1.00					14.1	0.4	10.46	687
1.25					14.1	0.4	10.46	686
1.50					14.1	0.4	10.48	686
1.75					14.1	0.4	10.51	686
2.00					14.1	0.4	10.31	686
2.25b					14.2	0.4	3.25	686
0752 hr			26-Oct-13					0810 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	13.7	0.4	9.88	673	13.3	0.4	10.31	657
0.25	13.7	0.4	9.82	674	13.3	0.4	10.11	659
0.50	13.7	0.4	9.81	674	13.3	0.4	10.08	657
0.75	13.7	0.4	9.82	674	13.3	0.4	9.96 (95%)	658
1.00	13.7	0.4	9.82	674	13.6	0.4	7.72	678
1.05b					14.2	0.4	2.80	705
1.25	13.7	0.4	9.77	674				
1.50	13.7	0.4	9.23	674				

26 October 2013. Gage height of 2.62 (morning) and 2.64 (afternoon). Clear in morning and afternoon with afternoon breeze. Air temperature of 7.8° C at 0720 hr and 15.1°C at 1532 hr. No mallards observe in the lagoon in morning. Notch cut in sandbar 30 feet wide and 3 feet deep. Inner and outer berm. Outer berm approximately 100 ft long, 4-5 ft high.

Station 1: Flume at 0720 hr. Reach 1- 100+ gulls bathing, 6 coots. No surface algae. Flume at 1532 hr. Reach 1- 7% surface algae. Too shaded to see underwater vegetation. 200+ gulls bathing, 17 coots around periphery of gulls.

Station 2: Stockton Avenue Bridge at 0730 hr. Secchi depth to bottom. Reach 2- No surface algae; 20 coots. Reach 2 at 1510 hr. 5% surface algae. To shaded for observing underwater vegetation. 25 coots.

Station 3: Railroad trestle at 0752 hr. Reach 3- 1% surface algae; 29 coots. At 1455 hr, Reach 3- 5% surface algae; too shaded for observing underwater vegetation. 47 coots, 1 mallard in water.

Station 4: Mouth of Noble Gulch at 0810 hr. 1% surface algae. No birds on downed wood. At 1442 hr. 10% surface algae. 11 mallards on downed cottonwood. Bottom algae 70% coverage 1-3 ft thick, averaging 2 ft. Pondweed + algae 30% coverage, averaging 3 ft thick. Domestic ducks absent at lagoon.

Station 5: Nob Hill at 0835 hr. Water temperature 11.3° C. Oxygen 10.34 mg/l (94%). Conductivity 532 umhos. Salinity 0.4 ppt. Nob Hill at 1605 hr. Water temperature 12.3° C. Oxygen 12.72 mg/l (119%). Conductivity 546 umhos. Salinity 0.4 ppt.

1532 hr			26-Oct-13					1510 hr
	Flume				**Stockton Avenue Bridge**			
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	15.1	0.4	12.67	707	15.2	0.4	13.52	709
0.25	15.0	0.4	12.74	706	15.2	0.4	13.75	701
0.50	15.0	0.4	12.88	704	14.9	0.4	13.81	696
0.75b	15.0	0.4	13.62	703	14.8	0.4	13.71	695
1.00					14.7	0.4	13.43	694
1.25					14.6	0.4	14.47	688
1.50					14.4	0.4	14.13	681
1.75					14.4	0.4	13.82	683
2.00					14.3	0.4	14.38 (141%)	682
2.25b					14.4	0.4	13.97	681
1455 hr			26-Oct-13					1442 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	15.7	0.4	12.78	704	15.6	0.4	11.02	702
0.25	15.6	0.4	12.61	707	15.4	0.4	10.96	696
0.50	15.3	0.4	13.20	699	14.7	0.4	10.82	628
0.75	14.8	0.4	14.13	687	14.6	0.4	11.43 (112%)	663
1.00	14.6	0.4	14.64	680	14.4	0.4	14.73	675
1.05b					14.4	0.4	9.74	675
1.25	14.5	0.4	15.22 (112%)	677				
1.50b	14.4	0.4	25.25	675				

			9-Nov-13					
	Flume			0710 hr	**Stockton Avenue Bridge**			0721 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	12.1	0.4	8.18	591	12.2	0.4	9.42	591
0.25	12.1	0.4	8.05	591	12.3	0.4	8.87	593
0.50	12.1	0.4	7.76 (72%)	591	12.3	0.4	8.70	594
0.75b	12.2	0.4	7.37	591	12.3	0.4	8.57	594
1.00					12.3	0.4	8.49	594
1.25					12.3	0.4	8.37	594
1.50					12.3	0.4	8.30	594
1.75					12.3	0.4	8.28	594
2.00					12.3	0.4	8.25 (77%)	594
2.25					12.4	0.4	7.74	595
			9-Nov-13					
	Railroad Trestle			0736hr	**Mouth of Noble Gulch**			0750 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	12.2	0.4	9.28	594	11.9	0.4	10.00	596
0.25	12.2	0.4	9.06	594	11.9	0.4	9.77	599
0.50	12.2	0.4	9.00	594	11.8	0.4	9.63	601
0.75	12.2	0.4	8.93	594	11.8	0.4	9.56 (89%)	600
1.00	12.2	0.4	8.84	594	11.9	0.4	9.10	605
1.05b					11.9	0.4	8.57	612
1.25	12.2	0.4	8.77 (82%)	594				
1.45	12.2	0.4	7.94	595				

9 November 2013. **After time change.** Gage height of 2.62 (morning) and 2.62 (afternoon). Clear and calm in morning and clear in afternoon. Air temperature of 8.6° C at 0710 hr and 13.7° C at 1510 hr.
Station 1: Flume at 0710 hr- Reach 1- 113 gulls bathing, 12 coots dabbling, 9 mallards. No surface algae. Flume at 1510 hr- Reach 1- 82 gulls bathing, 32 coots. No surface algae. Too dark to observe vegetation.
Station 2: Stockton Avenue Bridge at 0721 hr- Secchi depth to bottom. Reach 2- No surface algae. 21 coots, 1 pied-billed grebe. Reach 2 at 1450 hr- Secchi depth to bottom. No surface algae. Too dark to see vegetation. 2 gulls, 33 coots, 9 mallards.
Station 3: Railroad trestle at 0736 hr- Reach 3- 2 mallards dabbling, 33 coots, 1 pied-billed grebe. At 1434 hr, Reach 3- No surface algae; 2 mallards, 39 coots,
Station 4: Mouth of Noble Gulch at 0750 hr- 4 mallards (may be from Reach 1) and 2 coots on cottonwood. No surface algae. At 1417 hr- No surface algae. 3 mallards on cottonwood. Too dark to observe vegetation. No domestic ducks observed at the lagoon.
Station 5: Nob Hill at 0815 hr- Water temperature at 10.5° C. Conductivity 535 umhos, Oxygen 10.72 mg/l. Salinity 0.4 ppt. Nob Hill at 1532 hr- Water temperature 11.7° C. Oxygen 11.28 mg/l. Conductivity 551 umhos. Salinity 0.4 ppt.

			9-Nov-13					
	Flume			1510 hr	**Stockton Avenue Bridge**			1450 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	13.0	0.4	11.90	603	13.2	0.4	11.88	606
0.25	13.0	0.4	11.81	602	13.2	0.4	11.86	607
0.50	13.0	0.4	11.79	602	13.2	0.4	11.93	607
0.75b	13.0	0.4	11.72	594	13.1	0.4	11.59	606
1.00					13.0	0.4	11.42	605
1.25					13.0	0.4	11.33	604
1.50					13.0	0.4	11.21	603
1.75					12.7	0.4	10.75	604
2.00					12.6	0.4	10.49 (99%)	603
2.25b					12.6	0.4	9.84	602
			9-Nov-13					
	Railroad Trestle			1434hr	**Mouth of Noble Gulch**			1417hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	13.5	0.4	12.35	617	13.7	0.4	11.93	624
0.25	13.4	0.4	12.33	615	13.6	0.4	12.22	623
0.50	13.3	0.4	12.23	614	13.4	0.4	12.37	618
0.75	13.1	0.4	11.99	613	12.9	0.4	9.45 (90%)	614
1.00	12.9	0.4	12.08	613	12.3	0.4	10.76	634
1.05b					12.3	0.4	10.58	635
1.25	12.6	0.4	12.01 (113%)	612				
1.45	12.6	0.4	11.94	610				

			23-Nov-13					
	Flume			0710 hr	**Stockton Avenue Bridge**			0725 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	10.2	0.4	7.67	638	10.2	0.4	7.86	602
0.25	10.2	0.4	6.89 (61%)	637	10.3	0.4	7.07	611
0.50	10.1	0.5	5.65 (50%)	669	10.3	0.4	6.86	618
0.55b	10.6	0.5	3.19	2043				
0.75					10.2	0.4	6.72	619
1.00					10.2	0.4	6.62	619
1.25					10.2	0.4	6.57	619
1.50					10.2	0.4	6.50	619
1.75					10.2	0.4	5.73 (51%)	619
1.85b					10.2	0.4	3.69	619
2.00								
			23-Nov-13					
	Railroad Trestle			0752 hr	**Mouth of Noble Gulch**			0812 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	9.8	0.4	9.61	616	9.4	0.4	10.85	644
0.25	9.8	0.4	8.91	618	9.3	0.4	10.49	655
0.50	9.8	0.4	8.67	618	9.3	0.4	10.21 (89%)	664
0.60b					9.6	0.4	9.44	654
0.75	9.9	0.4	7.84 (69%)	610				
1.00b	9.8	0.4	7.56	611				
1.25								
1.50								

23 November 2013. Gage height of 1.06 (morning) and 0.7 (afternoon). Clear and breezy in morning and clear in afternoon. Air temperature of 5° C at 0710 hr and 12.4° C at 1510 hr. Light rain on night of 20-21 November. 3 boards removed prior.

Station 1: Flume at 0710 hr- Reach 1- 100+ gulls bathing, 11 coots dabbling. No surface algae. Flume at 1500 hr- Reach 1- 150+ gulls bathing, 15 coots. No surface algae. Too dark to observe vegetation.

Station 2: Stockton Avenue Bridge at 0725 hr- Secchi depth to 0.7 m. Reach 2- No surface algae. 6 mallards, 4 coots, 1 cormorant. Reach 2 at 1431 hr- Secchi depth to 0.75. No surface algae. Too dark to see vegetation. 7 coots.

Station 3: Railroad trestle at 0752 hr; Secchi depth to bottom- Reach 3- 14 mallards dabbling, 28 coots, 1 pied-billed grebe, 3 bufflehead ducks. At 1413 hr, Reach 3- No surface algae; 11 mallards, 21 coots, 2 pied-billed grebes.

Station 4: Mouth of Noble Gulch at 0812 hr- 2 mallards on willow branches next to cottonwood. No surface algae. At 1400 hr- No surface algae. 13 mallards and 1 coot on cottonwood. 3 mallards on Golino wood. Too dark to observe vegetation. No domestic ducks observed at the lagoon.

Station 5: Nob Hill at 0845 hr- Water temperature at 8.8° C. Conductivity 557 umhos, Oxygen 12.46 mg/l (107% sat.). Salinity 0.4 ppt. Nob Hill at 1529 hr- Water temperature 9.7° C. Oxygen 12.55 mg/l. Conductivity 576 umhos. Salinity 0.4 ppt.

			23-Nov-13					
	Flume			1500 hr	**Stockton Avenue Bridge**			1431hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	11.3	0.4	9.11	649	11.4	0.4	8.34	652
0.25	11.4	0.4	8.50	649	11.2	0.4	8.17	650
0.45b	11.1	0.4	8.29	645				
0.50					11.0	0.4	8.18	646
0.75b					10.7	0.4	7.93	644
1.00					10.6	0.4	7.53	646
1.25					10.5	0.4	7.30	647
1.50b					10.6	0.4	6.48	647
1.75								
2.00								
2.25								
			23-Nov-13					
	Railroad Trestle			1413hr	**Mouth of Noble Gulch**			1400 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	12.1	0.4	9.64	687	11.7	0.4	9.91	650
0.25	11.8	0.4	9.25	685	11.4	0.4	9.54	655
0.50	11.5	0.4	9.03	685	10.8	0.4	9.59 (87%)	648
0.55b					11.0	0.5	9.11	761
0.75	11.3	0.4	9.24 (84%)	687				
0.80b	11.4	0.4	8.42	689				
1.00								
1.25								
1.50								

			8-Dec-13					
	Flume			0945 hr	**Stockton Avenue Bridge**			0955 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	6.7	0.4	10.99	490	6.3	0.4	12.13	518
0.25	6.7	0.4	10.82	489	6.3	0.4	11.87	518
0.50	6.6	0.4	10.76	490	6.3	0.4	11.77	517
0.75b	6.6	0.4	10.75	491	6.3	0.4	11.70	518
1.00					6.2	0.4	11.66	519
1.25					6.2	0.4	11.62 (94%)	519
1.50					6.2	0.4	11.64 (94%)	519
1.75					6.2	0.4	11.53 (92%)	519
1.85b					6.2	0.4	11.38	519
2.00								
			8-Dec-13					
	Railroad Trestle			1025 hr	**Mouth of Noble Gulch**			1039 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	6.1	0.4	13.05	527	5.9	0.4	13.15	537
0.25	6.1	0.4	12.76	526	5.8	0.4	12.93	539
0.50	6.1	0.4	12.69	527	5.7	0.4	12.82	543
0.75	6.0	0.4	12.62	528	5.7	0.4	12.84 (103%)	547
0.87b					5.9	0.4	14.01 (112%)	551
1.00	6.0	0.4	12.51 (101%)	527				
1.25b	6.0	0.4	12.35	528				
1.50								

8 December 2013. Gage height of 2.09. Clear and calm. Air temperature of 3.1° C at 0945 hr. 3 boards are removed from 6 December on restaurant side of flume inlet in preparation of evening storm.
Station 1: Flume at 0945 hr- Reach 1- 6 gulls bathing, 3 coots dabbling, 3 mergansers. No surface algae. Water was tea-colored and vegetation was invisible.
Station 2: Stockton Avenue Bridge at 0956 hr- Secchi depth 1 m. Reach 2- People feeding waterfowl. No surface algae. 14 mallards, 15 coots, 1 pied-billed grebe, 6 gulls, 1 bufflehead duck attracted by free bread scraps.
Station 3: Railroad trestle at 1025 hr- Secchi depth to bottom. Reach 3- 29 coots, 2 mergansers, 1 golden eye duck, 4 bufflehead ducks (one from Reach 2).
Station 4: Mouth of Noble Gulch at 1039 hr. Secchi depth to bottom.-No waterfowl on cottonwood. No surface algae. No domestic ducks observed at the lagoon.
Station 5: Nob Hill at 1108 hr- Water temperature at 4.9° C. Conductivity 580 umhos, Oxygen 14.21 mg/l (111%). Salinity 0.5 ppt.

			9-Dec-13					
	Flume			0942 hr	**Stockton Avenue Bridge**			0955 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	5.4	0.4	12.16	538	5.5	0.4	12.58	540
0.25	5.4	0.4	11.88	535	5.4	0.4	12.41	540
0.50	5.5	0.4	11.70 (93%)	536	5.2	0.4	12.44	545
0.75	5.5	0.4	11.74 (93%)	538	5.1	0.4	12.41	548
0.85b	5.3	0.4	11.71	538				
1.00					4.9	0.4	12.44	555
1.25					4.6	0.4	12.46	568
1.50					4.6	0.4	12.51 (97%)	572
1.65b					4.6	0.4	12.54	572
1.75								
2.00								
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	13.5	0.4	12.35	617	13.7	0.4	11.93	624
0.25	13.4	0.4	12.33	615	13.6	0.4	12.22	623
0.50	13.3	0.4	12.23	614	13.4	0.4	12.37	618
0.75	13.1	0.4	11.99	613	12.9	0.4	9.45 (90%)	614
1.00	12.9	0.4	12.08	613	12.3	0.4	10.76	634
1.05b					12.3	0.4	10.58	635
1.25	12.6	0.4	12.01 (113%)	612				
1.45	12.6	0.4	11.94	610				

9 December 2013. 2 boards added back to flume inlet in afternoon.

			21-Dec-13					
	Flume			0731 hr	**Stockton Avenue Bridge**			0741 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	7.6	0.4	11.41	581	7.7	0.4	11.73	582
0.25	7.6	0.4	11.14	581	7.7	0.4	11.46	583
0.50	7.6	0.4	11.04 (93)	581	7.7	0.4	11.39	583
0.75	7.6	0.4	10.98 (92)	581	7.7	0.4	11.29	583
1.00b	7.7	0.4	10.74	581	7.7	0.4	11.24	583
1.25					7.7	0.4	11.19	584
1.50					7.7	0.4	11.16	583
1.75					7.7	0.4	11.12	583
2.00					7.7	0.4	11.03 (93)	584
2.25					7.8	0.4	8.62	584
			21-Dec-13					
	Railroad Trestle			0800 hr	**Mouth of Noble Gulch**			0812 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	7.6	0.4	11.72	588	7.6	0.4	11.27	589
0.25	7.6	0.4	11.40	588	7.6	0.4	10.85	584
0.50	7.6	0.4	11.29	588	7.5	0.4	10.65	588
0.75	7.6	0.4	11.18	588	7.5	0.4	10.14 (85)	587
1.00b	7.6	0.4	11.06	588	7.5	0.4	9.43	594
1.25	7.6	0.4	10.97 (92)	588				
1.37b	7.6	0.4	10.85	588				
1.50								

21 December 2013. Gage height of 2.61 (morning) and 2.50 (afternoon). Clear and breezy in morning and clear in afternoon. Air temperature of 3.7° C at 0731 hr and 11.3° C at 1550 hr. Flume inlet 0.9 ft. Flume outlet 0.8 ft.

Station 1: Flume at 0731 hr- Reach 1- 23 gulls bathing, 11 coots dabbling, 1 bufflehead duck. No surface algae. Flume at 1550 hr- Reach 1- 45 gulls bathing, 16 mallards, 6 coots, 1 bufflehead duck. No surface algae. Too dark to observe vegetation.

Station 2: Stockton Avenue Bridge at 0741 hr- Secchi depth to bottom. Reach 2- No surface algae. 8 mallards, 6 coots. 1 homeless person sleeping on concrete under Stockton Bridge. Reach 2 at 1530 hr- Secchi depth to bottom. No surface algae. Too dark to see vegetation. 7 coots, 9 mallards.

Station 3: Railroad trestle at 0800 hr; Reach 3- 26 coots, 1 pied-billed grebe, 2 bufflehead ducks, 1 golden eye duck, 1 greenback heron in tree. At 1515 hr, Reach 3- No surface algae; 24 coots, 3 pied-billed grebes (one with steelhead in mouth), 4 bufflehead ducks, 1 golden eye duck.

Station 4: Mouth of Noble Gulch at 0812 hr- No birds on in-channel wood. No surface algae. At 1501 hr- No surface algae. No birds on in-channel wood. Too dark to observe vegetation. No domestic ducks observed at the lagoon.

Station 5: Nob Hill at 0836 hr- Water temperature at 6.1° C. Conductivity 535 umhos, Oxygen 12.99 mg/l (105% sat.). Salinity 0.4 ppt. Nob Hill at 1619 hr- Water temperature 6.8° C. Oxygen 12.33 mg/l. Conductivity 543 umhos. Salinity 0.4 ppt.

			21-Dec-13					
	Flume			1550 hr	**Stockton Avenue Bridge**			1530 hr
Depth	**Temp 1**	**Salin 1**	**O2 1 (% saturation)**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	8.4	0.4	11.48	594	8.5	0.4	11.09	597
0.25	8.4	0.4	11.35	593	8.6	0.4	11.19	597
0.50	8.4	0.4	11.24	593	8.5	0.4	10.94	596
0.75	8.4	0.4	11.20 (96)	593	8.4	0.4	10.82	595
1.00	8.3	0.4	11.15 (95)	591	8.3	0.4	10.75	593
1.08b	8.3	0.4	11.01	592				
1.25					8.2	0.4	10.65	592
1.50					8.2	0.4	10.50	592
1.75					8.1	0.4	10.46	590
2.00					8.1	0.4	10.84 (89)	590
2.25b					8.2	0.4	8.26	592
			21-Dec-13					
	Railroad Trestle			1515 hr	**Mouth of Noble Gulch**			1501 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	8.6	0.4	10.73	606	8.6	0.4	10.01	603
0.25	8.5	0.4	10.43	605	8.4	0.4	9.56	601
0.50	8.4	0.4	10.29	604	8.3	0.4	9.47	598
0.75	8.4	0.4	10.17	603	8.2	0.4	9.39	601
1.00b	8.4	0.4	10.06 (86)	603	8.1	0.4	11.64	617
1.25	8.3	0.4	10.05 (86)	602				
1.37b	8.3	0.4	9.86	602				
1.50								

29 December 2013. High tide combined with large swell had eroded the out beach berm but did not breach the inner berm and the sandbar. Tidal overwash occurred into the lagoon. The shroud was installed and the beach berm was re-established. Alley observed tractor work in the afternoon, along with Morrison.

			04-Jan-14					
	Flume			0750 hr	**Stockton Avenue Bridge**			0803 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	7.7	0.6	12.05	744	7.7	0.5	12.47	721
0.25	7.7	0.6	11.62	746	7.7	0.5	12.17	722
0.50	7.7	0.6	11.46	746	7.7	0.5	11.97	722
0.75	7.6	0.6	11.35	748	7.8	0.5	11.85	724
0.87b	7.7	0.6	11.21	747				
1.00					7.8	0.5	11.65	735
1.25					7.9	0.6	11.43	779
1.50					8.4	0.7	10.64	975
1.75					8.5	1.0	9.89	1357
2.00					8.6	1.6	8.94 (85%)	2087
2.15b					8.9	1.6	7.19	2154
			04-Jan-14					
	Railroad Trestle			0824 hr	**Mouth of Noble Gulch**			0835 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	7.7	0.5	12.61	706	7.8	0.5	12.69	706
0.25	7.7	0.5	12.28	709	8.0	0.5	12.16	720
0.50	7.7	0.5	12.14	712	8.2	0.6	11.77	768
0.75	7.8	0.5	11.94	730	8.5	0.6	11.42 (98%)	827
0.95b					8.7	0.7	10.87	919
1.00	8.1	0.6	11.15 (95%)	771				
1.25b	8.7	0.8	9.82	1090				
1.50								

04 January 2014. Gage height of 2.22 (morning) and 2.19 (afternoon). Clear with slight cirrus cloud cover in morning and clear in afternoon. Air temperature of 5.8° C at 0750 hr and 12.1° C at 1553 hr. Flume inlet 1.0 ft; flume outlet 0.7 ft in the afternoon. The shroud was in place on the restaurant side of the flume inlet. Recommended that the shroud be removed with low salinity.
Station 1: Flume at 0750 hr- Reach 1- 24 gulls bathing, 05 coots dabbling, 4 coots on Venetian Court margin standing, 3 mergansers (one male), 5 wild mallards. No surface algae. Flume at 1553 hr- Reach 1- 36 gulls bathing, 14 mallards, 11 coots, 1 golden eye duck. No surface algae. Too dark to observe vegetation. A guy was feeding white bread to the gulls near Venetian Court.
Station 2: Stockton Avenue Bridge at 0803 hr- Secchi depth to bottom. Reach 2- No surface algae. 2 mallards on log raft under bridge, 11 coots, 1 gull. Reach 2 at 1529 hr- Secchi depth to bottom. No surface algae. Too dark to see vegetation. 14 coots, 11 mallards. Salinity 1.2 ppt at 2.5 meters on the bottom adjacent Venetian Court.
Station 3: Railroad trestle at 0824 hr; Reach 3- 28 coots, 2 pied-billed grebe, 2 golden eye ducks. At 1515 hr, Reach 3- No surface algae; 17 coots, 2 pied-billed grebes, 5 wild mallards, 1 merganser (male).
Station 4: Mouth of Noble Gulch at 0835 hr- No birds on in-channel wood. No surface algae. At 1501 hr- No surface algae. No birds on in-channel wood. Too dark to observe vegetation. No domestic ducks observed at the lagoon.

Station 5: Nob Hill at 0910 hr- Water temperature at 7.5° C. Conductivity 553 umhos, Oxygen 12.44 mg/l (104% sat.). Salinity 0.4 ppt. Nob Hill at 1627 hr- Water temperature 8.2° C. Oxygen 14.25 mg/l (121% of full saturation). Conductivity 563 umhos. Salinity 0.4 ppt.

			04-Jan-14					
	Flume			1550 hr	**Stockton Avenue Bridge**			1530 hr
Depth	**Temp 1**	**Salin 1**	**O2 1 (% saturation)**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	8.9	0.7	13.53	900	9.2	0.6	13.22	840
0.25	8.9	0.7	13.25	900	9.1	0.6	12.91	831
0.50	8.9	0.7	13.16	902	9.1	0.6	12.77	824
0.75	8.8	0.7	13.09 (113)	925	8.7	0.6	12.73	807
1.00	8.8	0.7	12.81	922	8.7	0.6	12.42	855
1.25					8.7	0.7	12.34	951
1.50					8.6	0.8	12.04	1074
1.75					8.7	1.0	11.18	1371
2.00					8.9	1.2	16.47 (144)	1674
2.15b					9.0	1.3	16.82	1729
2.50 Venetian Wall						1.2		
			04-Jan-14					
	Railroad Trestle			1515 hr	**Mouth of Noble Gulch**			1501 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	9.0	0.6	12.43	810	9.7	0.6	11.23	801
0.25	9.0	0.6	12.35	811	9.5	0.6	11.31	804
0.50	9.0	0.6	12.29	812	9.4	0.6	10.99	816
0.75	9.0	0.6	12.25	812	9.4	0.6	10.91 (96)	826
0.95b					9.5	0.7	10.74	917
1.00	9.0	0.6	12.22 (106)	813				
1.25b	9.0	0.6	11.61	813				
1.50								

			18-Jan-14					
	Flume			0745 hr	**Stockton Avenue Bridge**			0800 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	8.6	0.4	12.31	599	8.8	0.4	12.15	600
0.25	8.6	0.4	12.19	599	8.8	0.4	12.13	600
0.50	8.7	0.4	12.24 (105)	599	8.8	0.4	12.16	600
0.75b	8.7	0.4	12.03	595	8.8	0.4	12.25	602
1.00					8.9	0.4	12.25	602
1.25					8.8	0.4	12.25	602
1.50					8.9	0.4	12.28	602
1.75					8.9	0.4	12.26	602
2.00					8.8	0.4	11.75 (102)	602
2.20b					8.9	0.4	9.46	602
			18-Jan-14					
	Railroad Trestle			0820 hr	**Mouth of Noble Gulch**			0834 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	8.6	0.4	11.78	591	8.6	0.4	11.43	592
0.25	8.7	0.4	11.67	593	8.6	0.4	11.36	592
0.50	8.7	0.4	11.68	593	8.6	0.4	11.36	592
0.75	8.7	0.4	11.68	593	8.6	0.4	11.37 (98)	590
1.00b	8.7	0.4	11.67	593	8.7	0.4	10.80	596
1.25	8.7	0.4	11.59 (100)	593				
1.37b	8.7	0.4	11.23	593				
1.50								

18 January 2014. Gage height of 2.43 (morning) and 2.20 (afternoon). Clear and breezy in morning and afternoon. Air temperature of 6.6° C at 0745 hr and 12.7° C at 1540 hr. Flume inlet 0.9 ft; flume outlet 0.7 ft in the afternoon. No shroud present

Station 1: Flume at 0745 hr- Reach 1- 45 gulls bathing, 20 coots dabbling, 3 mergansers, 2 pied-billed grebes in water. 13 wild mallards and 2 coots on log raft under bridge. No surface algae. Flume at 1540 hr- Reach 1- 57 gulls bathing, 14 coots in water. No surface algae. Too dark to observe vegetation.

Station 2: Stockton Avenue Bridge at 0800 hr- Secchi depth to bottom. Reach 2- No surface algae. 9 coots, 9 mallards in water from log raft. Reach 2 at 1524 hr- Secchi depth to bottom. No surface algae. Too dark to see vegetation. 12 coots in water. 6 wild mallards on trestle abutment.

Station 3: Railroad trestle at 0820 hr; Reach 3- 20 coots, 2 more pied-billed grebes, 4 golden eye ducks, 3 wild mallards in water. At 1511 hr, Reach 3- No surface algae; 19 coots, 2 pied-billed grebes, 2 wild mallards, 2 pied-billed grebes.

Station 4: Mouth of Noble Gulch at 0834 hr- 2 wild mallards on downed cottonwood. No surface algae. At 1501 hr- No surface algae. Too dark to observe vegetation. No waterfowl on instream wood. No domestic ducks observed at the lagoon.

Station 5: Nob Hill at 0859 hr- Water temperature at 8.1° C. Conductivity 562 umhos, Oxygen 11.19 mg/l (95% sat.). Salinity 0.4 ppt. 3 mergansers (from lagoon?) and 3 mallards. Nob Hill at 1610 hr- Water temperature 9.1° C. Oxygen 13.44 mg/l (117% of full saturation). Conductivity 578 umhos. Salinity 0.4 ppt.

			18-Jan-14					
	Flume			1540 hr	**Stockton Avenue Bridge**			1524 hr
Depth	**Temp 1**	**Salin 1**	**O2 1 (% saturation)**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	9.1	0.4	14.81	613	9.9	0.4	14.30	617
0.25	9.6	0.4	14.84	613	9.9	0.4	14.24	615
0.50	9.5	0.4	14.86	609	9.9	0.4	14.21	615
0.65b	9.5	0.4	14.53					
0.75				604	9.8	0.4	14.05	614
1.00					9.7	0.4	13.90	611
1.25					9.6	0.4	13.69	610
1.50					9.4	0.4	13.70	608
1.75					9.3	0.4	13.61 (119)	606
2.00					9.3	0.4	13.84 (121)	605
2.10b					9.3	0.4	12.40	605
			18-Jan-14					
	Railroad Trestle			1511 hr	**Mouth of Noble Gulch**			1501 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	10.2	0.4	13.84	616	10.7	0.4	12.51	612
0.25	9.9	0.4	14.00	613	10.3	0.4	12.15	611
0.50	9.8	0.4	14.06	612	10.0	0.4	12.36	612
0.75	9.7	0.4	14.65	610	9.7	0.4	12.85 (113)	616
0.95b					9.6	0.4	12.98	624
1.00	9.6	0.4	14.87 (131)	608				
1.25b	9.6	0.4	14.47	607				
1.50								

23 January 2014. Berm around lagoon was reinforced in preparation of predicted high tide. Trying to prevent tidal overwash.

24 January 2014. Tidal overwash occurred along Venetian Court wall. But it was minor and no shroud was deemed necessary to pull saltwater off bottom. The berm was reinforced in the afternoon.

			01-Feb-14					
	Flume			0710 hr	**Stockton Avenue Bridge**			0728 hr
Depth	**Temp 1**	**Salin 1**	**O2 1**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	11.6	0.4	13.43	652	11.8	0.4	13.95	644
0.25	11.7	0.4	13.74	653	11.8	0.4	14.04	654
0.50	11.6	0.4	13.82	654	11.8	0.4	14.07	655
0.70b	11.6	0.4	13.40	635	11.8	0.4	14.06	654
0.75								
1.00					11.8	0.4	14.05	653
1.25					11.7	0.4	14.02	651
1.50					11.7	0.4	14.02	650
1.75					11.7	0.4	14.01	650
2.00					11.7	0.4	13.67	650
2.25b					11.7	0.4	4.06	649
			01-Feb-14					
	Railroad Trestle			0748 hr	**Mouth of Noble Gulch**			0802 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	11.3	0.4	13.43	641	11.3	0.4	11.65	616
0.25	11.4	0.4	13.46	643	11.3	0.4	11.61	642
0.50	11.4	0.4	13.52	643	11.3	0.4	11.60	644
0.75	11.3	0.4	13.56	642	11.3	0.4	11.60 (106)	644
1.00b	11.3	0.4	13.49	642	11.3	0.4	10.85	644
1.25	11.3	0.4	13.43 (123)	642				
1.45b	11.4	0.4	12.41	643				

01 February 2014. Gage height of 2.62 (morning) and 2.48 (afternoon). Clear and breezy in morning and afternoon. Air temperature of 3.8° C at 0710 hr and 11.4° C at 1558 hr. Flume inlet 9 ft; flume outlet 0.7 ft in the afternoon with 1 4x4 at base of outlet opening.
Station 1: Flume at 0710 hr- Reach 1- 25 gulls bathing, 12 coots dabbling, 7 coots on Venetian Court margin standing, 1 wild mallard in water. Later at 0816 hr- observed 10 mallards and 3 coots on log raft under bridge. No surface algae. Flume at 1558 hr- Reach 1- 66 gulls bathing, 28 coots in water. No surface algae. Too dark to observe vegetation.
Station 2: Stockton Avenue Bridge at 0728 hr- Secchi depth to bottom. Reach 2- No surface algae. 3 wild mallards and 1 hooded merganser in water; 2 mallards on Stockton Ave Bridge ledge. Reach 2 at 1529 hr- Secchi depth to bottom. No surface algae. Too dark to see vegetation. 5 coots, 12 mallards in water. Salinity 0.4 ppt (freshwater) at 2.5 meters on the bottom adjacent Venetian Court.
Station 3: Railroad trestle at 0748 hr; Reach 3- 8 coots, 2 pied-billed grebes, 7 mallards.
At 1515 hr, Reach 3- No surface algae; 9 coots and 2 wild mallards.
Station 4: Mouth of Noble Gulch at 0802 hr- No birds on in-channel wood. No surface algae. At 1500 hr- No surface algae. No birds on in-channel wood. Too dark to observe vegetation.
Station 5: Nob Hill at 0834 hr- Water temperature at 9.0° C. Conductivity 658 umhos, Oxygen 12.94 mg/l (95% sat.). Salinity 0.4 ppt. Nob Hill at 1616 hr- Water temperature 9.9° C. Oxygen 14.40 mg/l (101% of full saturation). Conductivity 579 umhos. Salinity 0.4 ppt.

			01-Feb-14					
	Flume			1558 hr	**Stockton Avenue Bridge**			1530 hr
Depth	**Temp 1**	**Salin 1**	**O2 1 (% saturation)**	**Cond 1**	**Temp 2**	**Salin 2**	**O2 2**	**Cond 2**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	12.5	0.4	13.35	663	12.4	0.4	12.95	659
0.25	12.5	0.4	13.27	663	12.5	0.4	12.87	662
0.50	12.5	0.4	13.25	663	12.5	0.4	12.89	662
0.70b	12.5	0.4	12.71	535	12.5	0.4	12.88	662
0.75								
1.00					12.5	0.4	12.80	663
1.25					12.5	0.4	12.84	662
1.50					12.4	0.4	12.76	662
1.75					12.2	0.4	12.30	662
2.00					12.2	0.4	12.50 (116)	660
2.15b					12.2	0.4	11.10	659
2.50 Venetian Wall						0.4		
			01-Feb-14					
	Railroad Trestle			1514 hr	**Mouth of Noble Gulch**			1500 hr
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**
(m)	**(C)**	**(ppt)**	**(mg/l)**	**umhos**	**(C)**	**(ppt)**	**(mg/l)**	**umhos**
0.00	12.3	0.4	11.69	657	12.4	0.4	10.08	648
0.25	12.3	0.4	11.64	657	12.4	0.4	10.08	649
0.50	12.3	0.4	11.70	657	12.2	0.4	10.59	657
0.75	12.3	0.4	11.83	657	12.1	0.4	10.39 (96)	655
1.00b	12.3	0.4	11.73	656	11.8	0.4	10.33	680
1.25	12.3	0.4	11.65 (109)	656				
1.35b	12.3	0.4	11.20	656				

2 February 2014. In preparation of stormflow, 2 boards were removed from each side of the flume inlet were removed. Maximum streamflow reached 13 cfs this day.

3 February 2014. Two more boards removed on one side to allow light to penetrate to the bottom.

4 February 2014. Two boards added back to flume to raise water surface elevation.

6 February 2014. Stormflow reached just over 20 cfs from another small storm. Sandbar remained intact.

7 February 2014. Sandbar prepared for potential emergency breach. CDFW notified that emergency breach may be necessary overnight.

8 February 2014. The biologist (Alley) was contacted by Morrison at 0420 hr that stormflow had reached 21 cfs at the Soquel Village gage and was rising, with a potential emergency breach likely. Kotilla was on his way to Capitola to operate the wheeled loader. The biologist arrived at the lagoon at 0534 hr with light sprinkles, though it was raining moderately in the mountains. The sandbar was intact and the lagoon water surface had overtopped the flume, with water entering though its grated ceiling. A

black-crowned night heron stood on the lagoon periphery near the flume inlet. A deeper notch had been cut through the sandbar and through the outer berm adjacent to the flume, leaving the inner berm near the lagoon intact. Rainfall increased over the next 3 hours, as did stormflow, slowly. At 0800 hr, the USGS gage reading in Soquel Village (2 miles upstream) was 30+ cfs. The estimated maximum flow through the flume is estimated to be 30 cfs. Noble Gulch and street runoff enter the Creek between the USGS gage and the flume. Adult steelhead were observed in the surf, shooting toward the flume outlet prior to sandbar breaching. At 0825 hr the lagoon water surface was increasing 1 inch per 5 minutes with the water surface level 14 inches above flume and 5 inches below the piling bolt at the elevation of overtopping of bulkhead at trestle.

The inner berm was opened by shovel to initiate an emergency breach at 0829 hr on 8 February to prevent bulkhead overtopping (flooding), with continued rain forecasted throughout the day. After the breach was initiated, the water surface increased to within 3 inches of the piling bolt before it began to drop. The USGS gage reading was 54 cfs at 0830 hr. By 0850 hr, the outlet channel was 20 feet wide. By 0907 hr the estuary water surface was 8 inches below the piling bolt. The biologist left the estuary at 0940 hr with water surface approximately 40 inches below the piling bolt and 18 inches below the top of the flume. At that time the outlet channel was 20-25 feet wide most of the way through the beach, opening up to about 40 feet wide at the surf. It had been an outgoing tide since about 0530 hr.

Light rain continued through 9 February with the streamflow reaching a maximum of about 125 cfs at 0400 hr on 9 February.

13 February 2014. The residual estuary was observed at low tide after the breach. Reaches 1 and 2 had pool depths of 0.5−0.75 m. The exit channel had begun deflecting to the east near its entrance to the Bay. The channel was 5−7 m (15−20 ft) wide and 0.5 ft deep across the beach at low tide. The flume was boarded up for the winter season.


02/13/2014 15:51

APPENDIX B. 2013 Drain Line Test for Restaurants Contiguous with Soquel Creek Lagoon.

2013 DRAIN LINE TEST FOR RESTAURANTS CONTIGUOUS WITH SOQUEL CREEK				
RESTAURANT	**INITIAL CONTACT**	**TEST DATE**	**COMMENTS**	**SIGN OFF**
MY THAI BEACH	Pron Pimol 22-Apr-13	5/1/2013	Approved	Van Son 5-9-13
BAY BAR	No contact 4/22/2013 23-Apr-13	5/1/2013	Corrections: Repair leaking floor sinks; water supply line; & drain pipes @ Bay Bar	
		5/14/2013	Approved	Van Son 5-14-13
PIZZA MY HEART	Georgia Tyrell 22-Apr-13	5/1/2013	Secure soda lines & remove all un-needed elect. & plumb.	
		5/14/2013	Approved	Van Son 5-14-13
FOG BANK	Amy Andrade 22-Apr-13	5/14/2013	Corrections: Repair leaking lines @ Fog Bank	
		5/14/2013	Approved	Van Son 5-14-13
PARADISE BAR & GRILL	Sarah Heath 22-Apr-13	5/8/2013	Corrections: Repair leaking lines & floor sinks; remove all debris	
		5/14/2013	Approved	Van Son 5-14-13
ZELDA'S	Pam Edmonds 22-Apr-13	8-May-13	Corrections: Repair waste line @ kitchen & remove all debris	
		5/14/2013	Approved	Van Son 5-14-13