D.W. ALLEY & Associates aquatic biology

SOQUEL CREEK LAGOON MONITORING, 1994

April, 1995
Project #106-04

Prepared for

CITY OF CAPITOLA
420 Capitola Avenue
Capitola, California 95010

330 Old River Lane • P. O. BOX 200 • Brookdale, California 95007 • (408) 338-7971 • FAX (408) 338-6045

TABLE OF CONTENTS

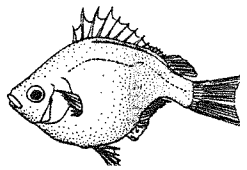


TABLE OF CONTENTS (continued)

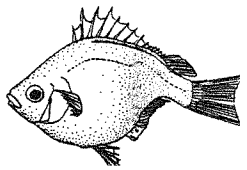
List of Tables

List of Figures

TABLE OF CONTENTS (continued)

List of Figures (continued)

List of Appendices



SOQUEL CREEK LAGOON MONITORING REPORT, 1994

ACKNOWLEDGMENTS

We wish to acknowledge the two funding entities for this, the fourth summer of lagoon monitoring and enhancement. They include the Coastal Conservancy, with Jim King being the project analyst who obtained state funds. Secondly, the other funding entity in implementing the **Soquel Creek Lagoon Management and Enhancement Plan (1990)**, has been the City of Capitola.

Susan Westman early on, now Kathy Barbaro of the Environmental Planning Department, have been very helpful and responsive. The monitoring was greatly facilitated by the many observant and hard-working Public Works personnel. We look forward to working with them again because they care about the fish in the lagoon. The City "raking crew" did a fine job at the time of sandbar closure along with Joseph Urbani's help. Bill Casalegno's skill in constructing the sandbar was again very appreciated. We thank Nels Westman and the Begonia Festival organizers for doing an effective job of gathering the flowers after the Festival in September, 1994. Young men from McDowell Youth Homes dismantled the floats and cleaned up afterwards.

We are grateful for the volunteer efforts of Tom and Carla Mader (Friends of Soquel Creek), Steve Leinau (Earth Links), Jennifer Tate, Gretchen Salem and Sandra Henn for helping with the fish census. Carla took some great pictures that are included on the cover and in **Appendix A.** Hopefully, we may obtain more volunteer help in 1995. We wish to thank the Friends of Soquel Creek for their continued interest in the fish and wildlife of Soquel Lagoon, as well as the watershed at large. The long-term health and welfare of Soquel Lagoon will depend on Capitola's citizens and their influence on watershed issues in the future.

Finally, we wish to acknowledge a familiar matriarch of the lagoon, Marion Hubback. She passed on in May 1994, as work began to close the sandbar. She was a long-time resident at the lagoon who dearly loved the birds that visited her. There will be someone important missing around the lagoon from now on.

EXECUTIVE SUMMARY

In May, 1994, Soquel Creek cut east across the beach to the jetty before emptying into the Monterey Bay, as it had in 1992 and 1993. Fish that may have been in this eastward channel were herded back into the main estuary with a 1/4-inch mesh seine at the advisement of the Department of Fish and Game. Then the channel was closed off for sandbar construction. The periphery of the lagoon was walked in search of tidewater gobies before sandbar construction began. None were seen. Sandbar construction involved a 3-day period (17-19 May) of opening the sandbar at low tide near dawn, raking furiously for 3-4 hours and plugging the sandbar when the tide changed to prevent salt water from washing in. City personnel and the biologist hand-raked decomposing kelp, sea grass and decomposed ooze out of the lagoon through the opening each day. The biologist searched the upper estuary for tidewater gobies on 19 May to beyond the Rispin Mansion. He observed none. A merganser with 12 young was observed at the upper end, however.

More than 90% of the decomposing plant material was removed before sandbar closure. As in 1992, in 1994 there was considerable ooze on the bottom. The shroud was placed over the flume inlet, and the saltwater was flushed out the first week.

Water quality for aquatic life in the lagoon was generally good with regard to oxygen, salinity, conductivity and cover. Oxygen levels were lowest at the bottom, with them being fair-to-good at all but the mouth of Noble Gulch throughout the summer. The lagoon bottom at Noble Gulch had oxygen depleted to poor levels as early as mid-July, which continued through most of the summer. Oxygen decline near the bottom at Noble Gulch corresponded to high levels of filamentous algae. A noticeable decline in oxygen level was detected under the railroad trestle in late August, which continued after the Begonia Festival. The site at Noble Gulch also registered a noticeable decline in oxygen following the Begonia Festival. However, in both cases this posed no significant problem for fishes, and had increased a week later at Noble Gulch. The site at the trestle continued to have lower

oxygen than the rest of the sites in late September. We have no good explanation for increased oxygen depletion at the trestle so early in the season, this being the first year of occurrence. Pigeon use of the trestle was not detected to be greater than previous years, and as oxygen levels were still fair-to-good at the trestle, they posed no problem.

An early storm of some magnitude brought pollutants and organic material into the lagoon in early October. High turbidity resulted in a cessation of photosynthesis, leading to apparently lethal depletion of oxygen about 4 days after the storm. Dead steelhead and staghorn sculpins were first noted by City personnel (Chris Crum) on 8 October in Reach 1. Lowering of the lagoon level to the point where light could penetrate to the bottom allowed algae to grow and produce oxygen again. Oxygen levels improved dramatically within 4 days of the lagoon adjustment. Fish sampling afterwards indicated that most steelhead survived the oxygen depletion.

Water temperatures were good initially and fair from mid-June to September, when the lagoon cooled to a good rating again. Temperatures were generally warmer in 1994 than the previous year, which had greater streamflow and a deeper lagoon. However, maximizing the gage height with good flume management in 1994 and foggy days contributed to better water temperatures than the previously low water year, 1992. The lagoon gage height was usually 0.2-0.4 feet higher than in 1992 and higher than in 1993 for the first half of the season. No boards were removed from the flume for the Begonia Festival in 1994, which allowed maintenance of water depth when little flow entered the lagoon.

Fish passage through the flume was adequate through July, 1994. An early rainy season resulted in the sandbar breaching on 7 November after only the second storm of the season. More rain followed soon after and prevented stagnation and excessive kelp decay in the estuary. It appeared to Ed Morrison of the City that someone had facilitated the breaching during the night. No notch had been present in the sandbar.

Fish sampling in October, in which steelhead were marked and

recaptured, indicated that the steelhead density in the lagoon was down from the previous year. The juvenile steelhead population in the lagoon in 1993 was estimated at 2,787 juveniles +/- 306. In 1994, the estimate was 1,140 juveniles +/-378 after the fish kill (approximately 53 juvenile steelhead, one adult steelhead and 11 staghorn sculpin counted). Besides the fish kill, another reason for the decline in steelhead numbers in 1994 was that Soquel Creek became intermittent by mid-August in Soquel Village. In 1993, the creek flowed continuously to the lagoon throughout the dry season. This hydraulic continuity allowed large numbers of juvenile steelhead to down-migrate to the lagoon throughout the summer to utilize valuable nursery habitat there. In 1993, the lowest estimated in-flow to the lagoon was 1 cfs in September. In 1994, on the other hand, in-flow declined below 1 cfs in late July and fell to an estimated 0.05 cfs by late September. A dry reach had developed through Soquel Village as in other drier years, cutting off down-migration of young-of-the-year steelhead to the lagoon's nursery habitat. A third reason for the decline in steelhead numbers may have been increased predation by mergansers, grebes and the green-back heron. No hatchery fish were captured during the census, indicating they migrated seaward the previous spring.

Regarding other fish species detected in the lagoon, Sacramento suckers were not captured in 1994, though they were common in 1992 and still present in 1993. However, tidewater gobies appeared to have increased with 35 being captured in the lower lagoon on 10 October 1994. A snorkel survey for tidewater goby throughout the lagoon in late August had yielded no observations of this species. This indicated that the tidewater goby population was probably small. Threespine sticklebacks were abundant throughout the lagoon again in 1994. Staghorn sculpins were present.

Regarding waterfowl, there were still four geese using the lagoon. This was considerably less than the 16 geese tallied back in July, 1989, before most were relocated. The 1994 density of mallards was similar to that of 1993, though they tended to use Reach 3 more in 1994. Numbers of mallards censused at 2-week intervals were generally between 15 and 30 individuals using the

lagoon until fall. A clutch of 4 mergansers was raised by a hen at the lagoon in 1994, as in 1993 (two young), with them leaving about a month earlier in 1994 and being gone by the end of July. Three to 6 pied-billed grebes and one green-back heron used the lagoon throughout the season. American coots again returned to the lagoon, but were about 2 weeks later than previous years. They were first observed on 30 September.

Pigeon sightings on the trestle were back to 1991 levels and only about 60% of 1993 levels. Pigeon feeding in Reach 2 was much reduced. Pigeons appeared to forage on the beach more in 1994 than previous years.

Aquatic plant production began early in 1994, with filamentous algae covering much of the bottom and extending up to 2.5 feet high by late June. Pondweed followed soon behind and dominated by early July. However, by mid-July the algae and pondweed had died back dramatically. By late July the filamentous algae had again become thick with the pondweed exhibiting dramatic growth in early August. By 12 August, there was substantial surface algae (30% of the surface). However, by late August the aquatic plants had died off once again, not to come back significantly for the remainder of the season. The lagoon at the mouth of Noble Gulch consistently had more pondweed and filamentous algae, both sub-surface and floating, than elsewhere in the lagoon.

No aquazine was required for algae control in 1994. The geese were seen feeding occasionally on natural aquatic vegetation in 1994. Their foraging was nothing like it had been immediately after the no bird-feeding signs went up in 1992.

At the flume, fecal bacterial levels in 1994 were generally lower than in 1993 through July. In August and September, coliform levels were similar to, or lower than those in 1993. However, they were generally higher than 1991 and 1992 levels for most of the summer and early fall. At no time during the summer of 1994 did coliform counts fall below the 200/ 100 ml standard of safety for swimming near the flume. Bacterial levels increased after the Begonia Festival in 1994. In 1994 there were generally more gulls on Capitola Beach between the wharf and jetty than in 1993,

which may have resulted in increased densities of gulls bathing in the lagoon and roosting on the restaurants. This would have increased the input of bird excrement and raised fecal coliform counts in the lower lagoon in 1994. Insufficient censusings in late morning and afternoon in 1994 prevented verification of these predictions.

At the Nob Hill site just upstream of the lagoon, coliform bacterial counts were generally similar or higher than in 1993. Both 1993 and 1994 had higher counts than previous years at Nob Hill, presumably due to the bridge work upstream. The County's coliform bacterial sampling was too infrequent elsewhere in the lagoon to draw conclusions.

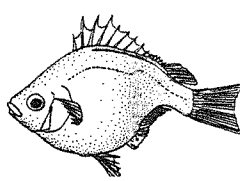
New Recommendations

1. The most critical recommendation yet to be implemented would be the installation of gutters on the lagoon-side of the restaurants to capture garbage and excrement-laden water to be transported away from the lagoon. This approach or installation of wires on the roofs to prevent roosting of gulls would significantly reduce nutrient and bacterial inputs to the lagoon.

2. Regarding sandbar closure and lagoon-raking, we recommended that the raking crew be equipped with chest waders instead of just hip waders. Use of hip waders greatly limits access, allowing only wading along the shallow periphery until the lagoon mostly drains. This allows only limited raking time in the main body of the channel before the sandbar must be plugged as the tide changes. Also, use the wide rakes that Chris Crum brought in 1994.

3. One educational tool to be implemented in 1995 will be dissemination of an explanation for not feeding the birds. Copies will be given to rental property owners and restaurant managers along the lagoon, in particular.

4. Encourage dog-owners to clean up after their dogs along the path adjacent to the lagoon. We recommend placement of a sign to



that effect at either end of the lagoon path. The sign should explain the health and pollution concerns.

5. Require the restaurant operator on Capitola Avenue near City Hall to wash his mats inside. Presently they are washed off outside, and the water enters the gutter that drains into Noble Gulch and the lagoon.

6. New management recommendations resulted from the fish mortality that occurred after the first rain in October. One is to lower the lagoon level after the first rain of the season to the point where the bottom is visible. This would allow algal growth despite the high turbidity. In this way, plant photosynthesis may continue to produce oxygen and prevent anoxic conditions lethal to fish. A previous recommendation in the Management Plan (1990) should be emphasized to prevent further fish mortality. It stated that parking lots and streets draining into the lagoon should be cleaned thoroughly before the first rain of the season.

7. Road work involving repaving and application of petrochemicals should be done early in the summer. This will allow sufficient time for these substances to penetrate and dry before fall rains can wash them into the lagoon.

8. Look into better ways of sealing the cracks between the boards in the flume inlet. Sandwiching rubber strips between the boards may solve the problem.

9. Change the text on the interpretive sign regarding the tidewater goby. It should read that the tidewater goby is now federally- and state-listed as an endangered species.

LAGOON AND ESTUARY FORMATION

Sandbar Construction, 1994. **Appendix A** provides pictures of the various activities associated with sandbar closure.

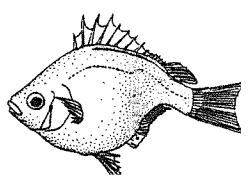
The City utilized a multiple-year Fish and Game Permit (**Appendix B**) to close the sandbar. It stated that no vehicles were to enter the wetted creekbed except within 25 feet of the flume. The Creek was flowing east of the flume across the beach to the rock jetty, as in 1992 and 1993. The stream went laterally east from the flume and parallel to the coastline for approximately 150 meters, then bent abruptly south at the jetty to empty into the surf. It was decided that fish in the east-coursing channel across the beach would be herded back into the lagoon before the sandbar was constructed around the lagoon.

16 May 1994. The periphery of the estuary and the lateral channel to the jetty were walked in search of tidewater gobies. None were observed. Mr. Casalegno got a late start, but opened a trench along the flume. The sandbar was not closed off this day.

17 May 1994. At 0800hr the lagoon was open to the Bay. Word came that Mrs. Hubback had died early that morning. The weather was unsettled all day with dark, threatening clouds, sprinkles of rain off-and-on and even hail. The lateral channel was seined to herd fish back into the lagoon before it was blocked with sand. After the sand was pushed across, the lateral channel drained. We searched the shallow channel and saw 6, 1.5-inch steelhead and one staghorn sculpin. One of the steelhead was captured and put in the lagoon.

The lagoon looked very deep. We could rake sea grass only within 25 feet of the flume. The sandbar was closed at 1330hr to prevent saltwater entering the lagoon. The sand in the flume was flushed out by 1600hr after concerted effort by City personnel. The flume was passable to fish that night.

18 May 1994. The flume was open and functioning. Five city employees and the biologist raked that day. Wide rakes obtained



by Chris Crum helped. Most kelp/sea grass was in the lower half of Reach 1. The water was muddy early in the morning from rain the previous afternoon, with it clearing up later on. The sandbar was closed at 1400hr. The baffle was observed inside the flume. Mr. Casalegno smoothed a pad for the pedal boat operator. The tractor did not enter the water.

19 May 1994. Five city employees (Cary, Lance, Tim, Chris and Mark), Joe-Joe and the biologist raked this day. The biologist searched upstream beyond the Rispin Mansion and saw no tidewater gobies. There was a common merganser hen with 12 young upstream of Shadowbrook Restaurant. Tim Calahan and the biologist rescued 6 prickly sculpin, 1 Sacramento sucker and 1 steelhead in Reaches 2 and 3 as the lagoon drained. We rescued 1 steelhead under the Stockton Avenue bridge, and one died before being noticed. Chris Crum relocated a turtle that appeared near the flume. It was put in the riparian corridor in Reach 3. The Venetian Court side of the lagoon was contoured above the water line. The sandbar was closed for the season at 1245hr. Afterwards, ten steelhead were rescued from the channel beside the flume on the ocean side after sand had been pushed across. They were placed in the lagoon. Jim Turcotte noticed them and helped with Cary and the biologist to catch them. Ellis spelled Bill on the D-6 Caterpillar. Joe-Joe confirmed that the rip in his garage-sale waders would in fact allow water to leak in and completely soak him! (See photos.)

Recommendations for Lagoon Preparation and Sandbar Construction

1. Continue to bring Tim Calahan back to the lagoon-raking crew if he wishes to return. His sense of humor and light-heartedness were much appreciated in 1994. He truly enjoys the aroma of rotting kelp and undoubtedly looks forward to sandbar closure each May, as we all do.

2. Regarding sandbar closure and lagoon-raking, we have recommended that the raking crew be equipped with chest waders instead of just hip waders. Use of hip waders greatly limit access, allowing only wading along the shallow periphery until the lagoon mostly drains. This allows only limited raking time

in the main body of the channel before the sandbar must be plugged as the tide changes. The desired goal is a maximum of 3 days of raking before final sandbar closure.

3. Continue to rake as much kelp and sea grass out of the lagoon as possible before final closure, including plant material trapped under the restaurants, in depressions around the bridge and at the mouth of Noble Gulch.

4. Dispose of kelp from the lagoon during sandbar closure in the bay rather than bury it in the sandbar. Disperse it up and down the beach so as to spread it out. Continue to include this in the Fish and Game permit for sandbar construction. County environmental health has no problem with this so long as kelp is spread out over a wide area (**J. Ricker, County Environmental Health, pers. comm.**).

5. Bring back the wide rakes that Chris Crum had in 1994.

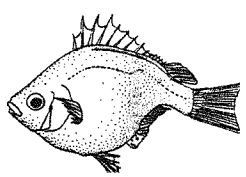
6. Evaluate the structural integrity of the flume and its supports. Repair cracks and supports as necessary.

7. 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 at low tide to drain out more kelp.

8. Search under the bridge and in Reaches 2 and 3 for stranded fish to rescue as the lagoon drains each day during raking.

9. Seal off storm drains on the west side of the street in front of the Esplanade. This should be the case from May 15 to after the clean-up from the Wine Festival in mid-September. Seal off any storm drain pipes leading from the street to the lagoon in front of the restaurants. This will reduce pollution from restaurant clean-up.

10. Attempt to make the area around the flume the deepest part of the lagoon so that heavy salt water will collect there and be pulled out easily by the shroud.



11. Continue to maintain the underwater portal in the flume for out-migration of adult steelhead until June 1, while maintaining a notched top plank for out-migration of smolts until 1 July.

12. Continue to maintain the 1-foot high baffle inside the flume until July 1 for smolt fish passage.

13. Continue to maintain a 6 to 8-inch depth at the outlet of the flume until July 1. Install two 4"x 4" planks in the outlet if necessary as per Fish and Game's suggestion.

Sandbar Breaching During the 1994-95 Rainy Season.

7 November 1994. The biologist was notified on Monday, 7 November, that the sandbar had breached Saturday night, 5 November. It had rained from Friday night through Sunday, and again Monday night. From Friday night to Sunday morning we had received 5 inches of rain in Brookdale. This was the second storm of a very wet winter. The flume with two boards out on either side of the flume inlet could not pass enough water. Observations on Monday afternoon indicated that the lagoon level had reached 1-2 feet above the piling bolt. Ed Morrison suspected that the breach was helped along. No notch was present in the sandbar prior to breaching. By Monday evening, the flume was boarded up for the season.

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. Street sweepers with water and suction may be necessary. In addition, road-work such as repaving and application of fresh petro-chemicals to pavement should be done early in the summer to allow sufficient time for penetration and drying before the rainy season. These chemicals can be lethal to fish.

2) Recommend to the owners of 443 River View that they build a better bulkhead to replace the old sandbag wall.

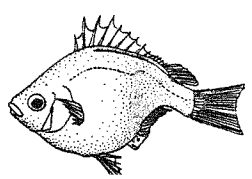
3) The notch in the sandbar should be cut slightly lower than the piling bolt. The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation.

4) Just before the first anticipated storm of the fall season, remove one board from each side of the flume if a small storm is anticipated. 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. Clear the sand away from the top of the flume back to the first hole cover.

Leave one board out on either side of the flume after each small storm and remove them before each storm until the sandbar is eventually breached during later, larger storms usually occurring after Thanksgiving. Remove the first flume portal cover and screen it if the entrance of the flume cannot handle the volume of the stormflow in October and early November. After the stormflow subsides, replace the cover until the next storm.

5) 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.

6) 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 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 in the lagoon and unable to migrate upstream because of insufficient streamflow.



MONITORING OF PONDWEED AND ALGAL DENSITIES

The lagoon was divided into 3 reaches. Reach 1 extended upstream from the flume to Stockton Avenue Bridge (**Figure 9**). Reach 2 extended upstream from Stockton Avenue Bridge to the railroad trestle. Reach 3 extended upstream to a point just past the Shadowbrook Restaurant. **Appendix A** provides photographs of pondweed and algae through the summer and fall months.

Aquatic plant production began early in 1994, with filamentous algae covering much of the bottom and up to 2.5 feet high by late June. Pondweed followed soon behind and dominated by early July. However, by mid-July the algae and pondweed had died back dramatically. By late July the filamentous algae had again become thick with the pondweed following with dramatic growth in early August. By 12 August, there was substantial surface algae (30% of the surface). However, by late August the aquatic plants had died off once again, not to come back significantly for the remainder of the season. The lagoon at the mouth of Noble Gulch consistently had more pondweed and filamentous algae, both sub-surface and floating, than anywhere else in the lagoon.

Plant growth in the 1994 lagoon was very different from 1993, but similar to the drier year of 1992. In 1994 as a whole, there were higher densities of aquatic plants than in 1993. In 1994, there was more ooze and sand in the lagoon than in 1993. The planktonic algal bloom was greater in 1994 before the pondweed and filamentous algae appeared. Pondweed made an earlier appearance in 1994 and filamentous algae was thick before July, 1994. In both 1993 and 1994, the most abundant floating filamentous algae occurred in early August and to similar levels. Whereas pondweed and algae were still thick in late September and October, 1993, they were reduced in September, 1994. Rains came earlier in 1994, bringing increased turbidity and less photosynthesis.

Table 1 provides a summary of pondweed and algal densities for 1994. In 1994 after a relatively dry winter, pondweed was first detected in late June (20% of the bottom) as opposed to September

the previous summer. It appears earlier after a drier winter than after a wetter winter. Filamentous algae began growing early, as well, with a third of the bottom covered by mid-June. By late June the entire lagoon bottom was covered with a thick forest of either pondweed with algae attached (20%) or clumps of algae by itself (80%).

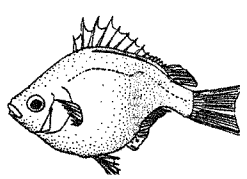
As has been the case in previous years, July was the month of considerable plant growth. Pondweed appeared to have peaked by the end of July and died back somewhat. However, the filamentous algae remained very thick.

In August the pondweed covered with algae again filled the entire lagoon bottom to within a duck neck's length from the surface. Surface algae was at a maximum in mid-August, especially in Reach 1 where it covered 30% of the area. At the same time, the mouth of Noble Gulch had a large algae bloom with 65% of the surface covered in the immediate vicinity. Twenty percent of the lagoon surface had floating algae near the Shadowbrook Restaurant. By the last week in August the aquatic plant populations had crashed and never reached the earlier densities and thickness for the remainder of the season.

By late September the pondweed was turning brown. The first rain of the next rainy season came in early October and was heavier than previous years, though the sandbar remained intact. Resulting turbidity restricted photosynthesis during October and caused a major plant die-off. Then the sandbar breached in early November.

Activity of the Begonia Festival had apparently eliminated much of the pondweed and algae in a 50-foot wide lane down the center of Reach 3. Three days after the Festival, this area had 50% exposed sandy bottom. On either side of the lane the pondweed and algae ranged from 0.5 to 2.5 feet high in deep areas, with 55-70% of the algae in the lagoon less than 0.5 feet thick.

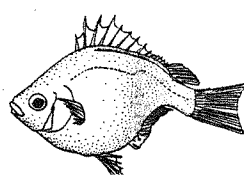
Noble Gulch continued to provide a nutrient in-flux to the lagoon in 1994, as indicated by the filamentous algal bloom that existed at its mouth all summer. Gray water was visible on several



occasions around Noble Gulch by ourselves and the County's water sampler, indicating pollution from upstream. One resident stated that she routinely observed workers at the restaurant on Capitola Avenue, washing their kitchen mats into the storm drain leading to Noble Gulch. Jim Turcotte of the City also mentioned the problem with the restaurant.

Table 1. Changes in Pondweed and Algae Densities, 1994.

Date	Reach #	Pondweed & assoc. Algae % covering bottom	Algae % bottom	Algae % surface
16-19May94		Sandbar Constructed.		
24May94	1,2,3	Slight planktonic algal bloom		
1Jun94	1,2,3	Thick planktonic algal bloom		
"	3	0	0	1
16Jun94	1	0	30(6" thick)	1
"	2	0	35(6"-2' thick)	1
"	3	0	30(6"-1.5'thick)	1
28Jun94	1	?	?(could not see)	0
"	2	20(1.5'-2.5')	80(1'-2.5')	0
"	3	20(1.5'-2.5')	80(6"-2.5')	0
7Jul94	1	?	?(could not see)	0
"	2	68(2'-3.5')	30(1'-2' thick)	2
"	3	65(1'-2.5')	20(6"-1.5' thick)	2
13Jul94	1	50(.6'-2.5')	50(1"-2" thick)	0
"	2	20(.5'-2')	30(3"-6" thick)	0
	2		50(1" thin film)	
"	3	10(1'-2')	20(3"-6" thick)	0
	Noble G.	65(.6'-2.5')	0	0
30Jul94	1	30(2'-4')	30	0
	2	20(2'-4')	80(2'-2.5'thick)	5
	3	10(2'-3')	90(2'-2.5'thick)	10
	Noble G.	65(2'-3')	35(2'-3' thick)	20
12Aug94	1	85(1'-3')	0	30
"	2	100(1'-3')	0	20
"	3	100(1'-2.5')	0	10
	Noble G.	100(1'-3')	0	65
	Shadowbrook			20
24Aug94	1	80(.5'-1')	0	0
"	2	15(1.5-2.5')	30(.5' thick)	2
	2		55(1" thick)	
"	3	10(2'-3')	30(.5' thick)	5
	3		60(1" thick)	
"	Noble G.	0	100(.5' thick)	5
	Shadowbrook			10
11Sep94	Day of the Begonia Festival			
14Sep94	1	?	?(too dark)	1
"	2	15(2'-2.5')	70(.2-.3'thick)	2
"	3	15(.5-2.5')	55	1
"	Noble G.	0	80(.2'-.3'thick)	0
30Sep94	1	20(2')	80(.2'-1')	-
"	2	20(2.5')	80(.2-.5')	10
"	3	20(2')	80	5
"	Noble G.		70(.2-.7'thick)	0
4Oct94	Rained.			



Recommendations for Control of Algae

1. Establish criteria which may be used to decide when algae is excessive, keeping in mind that pondweed and algae provide necessary cover for fish from bird predators. If aquazine is used in mid-summer, apply a low dose to the lower lagoon to clear out the algae, making it easier for fish to move around and feed on invertebrates, as well as give pondweed a competitive advantage over the algae.

2. If a mid-summer treatment of aquazine is deemed necessary, apply it in a low dose (3 pounds or less) well below the Stockton Avenue Bridge so that no pondweed is killed and only Reaches 1 and 2 will be affected. If pondweed is not present in Reaches 2 and 3 at the time of aquazine treatment, algae control will leave little or no cover for fish, requiring special concern about aquazine spreading upstream of Reach 1 after treatment. In such cases, we recommend that just 2-3 pounds of aquazine be applied near the flume only and in early morning before the onshore breeze develops.

3. Choose to skim off floating algae until just before the Begonia Festival, at which time aquazine may be used to reduce algae before people walk around in the lagoon. The skimming off of algae removes the nutrients stored in the algae and may slow future algal growth. Use of aquazine returns the nutrients to the lagoon during bacterial decomposition. This release of nutrients stimulates faster algal growth afterwards. Offer to donate funds to a volunteer group, if necessary, to skim off algae the lagoon surface instead of paying to have the lagoon treated with aquazine.

4. Require the restaurant operator on Capitola Avenue near City Hall to wash mats inside. In this way the organic material will enter the sewer system instead of Noble Gulch and the lagoon.

5. Disseminate an explanation for not feeding the birds. Copies will be given to rental property owners and restaurant managers along the lagoon, in particular.

ANALYSIS OF FECAL BACTERIA MONITORING

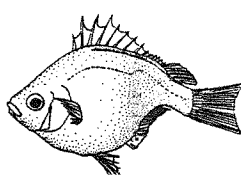
Fecal Coliform Counts from Santa Cruz County Monitoring

The summer months were focused on, from the time of sandbar closure (mid-May before Memorial Day weekend) to just after the Begonia Festival (first weekend in September). (Actual bacterial counts from samples may be found in **Appendix C**). These are the months in which recreational use of the lagoon would potentially be highest, and when reductions in fecal bacterial counts would allow swimming. A management goal is to reduce fecal coliform counts below the 200/100 ml level, which is deemed hazardous to health by the Environmental Protection Agency. If this can be done, the lagoon may once again be used for swimming.

Reach 1 (lower lagoon) spanned from the flume to the Stockton Avenue Bridge (**Figure 8**). Reach 2 (middle lagoon) included the area from the Stockton Avenue Bridge to the railroad trestle. Reach 3 (upper lagoon) went from the trestle upstream to beyond the Shadowbrook Restaurant.

The County's Department of Environmental Health collected weekly samples at primarily the flume entrance in the Soquel Creek Lagoon. Other weekly stations were on the Creek near Nob Hill and in Noble Gulch at Bay Avenue (above the tunnel and not in the lagoon). Additional stations in the lagoon were occasionally monitored at the mouth of Noble Gulch and at the railroad trestle.

The raw County data that were graphically represented are in **Appendix C.** Coliform bacterial counts were graphed for Reach 1 from the station near the flume in 1990-93 (**Figure 1a**) and in 1993-94 (**Figure 1b**). Upper Reach 2 and lower Reach 3 were represented by the trestle station data which were graphed for 1990-93 (**Figure 2a**) and 1993-94 (**Figure 2b**). Data for the site in Noble Gulch near Bay Street (not in the lagoon) for 1993-94 were graphed (**Figure 3**). Upper Reach 3 at a potential problem spot was represented by data collected at the mouth of Noble Gulch in the lagoon. These data were compared for 1991-92



(**Figure 4a**) and 1991-94 (**Figure 4b**). However, samples were sporadically collected there. The counts at the site behind Nob Hill Shopping Center represented fecal bacterial levels entering the lagoon. They were graphed for 1992-94 (**Figure 5**).

The discussion will focus primarily on Reach 1 at the flume and at the upstream end of the lagoon at Nob Hill because sampling was more restricted in 1993 and 1994 than previous years.

The station at the flume was sampled weekly. The station at the trestle was was monitored 7 weeks in 1993 and only twice in 1994 during closed sandbar conditions. The station at the mouth of Noble Gulch represented upper Reach 3 and was monitored twice in 1993 and 10 weeks (14 times) in 1994. Unfortunately in 1994, samples were not taken consistently at the mouth of Noble Gulch until September, making comparisons difficult. It must also be understood that bacterial concentrations may vary considerably from one place to another. In addition, 1994 samples were taken on successive days (3-4 October) and twice a week at the flume in September after the Begonia Festival. Coliform counts varied widely from day to day. Therefore, the data only indicated bacterial levels in a general way.

Fecal Bacterial Counts in Reach 1. Week 2 was when the sandbar was closed in 1994. Week 20 was a week after the Begonia Festival. Counts in 1994 were generally lower than 1993 until Week 10 (11 July), when they were considerably higher than 1993 (**Figure 1b**). During Weeks 11-13, counts were similarly high, but for Weeks 14-16 (August), they were considerably lower in 1994 than in 1993. However, at no time during the summers of 1993 or 1994 did coliform counts fall below the 200/ 100 ml standard of safety for swimming.

In 1994, there was a substantial increase in the coliform bacterial count on the Monday after the Begonia Festival, which was not seen in 1993. Apparently, significant amounts of bacteria were suspended from the sediments during Festival activities. This could be expected from other recreational activity in Reach 1 involving wading.

The City inspected the pipes under the restaurants that border the lagoon and pipes were repaired as needed (**Appendix D**).

Fecal Bacterial Counts in Upper Reach 2 and Lower Reach 3. No comparisons could be made between 1993 and 1994 fecal coliform counts at the trestle because of the paucity of samples until late September and October, 1994 (**Figure 2b**). There were two weeks in October, 1994, when it was safe to swim according to the health standards.

Fecal Bacterial Counts in Noble Gulch. The monitoring station was located at the entrance of the tunnel at Bay Avenue. Fecal coliform counts fluctuated considerably in 1993 and 1994, except in weeks 12-15 (25 July to 15 August). There were some weeks when they were quite low and others when they were relatively high (**Figure 3**).

Fecal Bacterial Counts in Reach 3 at the Mouth of Noble Gulch. In 1994, the counts were quite high in Week 5 (14 June), but near or below the safety level for swimming in September, October and November, except for a count of 860/ 100 ml on October 4, though on October 3 it was only 240/ 100 ml (**Appendix C**). Grayish water was observed on several occasions. In 1993, only 2 weeks were monitored. However, in 1994 there appeared to be a concentrated source of coliform bacteria in Week 5 (14 June) and in 1993 during Week 18 (7 September) (**Figure 4**). The County staff noted the presence of saw dust on 7 September 1994, but clear water on 14 June 1994.

Comparison of Fecal Coliform Counts at the Flume, Railroad Trestle and the Mouth of Noble Gulch, 1994.

Insufficient water sampling occurred in 1994 to compare the three sites. Fecal coliform bacterial counts in 1994, as in previous years, were consistently higher in Reach 1 than in Reaches 2 and

3 when all three were monitored (**Figures 1b, 2a and 4b**). Late in the season, counts were similarly low in Reaches 2 and 3 (**Figures 2b and 4a**).

Comparison of Fecal Coliform Counts at Nob Hill, 1992-94.

Counts were higher in 1994 than 1993 in 6 of the 11 common monitoring weeks (**Figure 5**). However, in those 6 weeks of higher counts, they were extremely high in 5 of 6 cases, leading to an overall pattern of higher fecal coliform entering the lagoon in 1994. Counts in 1992 were generally lower than both 1994 and 1993 except for Week 6 of 1992 when it rained. Counts were well above 1000/ 100 ml in 10 of 12 weeks in 1994 and 9 of the same 12 weeks in 1993.

Conclusions from Fecal Bacterial Monitoring

In 1994, coliform levels were generally somewhat better than 1993, except after the Begonia Festival. However, the lower lagoon near the flume came close in only one week to meeting the safe swimming standards. From data obtained during limited county sampling at the trestle and the mouth of Noble Gulch, the water there met the safety standards for swimming during many of the weeks after the Begonia Festival. Data from mid-summer were lacking in 1993 and 1994. Data for 1991 and 1992 indicated that the health standards were met at the trestle and Noble Gulch in many weeks (**Figures 2a and 4a**).

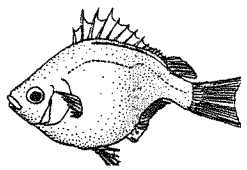
We had concluded that fecal bacterial counts were reduced in 1991 compared to 1990 in Reaches 1 and 2 (**Alley 1992**). Counts in 1992 were similar to those in 1991. In Reach 1 the counts were at unsafe levels for swimming during 82% of the weeks in 1991 and 94% of the weeks in 1992, from the time of sandbar closure to the weekend of the Begonia Festival. On the other hand, in Reach 2 at the trestle, counts were at safe levels of coliform bacteria 65 % of the weeks in 1991 and 61% of the weeks in 1992 during the same time period.

Reasons for the increase in fecal bacterial counts in 1993 and 1994 may be due to at least 3 factors. According to John Ricker at the Santa Cruz County Environmental Health Department, two probable factors were: one, the disturbances at the two bridge modifications upstream of the lagoon; two, sufficient streamflow through the early summer in 1994 and the entire summer in 1993 to carry the bacteria downstream from the bird colony at Soquel Avenue bridge. An additional factor in 1993 was probably the three-fold increase in pigeons roosting on the railroad trestle. An average of 16 pigeons were there during each monitoring in 1993, with a maximum of 30 observed at one time. For 1994, the bridge work continued, though there were not the higher streamflows and higher pigeon densities on the trestle. In 1994 there were generally more gulls on the beach than 1993, which may have resulted in increased densities of gulls bathing in the lagoon and roosting on the restaurants. This would have increased the input of bird excrement in the lower lagoon in 1994. Insufficient censusings later in the day in 1994 were made to verify these predictions.

Monitoring of Dog Excrement - Not Again!

The first record of excrement was on 30 July with 4 dog piles at the trestle park (private property). On 12 August there were 9 piles there with 7 being "fresh." By 24 August there were 22 piles at the trestle park! Two piles were on the path. We saw 6 dogs walked on the path during the monitoring that day. It appeared that the dog excrement was removed during or before the Begonia Festival because afterwards, on 14 September, there was just one fresh pile of excrement at the trestle park. By 30 September, 4 piles were at the park and 2 piles were on the path.

Presumably the residents along the path clean up the excrement because the piles observed on the path are usually fresh. Who knows where the excrement is disposed of? This would be a good survey project for a UCSC Environmental Studies student. "Where do you dump your dog's crap, madam, in the trash can or the lagoon?"



Recommendations Regarding the Monitoring and Reduction of Fecal Bacteria

1. Encourage dog-owners to clean up after their dogs along the path adjacent to the lagoon. We recommend placement of a sign to that effect at either end of the path along the lagoon.

2. Continue to enforce the no bird-feeding ordinance at the lagoon. Discourage feeding of fish at the lagoon, as well.

3. Continue to dispose of kelp from the lagoon along the beach during sandbar closure rather than bury it in the sandbar. Disperse it up and down the beach to spread it out.

4. Continue to open and close the sandbar during outgoing tides and before incoming tides, respectively, during sandbar construction and the raking out of decomposing plant material.

5. Spend the necessary time to remove as much kelp as possible from the lagoon with hand tools during the time required for sandbar construction.

6. Remove the remaining domestic geese and ducks from the lagoon and transplant them to an acceptable private pond.

7. Maintain weekly fecal bacteria sampling stations at the flume, the park at Stockton Avenue Bridge (in front of Mrs. Hubback's house), near the railroad trestle and at the mouth of Noble Gulch for the period 15 May to 15 September.

8. Discuss the feasibility of opening Reaches 2 and 3 to swimming if fecal coliform counts are consistently less than 200/ 100 ml in the samples. This requires that these reaches be monitored, however.

9. Continue to maintain a log of complaints/reports of pollution entering the lagoon, as well as excessive algae. Record the date, time and names of the concerned parties.

10. Choose to manually skim off floating algae from the lagoon instead of using aquazine, except possibly before the Begonia Festival.

11. Continue to seal off storm-drains on the west side of the street in front of the Esplanade. This should occur from May 15 to after the clean-up from the Wine Festival in mid-September.

12. Continue to seal the drain under the restaurants during the period of sandbar closure.

13. Require that bypass tubes be connected to the drain pipes from the roof of Larry's Surf and Turf Restaurant such that they drain away from the lagoon for the period, 15 May until the sandbar is breached in the fall/winter. Require that they construct a gutter system under their windows which will prevent window-washing water from entering the lagoon.

14. Require that Sea Bonne and Margaritaville Restaurants attach gutter systems to the concrete wall that will prevent wash-water and food particles from entering the lagoon where they presently hose off their decks into the lagoon.

15. Require that repairs of plumbing under the Esplanade restaurants be done with double-walled pipes to prevent sewage leaks.

16. Continue the annual inspection program for evaluating the plumbing under Esplanade restaurants. Continue to send a copy of the sign-off sheet to the consultant for the monitoring report.

Reports From the Public Regarding Pollution Entering the Lagoon and Other Problems Related to Aesthetics, Recreation, Etc.

The one problem reported was by the Surf Rider Foundation. The ocean at Capitola Beach was posted for approximately two weeks in early June, 1994. The reason for closure was high fecal coliform counts. The Surf Rider Foundation requested that the City post more and larger signs along the beach to warn people about the danger of entering the water. Sources of coliform bacteria may be bird excrement, sewage leaks or decomposing plant material (kelp and sea grass). No sewage leaks were found. Raking of the lagoon before sandbar closure undoubtedly increased the amount of decomposing plant material in the ocean in the vicinity of the flume. However, the water quality, fish habitat, aesthetics and air quality in and along the lagoon were improved by the raking of sea grass and kelp from the lagoon. These benefits must be weighed against the potential loss of ocean-side recreational benefit for a short period after sandbar closure, if indeed lagoon-raking was the cause of the high bacterial counts in the surf. Ed Morrison of the City stated that bacterial counts were much higher when water samples were taken at the water's edge as opposed to a few feet out into the surf. Samples taken out in the surf would better indicate health hazards, we would suspect, although they would be slightly more difficult to obtain.

Rating Criteria

Water quality parameters were rated according to the tolerances of steelhead. This was because other fishes were more tolerant to low oxygen, higher salinity and higher temperatures than steelhead. 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 22 C (72 F) and oxygen levels below 5 parts per million (mg/l) are thought to stress steelhead. However, steelhead have been found surviving

in pools in the Carmel River at 1-2 ppm for 1-2 hours at dawn. Based on 1988 monitoring, steelhead appear to survive in Soquel Lagoon at water temperatures of 23-25 C for 1-2 hours toward the end of the day (Habitat Restoration Group 1990). Water temperature may rise 3-4 degrees C by the end of a sunny day.

Oxygen levels critical to the survival of steelhead were classified as those measured in the lower 0.25 meters from the bottom, where steelhead would inhabit. Morning oxygen levels below 2 mg/L were rated critical. Morning oxygen levels below 5 mg/L were rated poor. Morning oxygen levels of 5 to 7 mg/L were rated fair with above 7 ppm rated as good. Morning water temperatures in the lower 0.25 meters of the water column of less than 20 C were rated good while those 20-21.5 C were rated fair. Temperatures above 21.5 C were rated poor.

High levels of dissolved carbon dioxide in water will inhibit absorption of oxygen by fish. However, in the alkaline conditions that exist in Soquel Creek Lagoon, carbon dioxide is poorly dissolved and believed not to be a problem (Jerry Smith, pers. comm.). Therefore, monitoring of carbon dioxide was unnecessary.

Lagoon depth was monitored with the staff gage on the eastern bulkhead, upstream of the Stockton Avenue Bridge. Readings less than 1.85 were rated poor. 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.

Results of Water Quality Monitoring After Sandbar Closure

Appendix E provides detailed data on water quality. **Table 2** summarizes conditions at each monitoring time, based on the rating criteria.

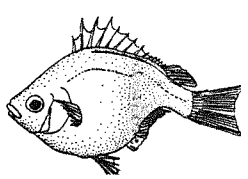


Table 2. Water Quality Ratings in Soquel Creek Lagoon, 1994.

Date	Flume Passage	Gage Height	Water Temperature	Oxygen	Salinity	Lagoon In-flow (cfs)
24May94	open	fair 2.01	good	good	good	5.5-6
1June94	open	fair 1.95	good	fair	good	5-5.5
12Jun94	open	fair 1.95	fair fair* good*	good	good	3.5-4
28Jun94	open	good 2.22	fair	good	good	1.75-2
13Jul94	open	fair 2.17	good	good	good	1.25
30Jul94	open	fair 2.00	fair fair good	good	good	.5-.7
12Aug94	closed	poor 1.79	fair fair good	good	good	0.25
24Aug94	closed	poor 1.72	fair fair good	good fair good	good	.25-.3
11Sep94	Begonia Festival					
14Sep94	closed	fair 1.96	fair good good	good fair poor	good	0.1
30Sep94	closed	poor 1.32	good good good	good fair good	good	0.05
4Oct94	Rained. One board each side was out. Another removed after storm to drain off scum. Then it was replaced.					
8Oct94	Dead fish first reported in Reach 1.					
10Oct94	open	fair 1.88	good	poor poor poor	good	-
10Oct94	We recommended that the lagoon be lowered 6"-8" to allow light penetration to the bottom for photosynthesis and oxygen production. It was done.					
14Oct94	Checked for oxygen.		good	fair		
23Oct94	-	poor 1.66	good	good	-	-
4-7Nov94	Rained. Morrison had 2 boards out on either side in anticipation.					
6Nov94	Sandbar breached anyway, possibly with help.					

* If 3 ratings are listed, they refer to Reaches 1, 2 and 3.

Lagoon Level. As of the first monitoring, 5 days after sandbar construction on 24 May 1994, until sandbar breaching on 6 November 1994, 13 monitoring periods were performed at approximately 2-week intervals, except more frequently after the fish kill. Lagoon depth was rated good on one occasion, fair on 6 occasions and poor on four occasions (**Table 2**). Placement of plastic sheeting over the flume boards and having all of the flume boards in place improved lagoon depth. With the exception of the month of August and late September, the City did an adequate job of maintaining as high a water surface elevation in the lagoon as possible with very little stream inflow (**Figure 6**). The problem in August was that water leaked around the plastic sheeting that was placed over the flume's inlet boards to seal up the opening. Because there was very little water entering the lagoon in 1994, a tight seal was required. By mid-September the lagoon was deeper, even though the stream inflow had diminished even more. This was because the seal was improved. It was beneficial that the lagoon level was not lowered for the Begonia Festival. The lagoon was lowered in late September in anticipation of a storm that did not materialize.

Flume Passability. According to the Management Plan (**1990**), fish passage was to be maintained until July 1. Passage for steelhead smolts was adequate to mid-July, 1994. Water depth at the flume outlet shallowed to 0.5 feet by 12 June, making it more difficult for adult steelhead to exit the flume easily after that. If the flume had not been present in this dry year, the sandbar would have probably closed in June because streamflow had declined to 2 cfs by that time. In other coastal streams that the biologist monitors near Cambria (Santa Rosa and San Simeon creeks), 3-5 cfs are required to keep their sandbars open. Therefore, the flume increased the period of smolt access to the ocean in this dry year. The flume in Soquel Creek was first accessible to upstream migration on 4 October after the first rainfall of the season. The sandbar later breached on 6 November during a significant storm event.

Water Temperature. Lagoon water temperature was fair or good all summer and fall, 1994 (**Table 2**). This was much better than in the dry year, 1992, when in July and August the lagoon was warmer

and entered the poor category much of the time (**Figure 7**). The improvement in 1994 was partly because the lagoon surface was mostly kept 0.2-0.4 feet higher in 1994 compared to 1992 (**Figure 6**). The lagoon was actually deeper in 1992 and 1993 than in 1994, based on measured depth at the Stockton Avenue Bridge through the summer. The major factor contributing to a cooler lagoon in 1994 was probably more foggy days, though we have no record to compare. We conclude by emphasizing the importance of maintaining as deep a lagoon as possible to reduce lagoon warming.

Dissolved Oxygen. Critical oxygen levels are lowest in the early morning after oxygen has been depleted by cell respiration and before plant photosynthesis can produce much oxygen. This was the time that levels were measured and rated. Oxygen levels were rated "fair" or "good" all summer and fall, 1994, except for "poor" ratings at the mouth of Noble Gulch after the Begonia Festival, as was the case in 1993 (**Table 2; Figure 8**). However, after the early storm on 4 October, oxygen became depleted in the lower lagoon. Anoxic conditions apparently developed in portions of Reach 1, downstream of the Stockton Avenue bridge by 8 October. This resulted in the death of some steelhead staghorn sculpins. By 10 October, oxygen levels were still in the 2.5-3.5 mg/L range within 0.25 meters of the bottom. However, after the lagoon depth was reduced to allow photosynthesis on the bottom, oxygen increased to above 6 mg/L by 14 October.

Salinity. Salinity was no problem all summer. Within 5 days of sandbar closure and shroud installation, the saltwater was gone.

Conductivity. Conductivity was not a problem.

Recommendations to Improve Water Quality and Fish Habitat in the Lagoon

1. Do not allow the pedal boat operator to dictate the lagoon level.

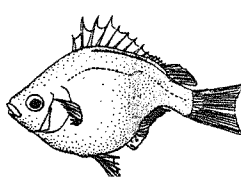
2. Maximize lagoon depth throughout the dry season, while maintaining passage through the flume for adult steelhead until June 1 and steelhead smolts until July 1. If the lagoon level begins to drop below the notch for steelhead smolts on one side of the flume because of the hole for adult steelhead on the other side after June 1, close up the hole for adults. Close up the adult hole by July 1 in any event. If adult steelhead are seen in the lagoon after June 1 and the adult hole has been closed up to raise the lagoon level, open the hole for a week, allowing the adults an opportunity to out-migrate.

3. After July 1, do not open the flume exit after it closes, unless flooding is eminent. Install plastic sheeting on the outside of the flume boards to prevent leakage into the flume. Put as many boards as possible into the flume entrance to raise the lagoon level as much as possible.

4. Lower the lagoon depth after the first storm of the season to the point where the bottom is visible. This would allow algal growth despite the high turbidity. In this way, plant photosynthesis may continue to produce oxygen and prevent anoxic conditions lethal to fish. A previous recommendation in the Management Plan (1990) should be emphasized to prevent further fish mortality. It stated that parking lots and streets draining into the lagoon should be cleaned thoroughly before the first rain of the season.

5. Road work involving repaving and application of petro-chemicals should be done early in the summer. This will allow sufficient time for these substances to penetrate and dry before fall rains.

6. If the lagoon level is reduced for the Begonia Festival, remove the board on the flume on the Friday before the Festival and re-install it immediately after the Festival clean-up. Avoid removing boards from the flume inlet before the Festival, if at all possible.



BIRD CENSUSING

In 1992, there were 16 censuses before the sandbar breached (27 May - 27 October) and 6 more after (5-12 November). In 1993, there were 19 censuses (3 June - 27 November), with the breaching occurring 9 December. In 1994 there were 14 censuses (1 June - 10 October) before the sandbar breached early on 6 November.

The 1994 density of mallards was similar to 1993, though they tended to use Reach 3 more in 1994. The range of mallards counted was generally between 15 and 30 individuals using the lagoon until fall. A clutch of mergansers was raised on the lagoon in 1994, as in 1993, with them leaving about two weeks later in 1994 and being gone by early August. Three to 6 pied-billed grebes and one green-back heron used the lagoon throughout the season. American coots again returned to the lagoon, but arrived two weeks later than before. They were first observed on 30 September.

Results of bird censusing in 1992-94 were not directly comparable to those in 1991. In 1991, censusing was carried out throughout the day. In 1992-94, most censusing occurred early in the morning. In 1992, 5 of 16 censuses (31%) were done later in the morning and afternoon while in 1993, 7 of 19 censuses (37%) were done later. In 1994, only 2 of 14 censuses were done later. In early morning, some ducks were roosting and not in the water. At times, a large group of ducks were roosting on the beach near Venetian Court in the morning and were counted but not included in any reaches.

Comparisons were made regarding bird distribution between the results obtained in 1991 (**Alley 1992**), 1992 (**Alley 1993**), 1993 (**Alley 1994**) and 1994. In all four years, the highest bird use of the lagoon was in Reach 1, it being dominated by gulls, domestic geese and mallards (**Tables 3 and 4**). However, in 1994 Reach 1 had less use due to fewer gulls bathing during early morning censusing. Reach 3 had more bird sightings, particularly for wild mallards.

The reduction in pigeon densities on the trestle in 1994 compared to 1993 resulted in a lower density of birds censused in Reach 2 in 1994 (**Table 4**).

Gulls roosted on building rooftops along the Esplanade. Larry's Surf and Turf positioned 3 stationary plastic owls on their roof in summer, 1992, to discourage gulls from roosting there. The owls worked very effectively for the first couple of weeks. After that they had more limited effect. If the owls were made to rotate, they may be more effective. Also, they could be taken down periodically and re-installed after a few days to possibly improve their effectiveness. In 1994 the owls appeared to be totally ineffective. We counted 145 gulls roosting on the roof during the afternoon of 16 June at 1420 hr. When the sun-bathers appeared in sufficient numbers, the gulls went to the roof. This was a common routine. Any bird excrement left on the roof and sky-windows was then washed into the lagoon the following morning. This was probably a significant source of fecal coliform bacteria for the lagoon. If this wash-water was funneled away from the lagoon with an effective gutter system, coliform bacterial counts would probably decrease. Of course, if the water was diverted to a capped storm drain along the Esplanade, that drain would require suction-pumping and disposal periodically. If the gulls could be kept from roosting on the roof, coliform bacterial counts would decrease, also.

Refer to **Table 4** for comparisons of average bird densities by groups in 1991-94.

Nearly all of the censused gulls were in Reach 1, with them totaling 80%, 54% and 58% of the birds counted there in 1992, 1993 and 1994, respectively. The relative percentage of gulls in Reach 1 in 1993 dropped due to fewer gulls bathing (at least in the early morning), and more mallards and coots. In 1994 there were even fewer gulls bathing, despite the higher number of gulls on Capitola Beach. We suspect that if more censusing had been done later in the day in 1994, the number of gull sightings in Reach 1 would have been greater.

Over 90% of the pigeons were observed in Reach 2, making up 30%

and 50% of the birds censused there in 1992 and 1993, respectively. In 1994, 58% of the birds censused in Reach 2 were pigeons. But only 42% of the pigeons counted were observed in Reach 2, with the remainder counted on the beach, away from the lagoon margin. In 1993, 88% of the pigeons in Reach 2 were roosting on the trestle, and the remainder were at the east Stockton Avenue Park near Mrs. Hubback's house. In 1994, 100% of the pigeons in Reach 2 were on the trestle. The significant increase in pigeon density on the trestle in 1993 was not sustained in 1994 (**Table 4**). The average number seen on the trestle in 1994 went down from 13 in 1993 to 7.2 pigeons per census in 1994. The lower density of trestle pigeons may have been due to the absence of bird seed near Mrs. Hubback's house. Pigeons seemed to have moved to the beach to forage. However, pigeon nests were observed on the trestle for the first time in 1994.

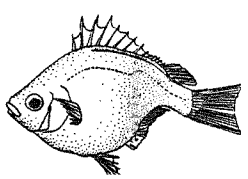
Table 3. Comparison of bird densities by Reach in Soquel Creek Lagoon, including American Coots. Pigeons on the railroad trestle (Reach 2) were excluded in 1991 and included in 1992-94. Birds on the sand at Venetian Court were not included in Reach 1.

YEAR	DATES	# OF CENSUSES	TOTAL BIRDS COUNTED	PERCENT COUNTED BY REACH		
				REACH 1	REACH 2	REACH 3
1991	19Aug-13Oct	24	1746 (55 coots)	58	19	23
1992	27May-27Oct	16	952 (145 coots, more counted later)	66	20	14
1993	3June-27Nov	19	1266 (304 coots)	45	37	18
1994	1June-10Oct	14	585 (49 coots)	41	25	35

Wild mallards were observed primarily in Reach 3 in early morning, though they were often seen in Reaches 1 and 2 and commonly roosted on the beach next to Venetian Court. They roosted most visibly along primarily the margins of Reach 2 on the bulkhead, on the concrete base of the trestle and on the sand near Venetian Court (at least early in the morning). Three clutches of young mallards were observed in 1994, four clutches in 1993 and only two clutches in 1992.

Fish-eating Birds Observed at the Lagoon

As in 1993, a clutch of mergansers was produced in 1994, with the mother hen and 4 young feeding throughout the lagoon. There were



twice the merganser sightings in 1994 compared to 1993, despite the fewer censuses in 1994 (**Table** 5). In 1993 the mergansers more often roosted near Venetian Court and went uncounted in the lagoon reaches. They did not stay the entire lagoon season in 1994, however, having last been sighted on 30 July. In 1993 the mother and three young decreased to the mother and two young that stayed on the lagoon until 3 September. This was presumably due to the higher steelhead density in 1993 than 1994. In 1994, the mother left the lagoon at least 2 weeks before the offspring. She originally had a clutch of 12 young at the time of sandbar closure.

Regarding other piscivorous birds, in 1994 there were as many as 6 pied-billed grebes on the lagoon at the same time, while there were at most four in 1993. They were more commonly seen in 1994 (**Table** 5). A green-back heron took up permanent residence in 1994 for the first time, though a few had been seen sporadically in previous years. A cormorant and great blue heron were each seen once in 1994. Three black-crowned night herons were seen during one censusing on 12 June 1994, but were not seen again.

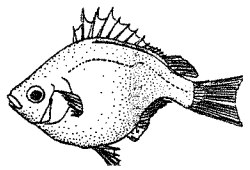
American coots appeared in late September, 1994, instead of mid-September, as was the case in 1993. We did not see many coots in 1994 because the sandbar breached in early November and censusing ended. In previous years the censusing continued into December before the sandbar breached.

Table 4. Comparison of Average Bird Densities in Soquel Creek Lagoon during each censusing for 1991-94. (Pigeons on trestle excluded in 1991 only.)

Group	Reach 1 Density '91	'92	'93	'94	Reach 2 Density '91	'92	'93	'94	Reach 3 Density '91	'92	'93	'94
Gulls*	30	32	16	11	3.2	0	0.2	0	1.1	0	0.1	0
Mallards (some domestic)	8.1	2.5	3.6	3.0	1.0	4.1	4.7	1.8	14	3.3	4.8	7.4
Domestic Ducks	0.4	2.0	1.7	1.0	1.0	0.1	0.2	0.4	0.6	0.4	0.2	0.5
Geese	2.3	0.3	2.6	1.5	0.2	0.6	0.6	0	0.9	0	0.2	0.6
Pigeons	0.8	0.1	0.9	-	7.8	3.5	13	7.2	0	0	0	0
Coots	1.6	6.6	8.2	0.4	0.8	5.1	12	0.8	3.3	9.0	10	2.6
Pied-billed Grebes		0.2	0.3	0.3		0.3	0.4	0.8		0.1	0.8	0.7
Mergansers				1.1				0.4				0.7
Cormorants		0.1	0	0		0.3	0	0		0.1	0	0.1
Green-back Herons				0				0.2				0.3
Kingfishers				0				0.2				0.3
Black-crowned Night Herons				0				0				0.2
Great Blue Heron				0.1				0				0

***Birds on Capitola Beach Between the Wharf and Jetty:**

Year	# of Censusings	Average # of Gulls	Range in # of Gulls	Avg # Pigeons	Range in # Pigeons
1992	8	183	61-367		
1993	13	196	141-347		
1994	8	301	179-570	15	10-31



Five domestic geese used the lagoon in 1991, three in 1992, four in 1993 and four in 1994. The total domestic duck (non-mallard) sightings in 1992 was greater than in 1991, and only one more sighting was made in 1993 than 1992 (40). This indicated a stable and not increasing number. The density of domestic ducks in 1994 was similar to 1992 and 1993 (**Table 4**), with 22 sightings during fewer censuses than previous years (**Table 5**). In 1993 there were at most four "popcorn ducks" censused at any one time at the lagoon. Three of these popcorn ducks were present in 1994.

Table 5. Fish-eating Bird Sightings at the Lagoon.

SPECIES	1992 Frequency (Sightings/17 day visits)	1993 Frequency (Sightings/19 day visits)	1994 Freq. (Sightings/ 13 day vis.)
Black-crowned night heron	0	1	3
Cormorant	8	0	1
Great blue heron	1	1 (night)	1 (Early morning)
Green-back heron	0	3	5
Kingfisher	8	5	6
Common merganser	1	14	28
Pied-billed grebe	18	28	22

Bird-feeding by Humans

In 1994 there was one instance of bird feeding observed. The parents and children were throwing bread from the wall at Venetian Court, 10 feet from the "no bird-feeding sign." Fewer censusings were done later in the day in 1994 than previous years. Therefore, the likelihood of observing bird feeding was

reduced. This was compared to 6 instances in 1993 and 1 instance in 1992. Mrs. Hubback was no longer there, and bird seed was absent from the area in front of her house. Pigeons no longer roosted there and appeared to forage more out on the beach in 1994. The "no bird-feeding sign" had to be removed under the trestle because of graffiti and vandalism.

Kathy Barbaro of the City's Environmental Planning Department suggested that we write and distribute a handout to the rental properties on the lagoon, explaining why visitors should not feed the birds. The biologist drafted text, and Ms. Barbaro made it more user-friendly for distribution in 1995 (**Appendix F**).

Waterfowl as Biological Control of Aquatic Plants

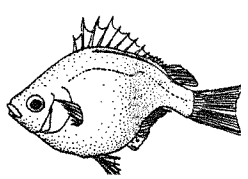
The effectiveness of ducks that grazed on pondweed and algae was evident in 1994 as in 1993 because very little algae reached the surface. Geese were occasionally seen feeding once again on natural vegetation in 1994, which had been observed in 1992, but not 1993. However, the geese often congregated near the walk-way between the restaurants and near the wall at Venetian Court, indicating that they had been trained to receive handouts there. They roosted somewhere in upper Reach 3 at night and would swim down to Reach 1 and Venetian Court each morning.

Recommendations Regarding Management of Bird-Feeding and Domestic, Non-native Waterfowl

1. Maintain enforcement of the no bird-feeding ordinance. Discourage fish-feeding, as well.

2. Request that restaurant owners put devices on their roofs to discourage roosting of gulls. Artificial owls that rotate on poles may be more effective than stationary ones. The bird droppings washed into the lagoon are pollution.

3. Maintain the presence of no bird-feeding signs at the lagoon.



4. Re-locate the remaining geese before they reproduce.

5. Distribute the explanation for not feeding the birds to rental property owners and restaurant owners. The owners should be encouraged to disseminate the explanation to their clients and customers.

FISH CENSUSING

Steelhead Plantings in Soquel Creek

In 1994, 720 and 450 pounds were planted at 6.4 fish/pound (7,488 fish) behind the Grange Hall on 22 and 24 March, respectively (Dave Strieg, Monterey Bay Salmon and Trout Project, pers. comm). They were seen in the estuary shortly thereafter by project volunteers.

Results of Fish Sampling in Soquel Creek Lagoon

On 10 October 1994 the biologist made four seine hauls for tidewater gobies with a 30-foot x 4-foot x 1/4-inch mesh beach seine in lower Soquel Lagoon near the beach. This was adjacent to Venetian Court and after the fish kill. This lower lagoon, downstream of the Stockton Avenue Bridge, is the only location where a seine could be adequately beached to capture tidewater gobies. After four seine hauls, a total of 35 tidewater gobies were captured. Three individuals were adults, the remainder being young-of-the-year fish. All captured gobies were released to the lagoon as required by our federal collecting permit.

The biologist had snorkeled the entire lagoon during the period 26-28 August 1994, searching for tidewater gobies, and had not observed any. Based on these results, it appeared that visual observations alone were insufficient to determine presence or absence of gobies when the population number was very small.

In fall, 1992, two tidewater gobies were captured during sampling. In fall, 1993, no tidewater gobies were captured after

a total of 6 seine hauls on two weekends with the fine-meshed seine. The low number captured in 1992-94 probably indicates the lack of backwater areas in Soquel Lagoon, which would be used as refuges for tidewater gobies during high winter stormflows.

Fall sampling for steelhead was undertaken on 16 and 23 October, 1994, in the same vicinity as the tidewater goby sampling. Refer to **Appendix A** for photographs of fish sampling activities. (Carla Mader was kind enough to take the great pictures and provide copies.) With the larger, coarser-meshed seine, no tidewater gobies were captured. Seventy-six juvenile steelhead were marked from two seine hauls on 16 October. On 23 October, 105 juvenile steelhead were captured with 7 being recaptures. Our steelhead population estimate for fall 1994 was 1140 juveniles +/- 398. Other species captured were Pacific staghorn sculpin (Leptocottus armatus) and threespine stickleback (Gasterosteus aculeatus).

In 1993 the juvenile steelhead estimate had been 2,787 +/- 306. That year 1,046 fish were marked one weekend, and on the following weekend 461 steelhead captured with 173 being marked recaptures.

A very rough estimate of the juvenile steelhead population in the lagoon in 1992 was probably a few hundred. This should be considered a significant number in terms of the population in the creek, though it was considerably less than the lagoon could support in other years. By comparison, in July, 1989, Jerry Smith had observed approximately 900 juvenile steelhead at the mouth of Noble Gulch during one observation. If the lagoon becomes too shallow, the upper lagoon becomes too shallow for steelhead to use. This is another reason to keep the lagoon as deep as possible during summer.

One reason for the reduced number of steelhead in 1994 compared to 1993 was the fish kill (approximately 53 juvenile steelhead, one adult steelhead and 11 staghorn sculpin counted). Another reason for the decline in 1994 was that Soquel Creek became intermittent by mid-August in Soquel Village. The creek flowed continuously to the lagoon throughout the dry season in 1993.

Hydraulic continuity allowed large numbers of juvenile steelhead to down-migrate to the lagoon throughout the summer in 1993 to utilize valuable nursery habitat there. In 1993, the lowest estimated in-flow to the lagoon was 1 cfs in September. In 1994, in-flow declined below 1 cfs in late July and fell to an estimated 0.05 cfs by late September. A third reason for the decline in steelhead numbers may have been increased predation by mergansers, grebes and the green-back heron in 1994.

Recommendations Regarding Fish Management

1. Maximize lagoon depth after 1 July by adding boards to the flume and sealing them with plastic.

2. Look into better ways of sealing the cracks between the boards in the flume inlet. Sandwiching rubber strips between the boards may solve the problem.

3. Do not unplug the flume exit after 1 July unless necessary to lower the lagoon before the Begonia Festival.

4. Replace the flume boards immediately after the Begonia Festival if any are removed for the Festival.

5. Maintain the lagoon in fall until streamflow has increased enough to prevent stranding of spawning adult steelhead and osmotic stress in lagoon-inhabiting steelhead. If necessary, install a perimeter fence with 2"x4" mesh 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 of fall.

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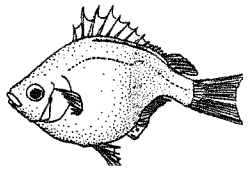
Soquel Creek Lagoon Management and Enhancement Plan. 1990. Donald Alley, Project Manager. Prepared by Habitat Restoration Group for the City of Capitola and the Coastal Conservancy.



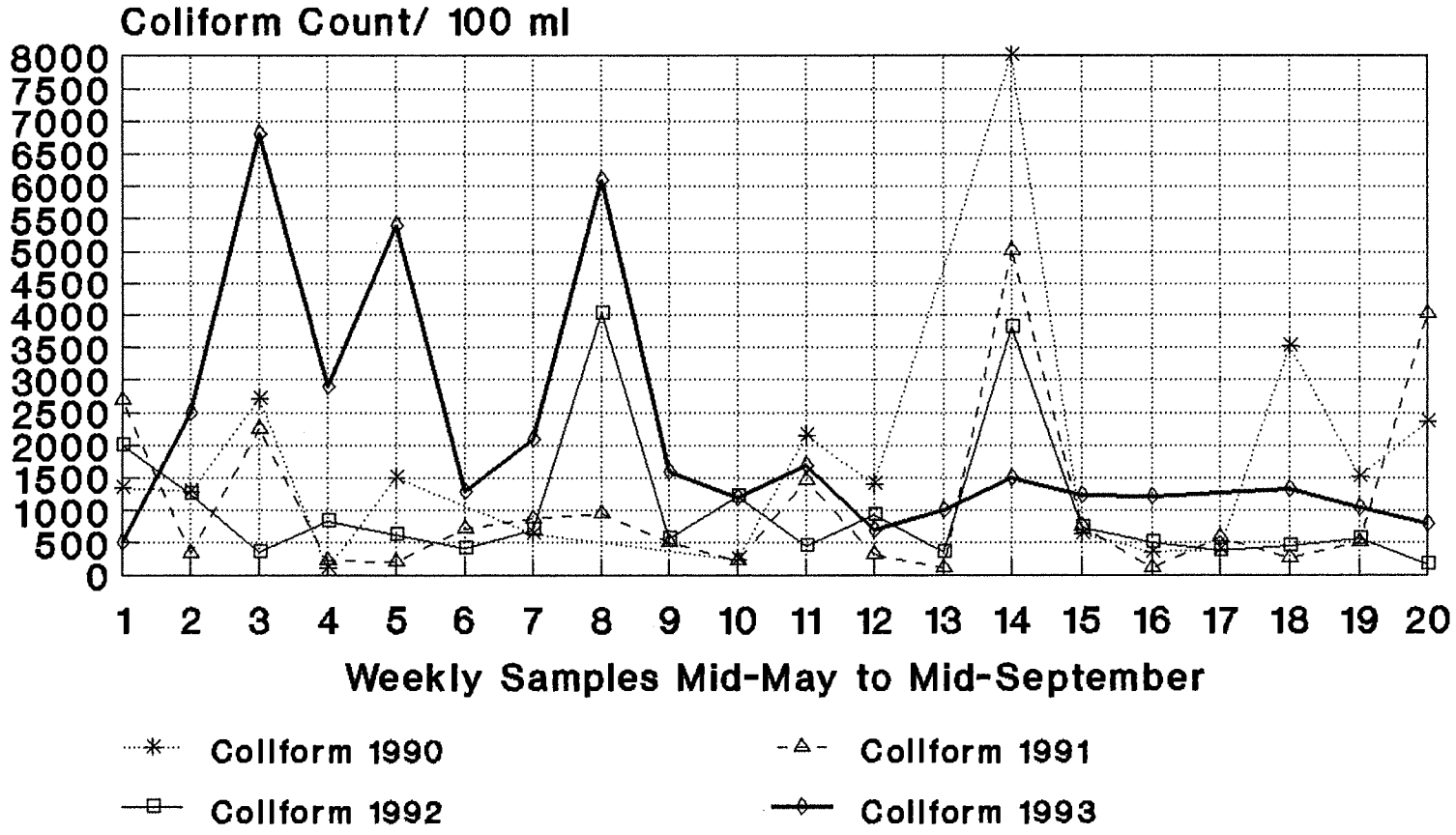


Figure 1a. Fecal Collform Counts
at the Flume Inlet, Comparing 1990-1993.
(Santa Cruz County Data)

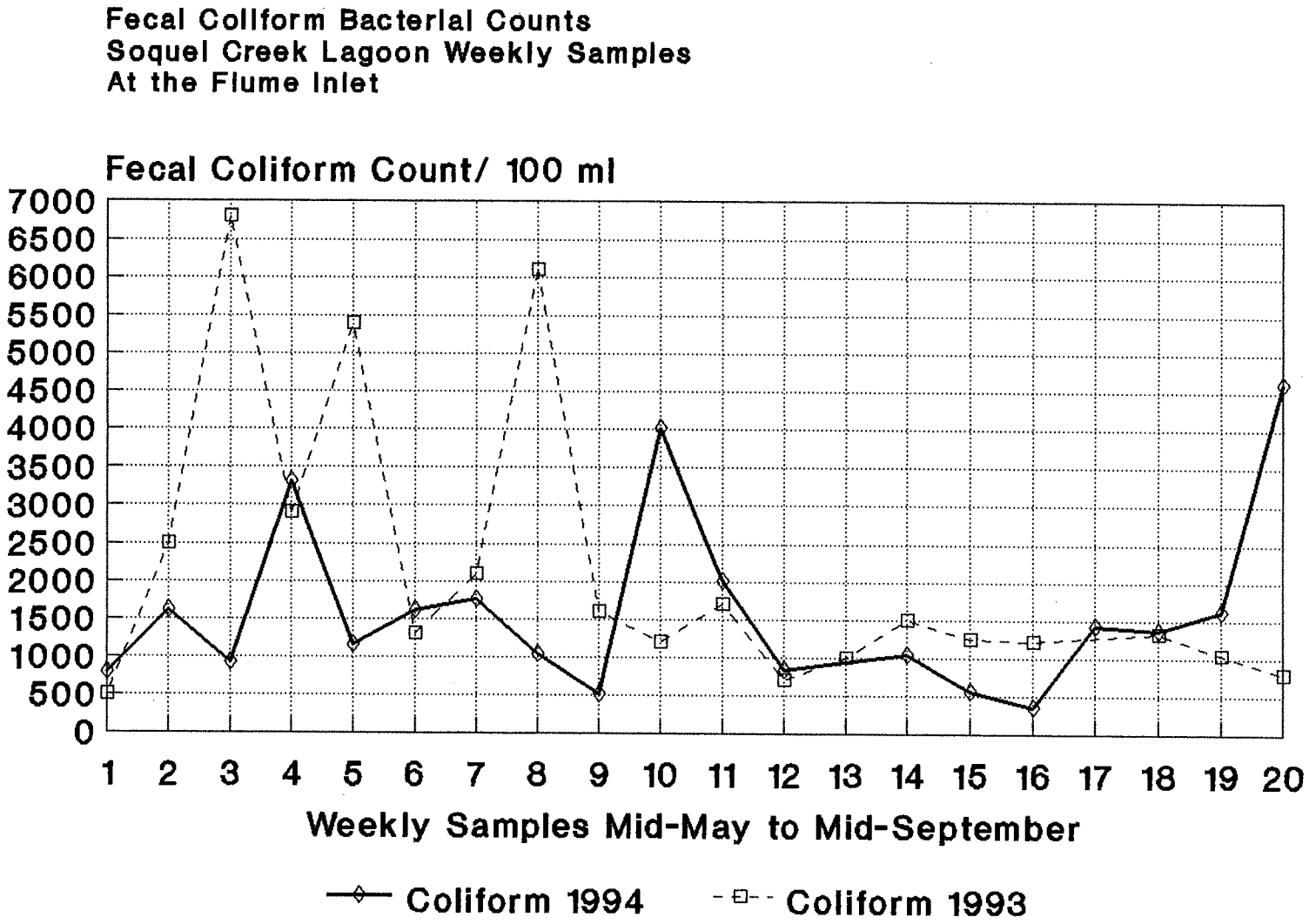


Figure 1b. Fecal Coliform Counts
at the Flume Inlet, 1993 and 1994.
(Santa Cruz County Data)

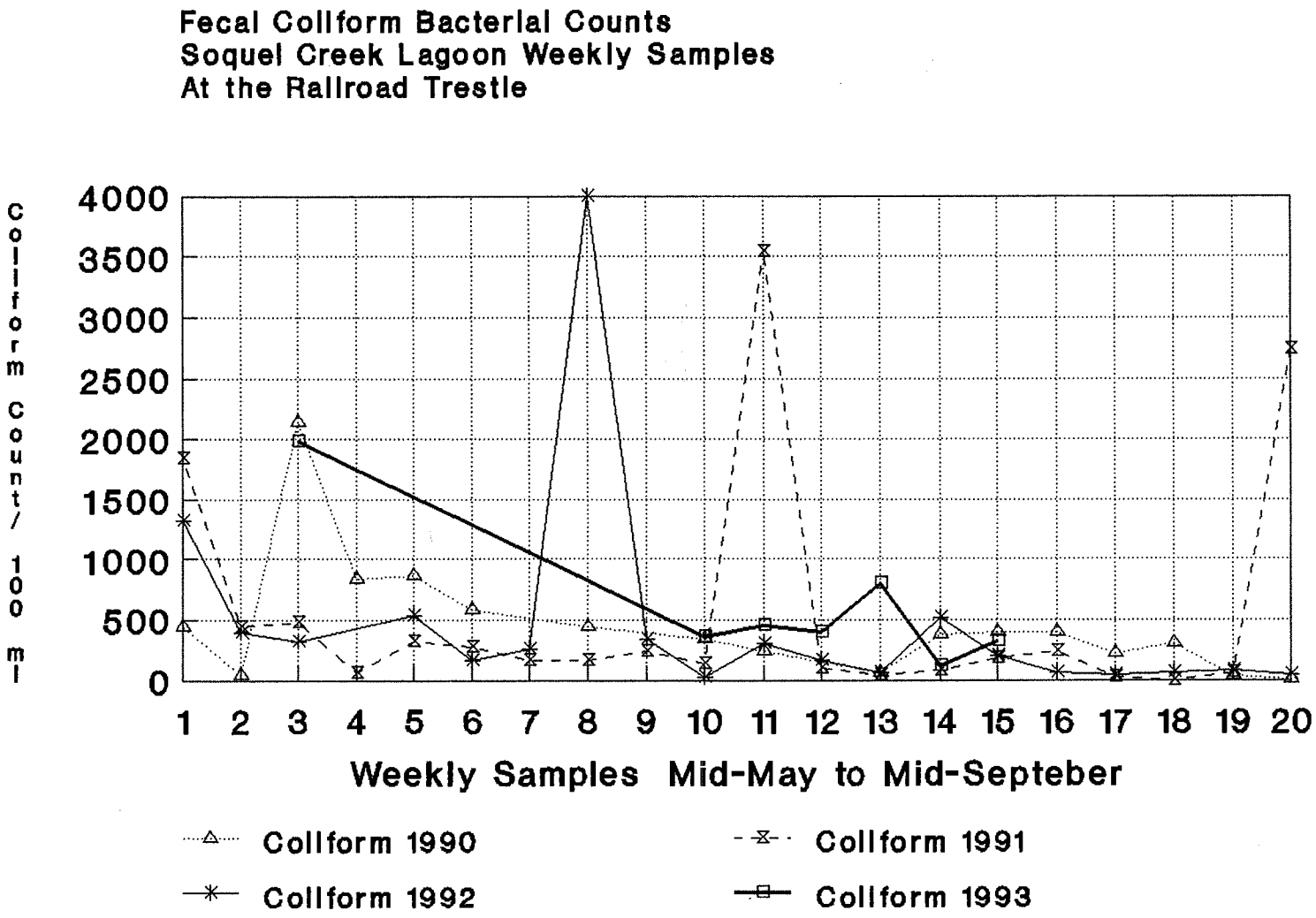


Figure 2a. Fecal Collform Counts at the Railroad Trestle, Comparing 1990-93. (Santa Cruz County Data)

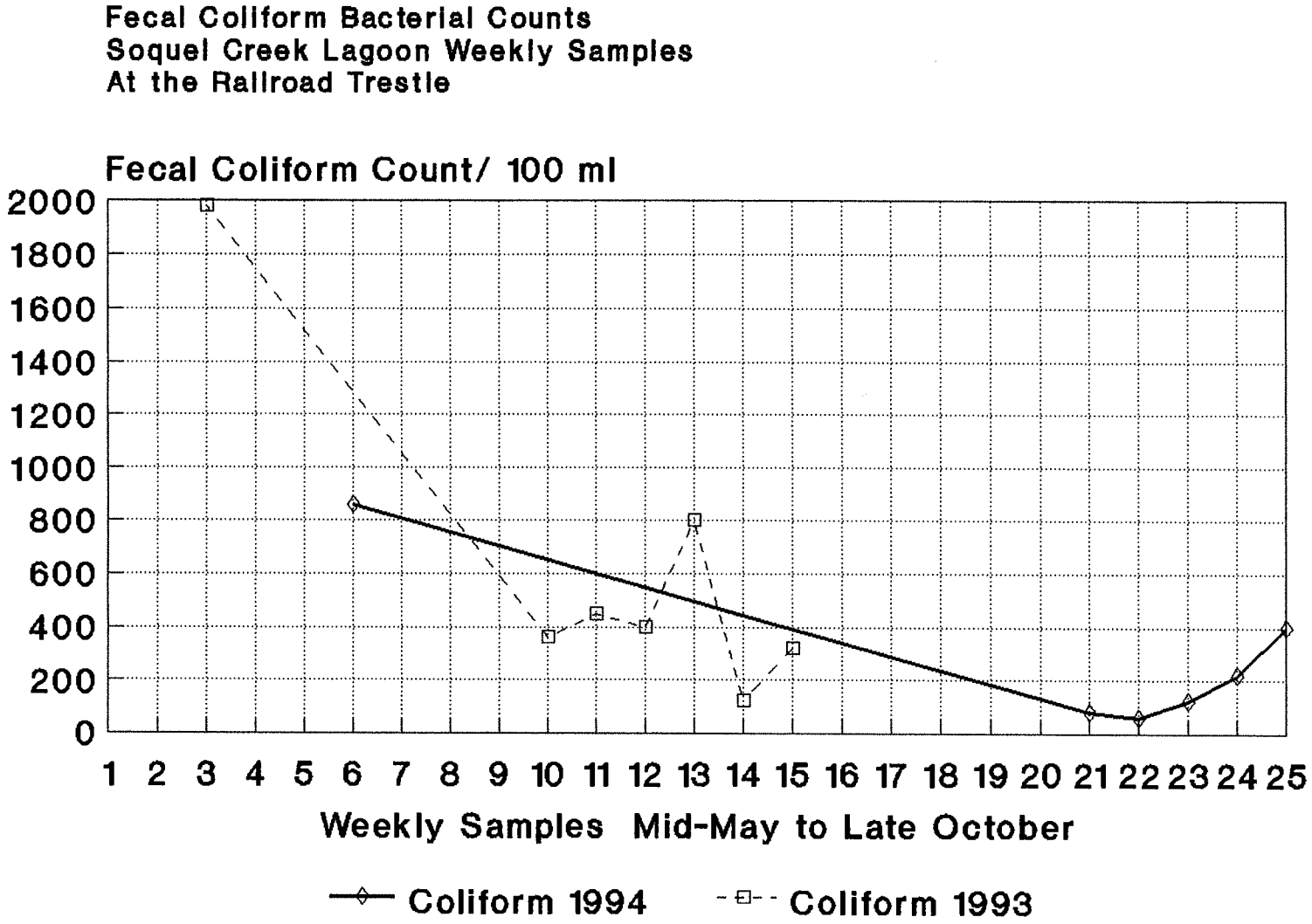


Figure 2b. Fecal Coliform Counts at the Railroad Trestle, 1993-94. (Santa Cruz County Data)

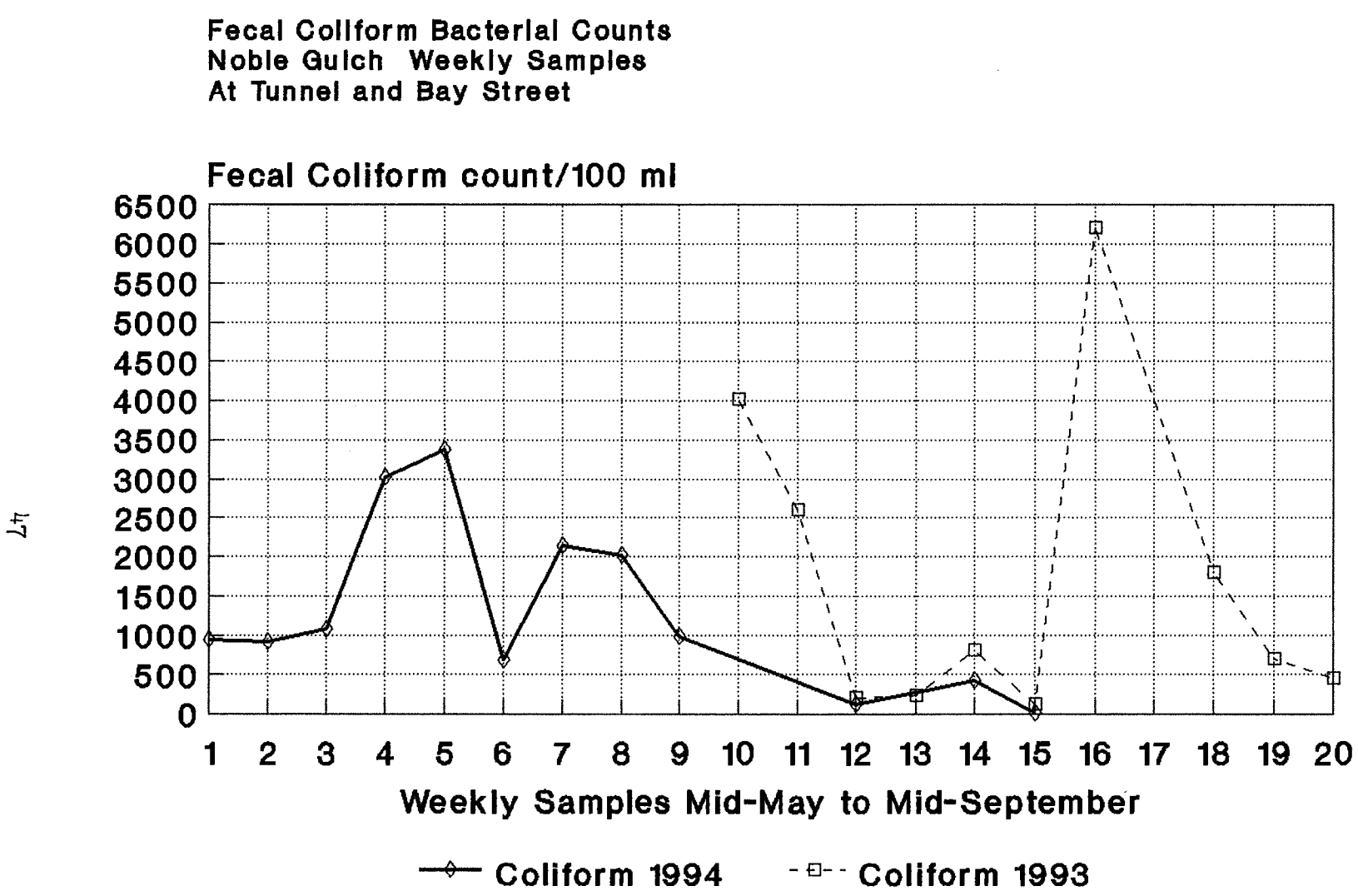


Figure 3. Fecal Coliform Counts at Bay St. Tunnel on Noble Gulch, 1993 and 1994. (Santa Cruz County Data)

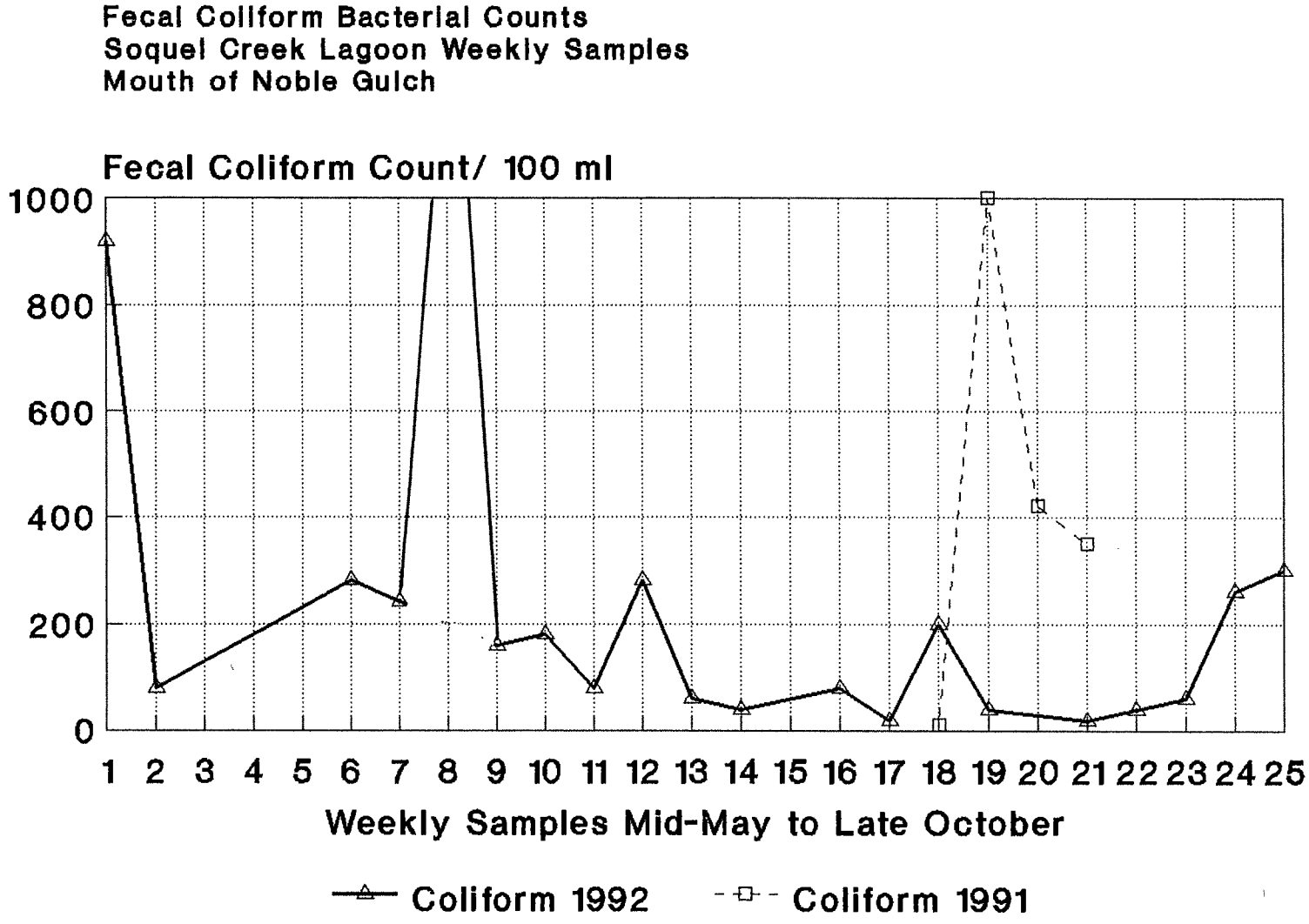


Figure 4a. Fecal Coliform Count
at the Mouth of Noble Gulch, 1991-92.
(Santa Cruz County Data)

Fecal Coliform Bacterial Counts
Soquel Creek Lagoon Weekly Samples
Mouth of Noble Gulch

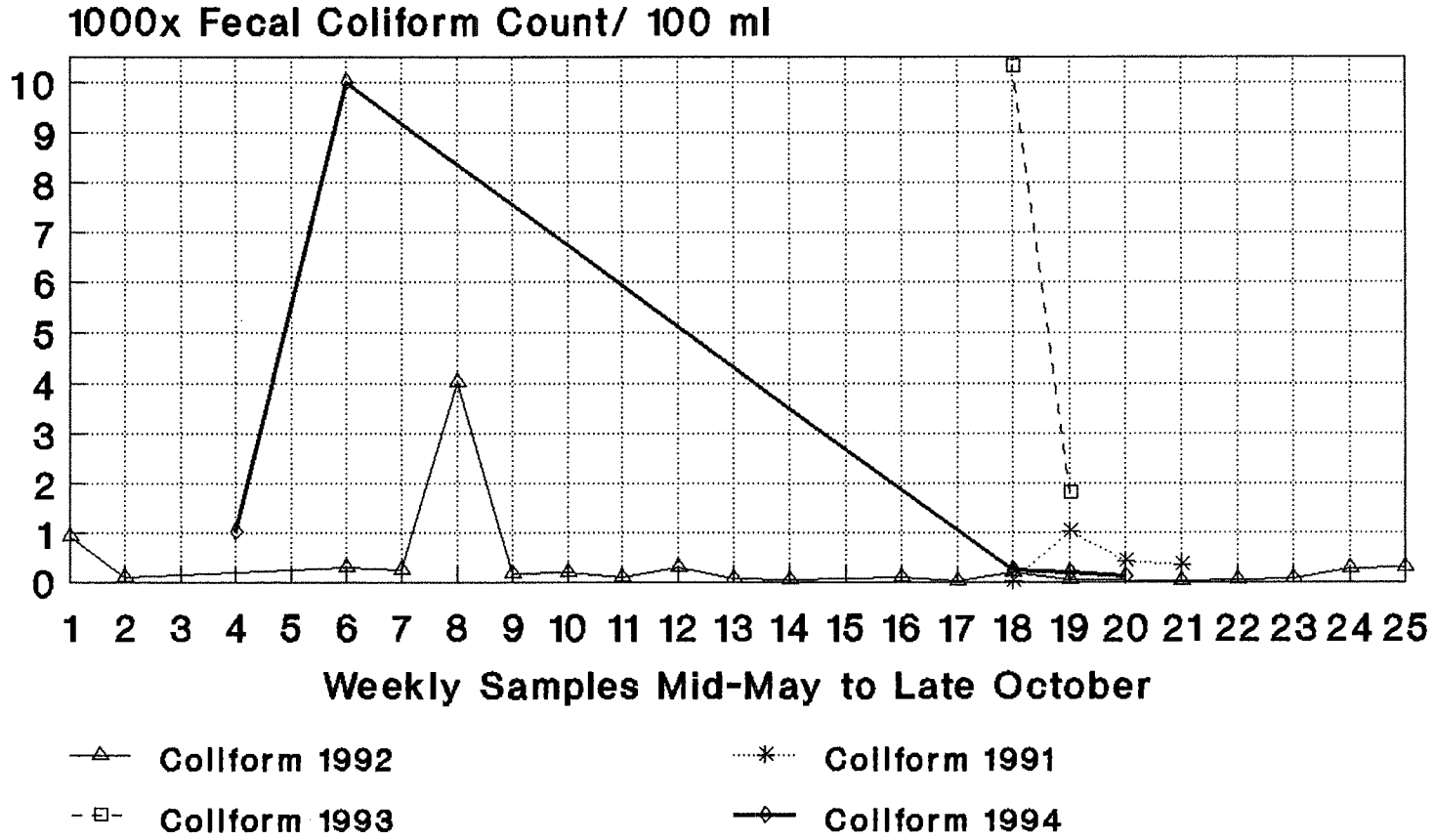


Figure 4b. Fecal Collform Count
at the Mouth of Noble Gulch, 1991-94.
(Santa Cruz County Data)

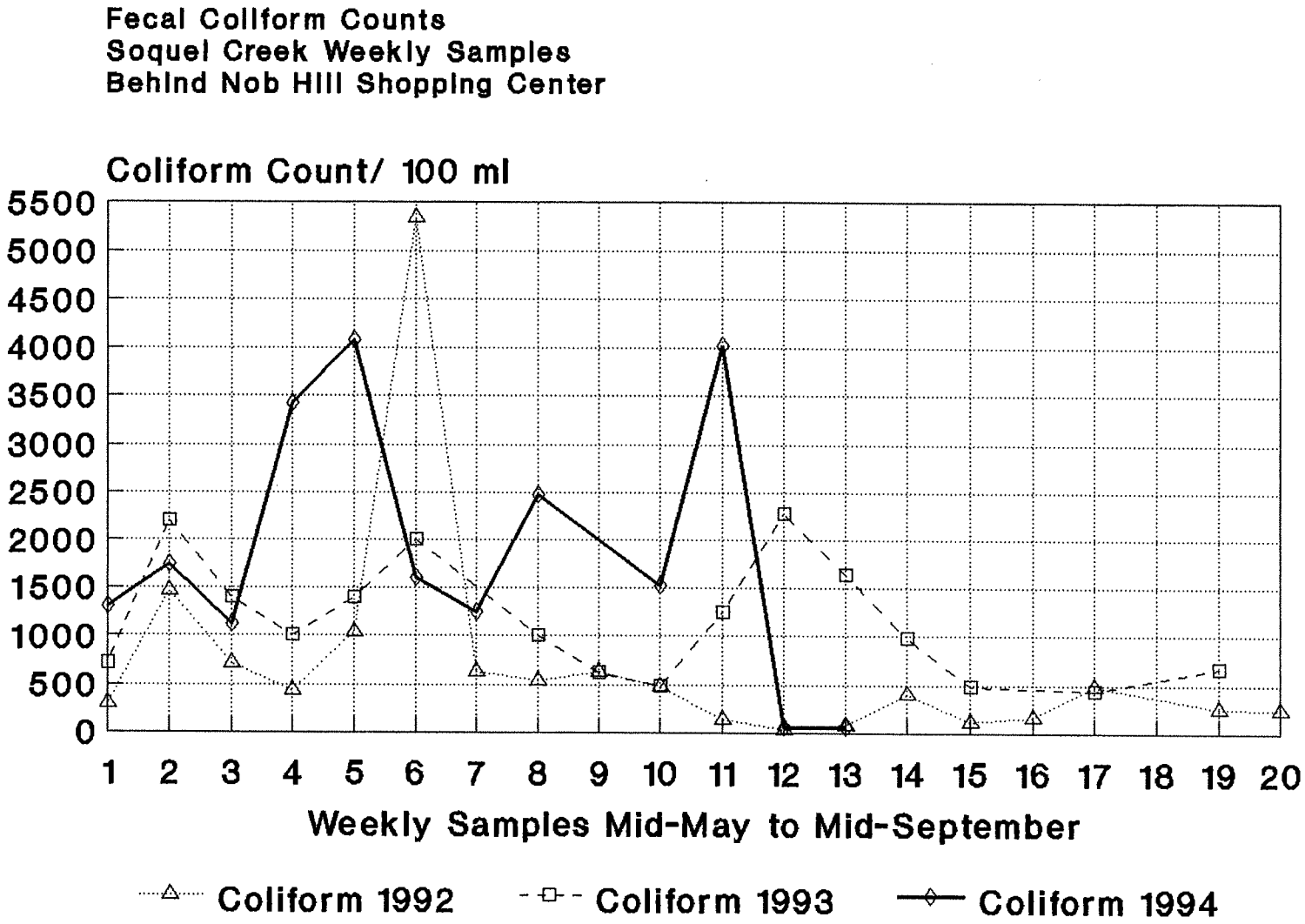


Figure 5. Fecal Coliform Counts at
Nob Hill, 1992, 1993 and 1994.
(Santa Cruz County Data)

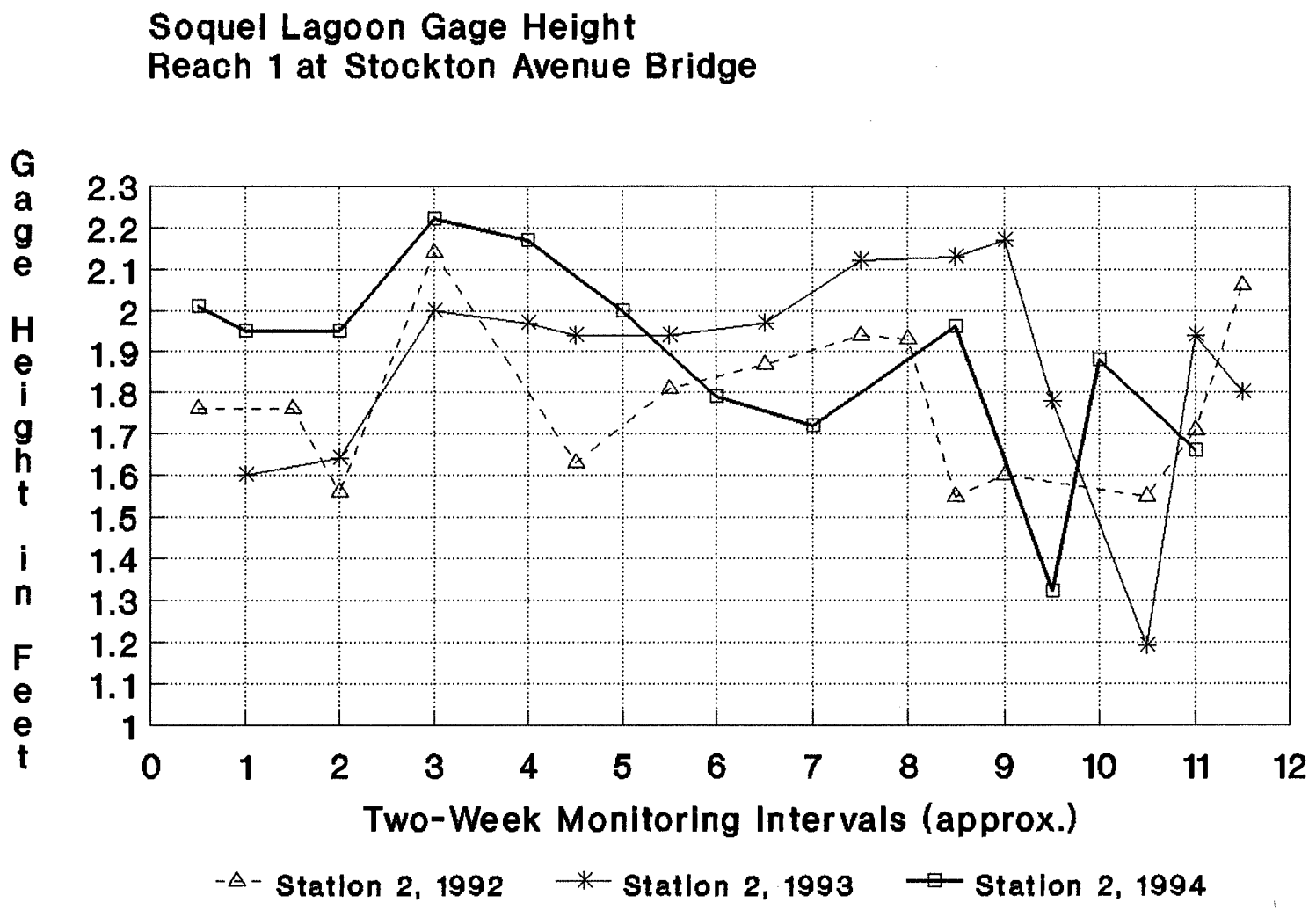


Fig 6. Soquel Lagoon Gage Height
Near Stockton Avenue Bridge
Late May to Late October, 1992-94

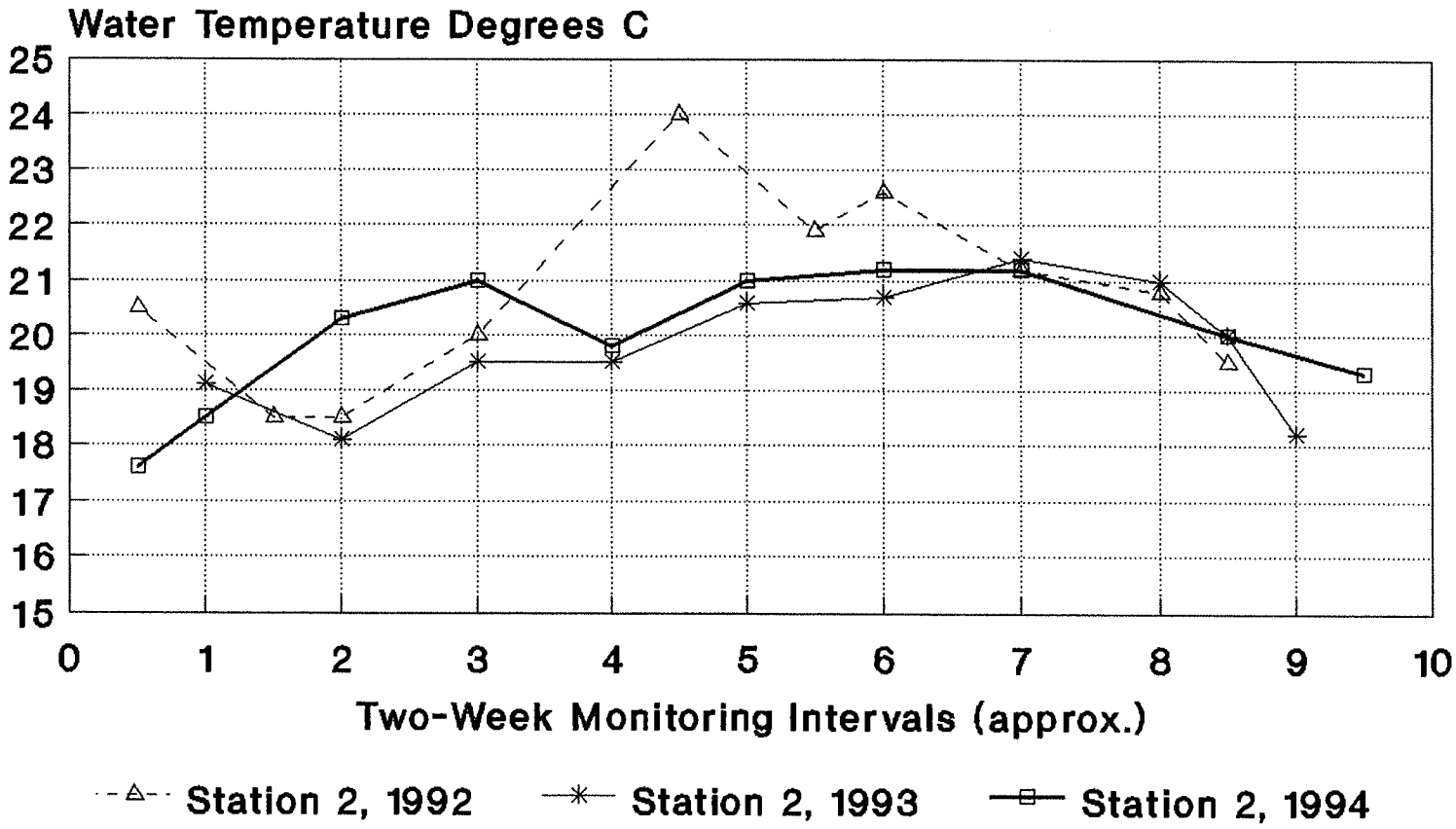


Fig 7. Soquel Lagoon Water Temp. Near Bottom at Dawn, Rch 1 at Stockton Avenue Bridge, Late May to Late Sept. 1992-94

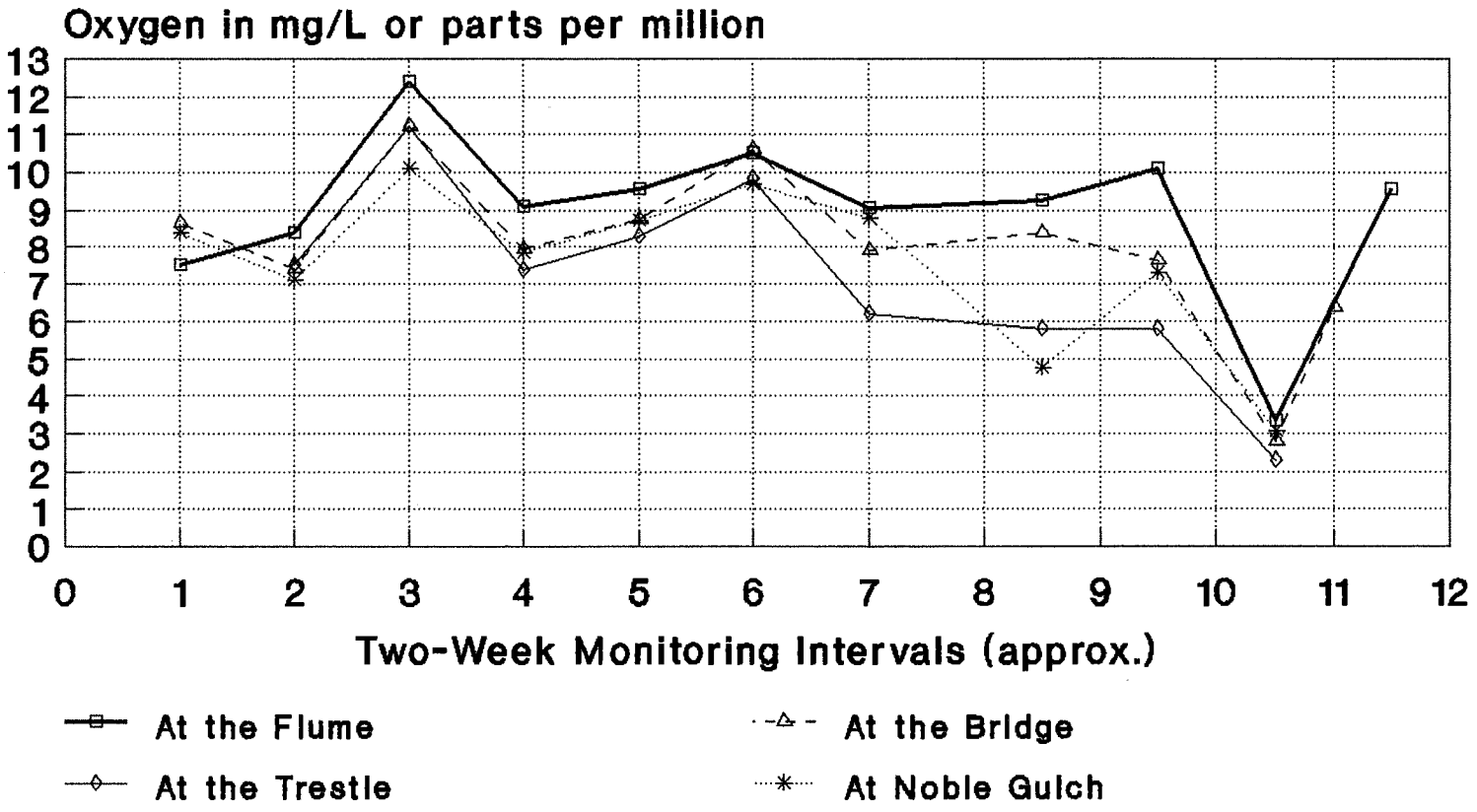


Fig 8. Oxygen Levels at Four Stations,
Soquel Lagoon Near the Bottom at Dawn;
24 May - 23 October, 1994.

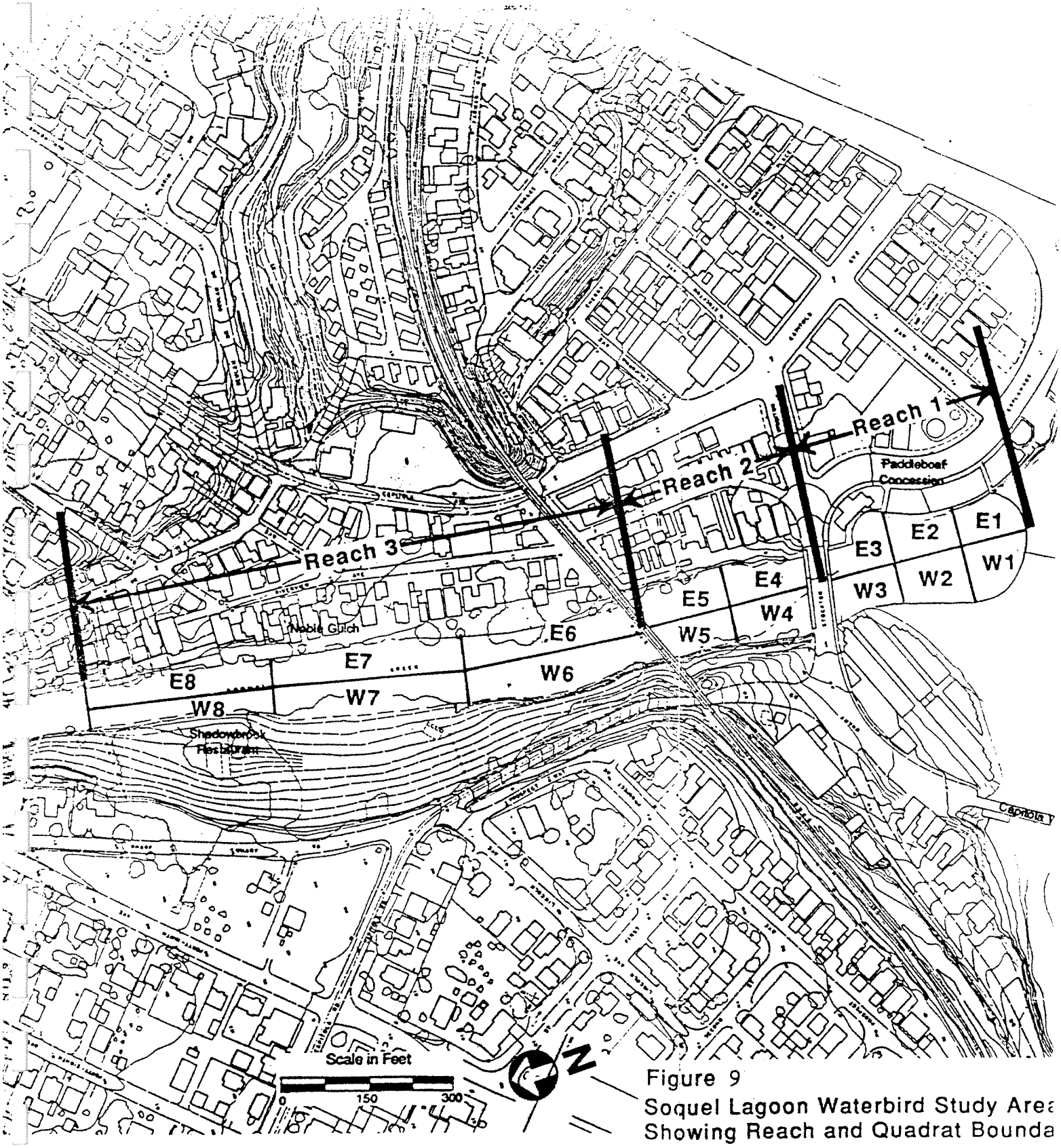
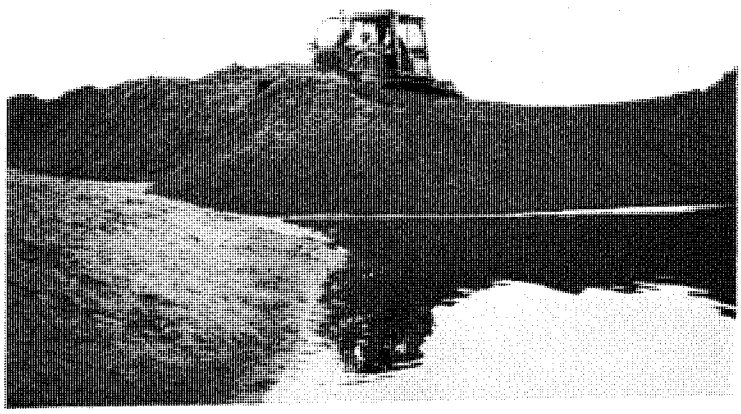


Figure 9
Soquel Lagoon Waterbird Study Area
Showing Reach and Quadrat Boundaries

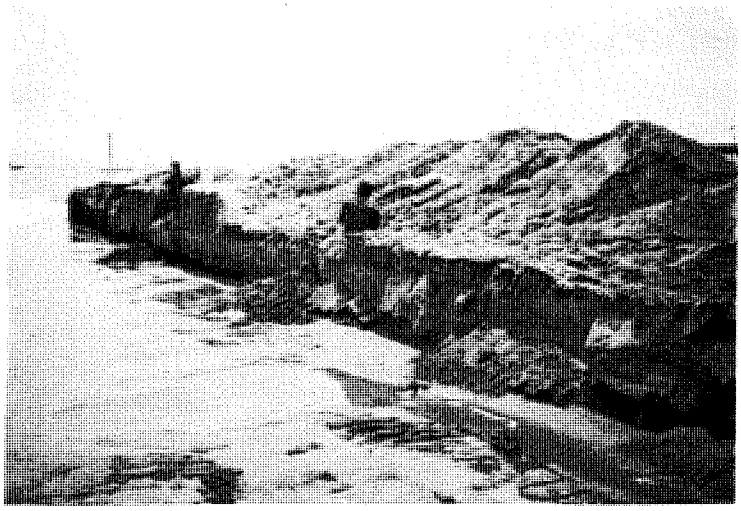
APPENDIX A.

PHOTOGRAPHS, 1994

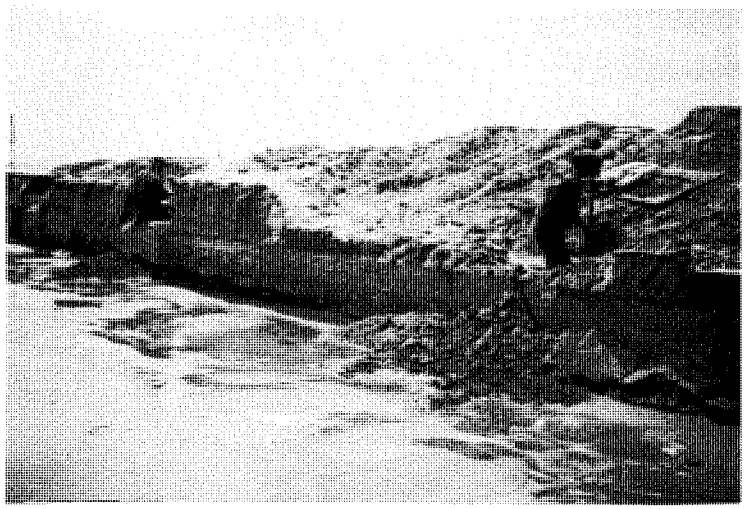


Closing off the Lateral Channel 17May94

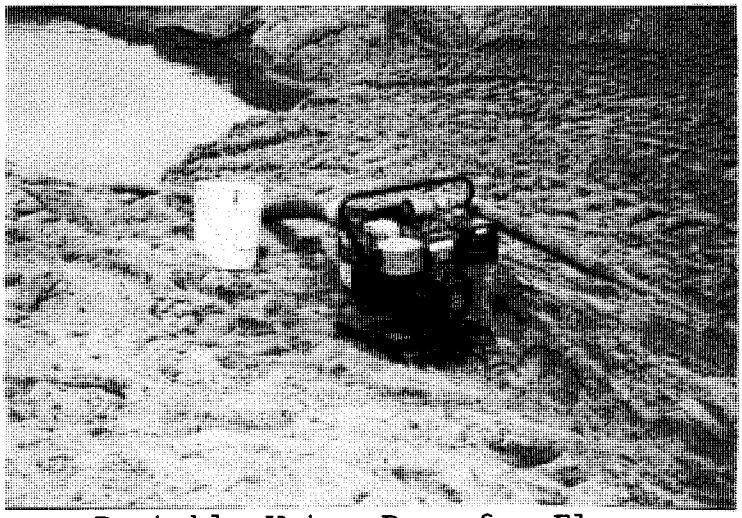
Raking and Flushing of the Flume 17May94



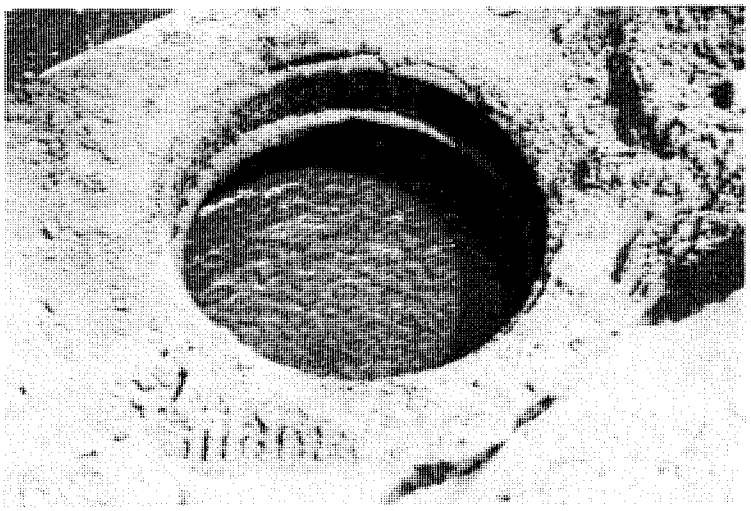
Sand Removal from Flume 17May94



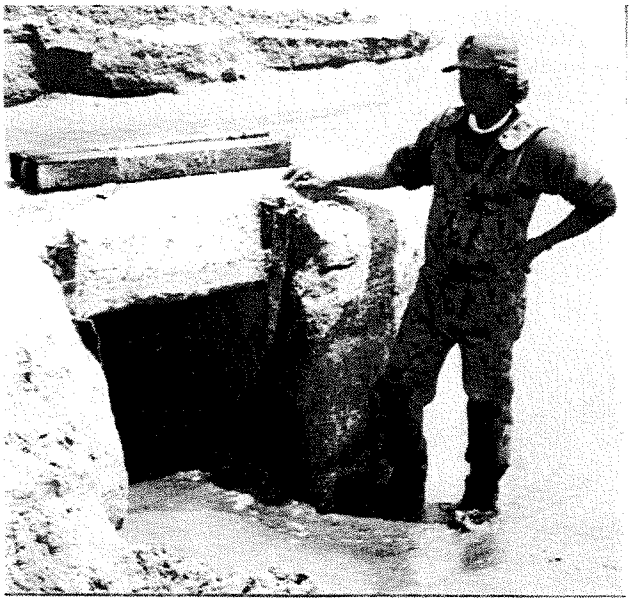
Removing Sand through Portals 17May94



Portable Water Pump for Flume 17May94

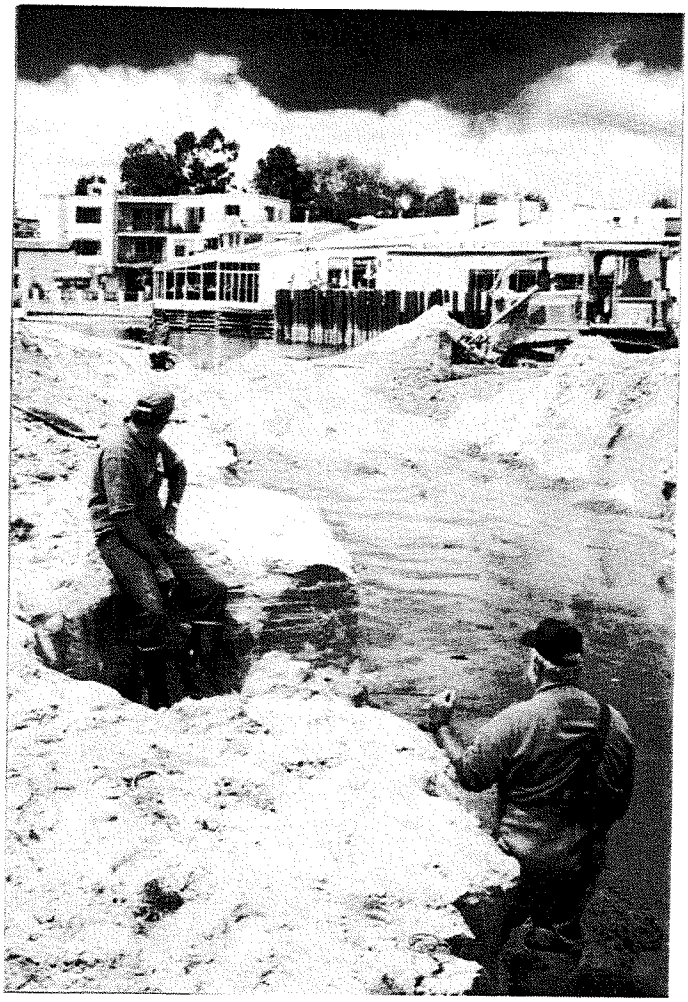


Sand Beginning to Move 17May94

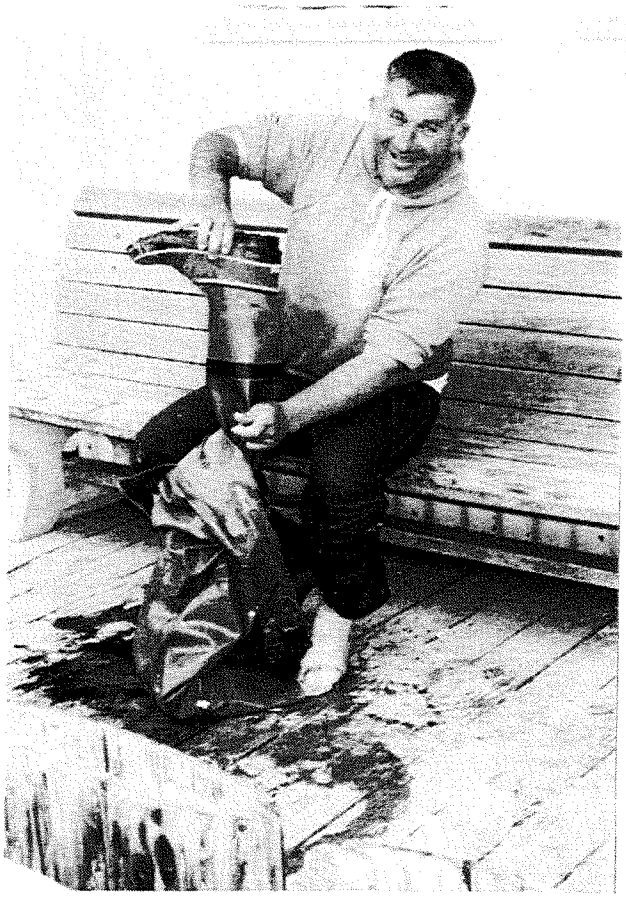


Gary after Opening the Flume
17May94

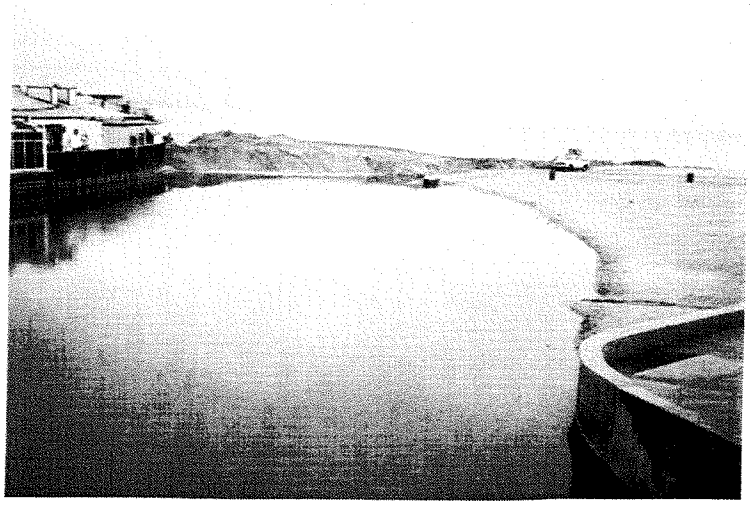
Lance and Chris Doing the
Rake-It-Out Shuffle
18May94



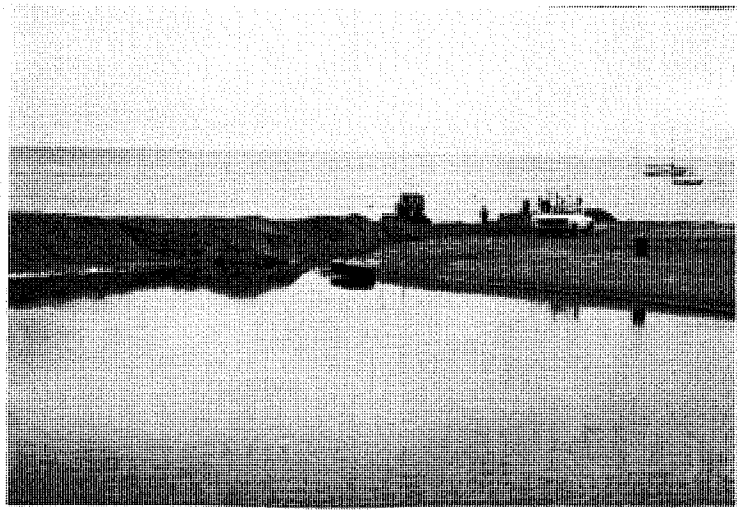
Closing the Sandbar, Hail on
the Way 17May94



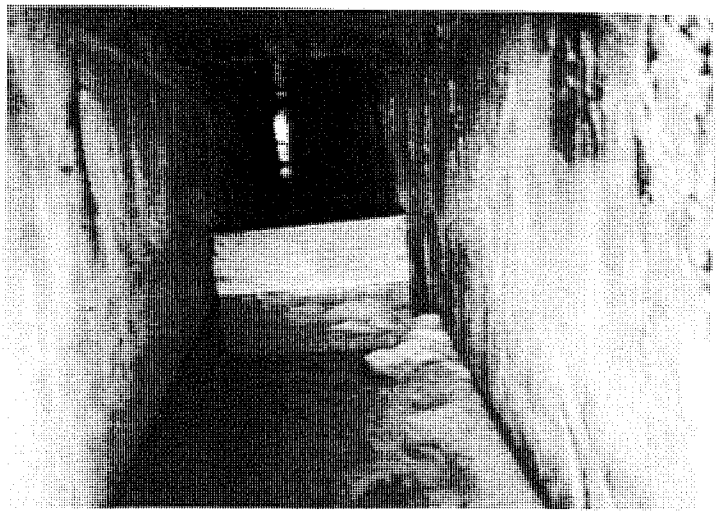
Joe-Joe Locates the Source of
His Leak 19May94



Sandbar Closed on First Day 17May

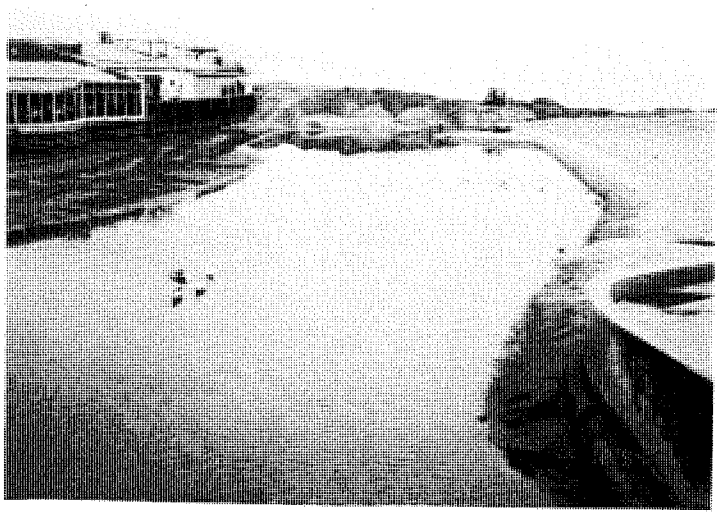


Berm Across Outflow Channel 17May94

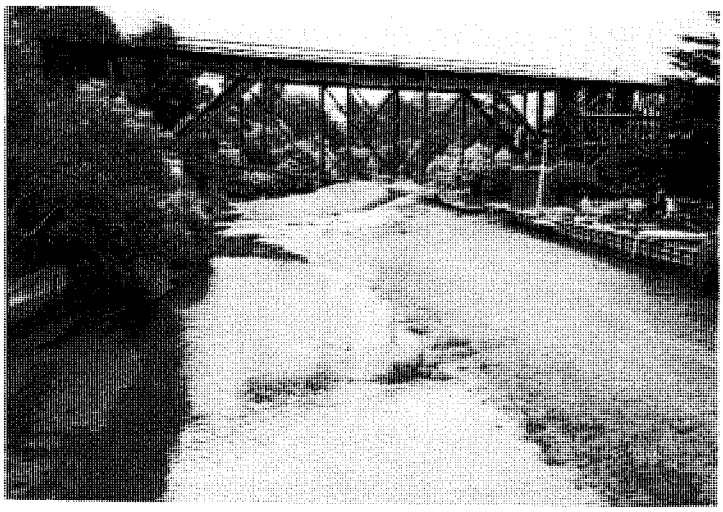


Baffle Intact Inside Flume 18May

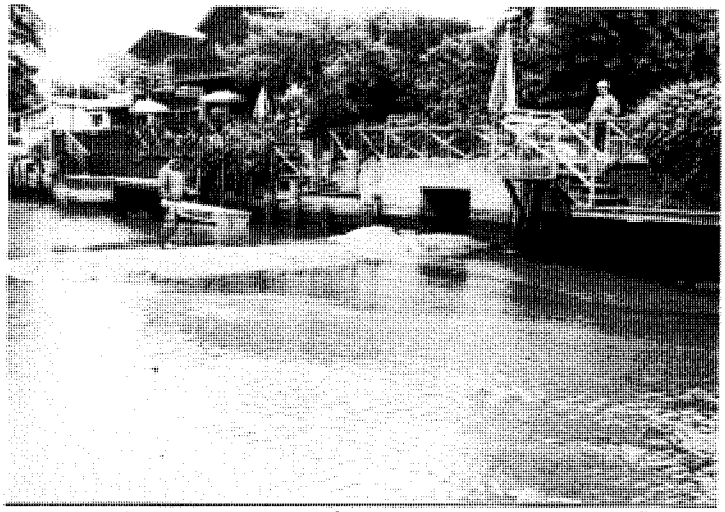
Lagoon Contoured for Pedal Boat Concession 18May94



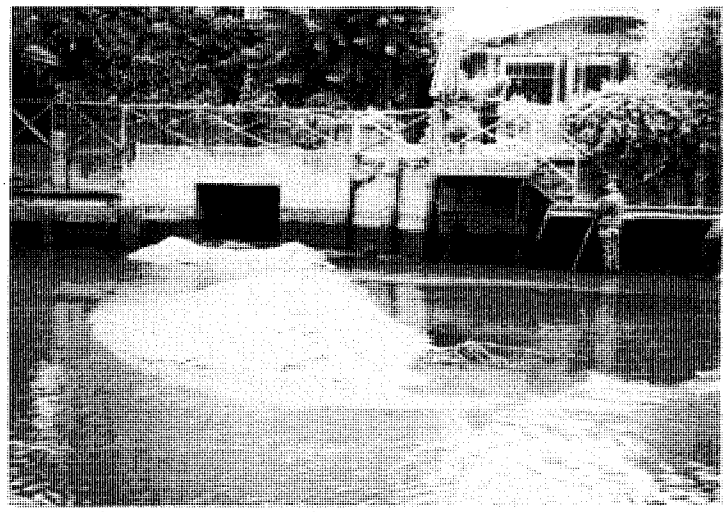
Sandbar Construction 18May94



Reach 2 During Construction 18May



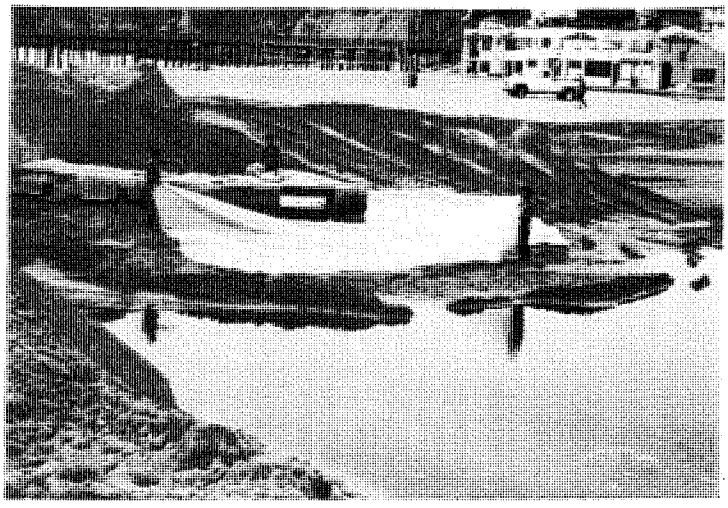
Sediment Deposit from Noble Gulch 19May94



Sediment Deposit from Noble Gulch 19May94

Venetian Court Side Contoured, Jim Turcotte, Supervising 19May94

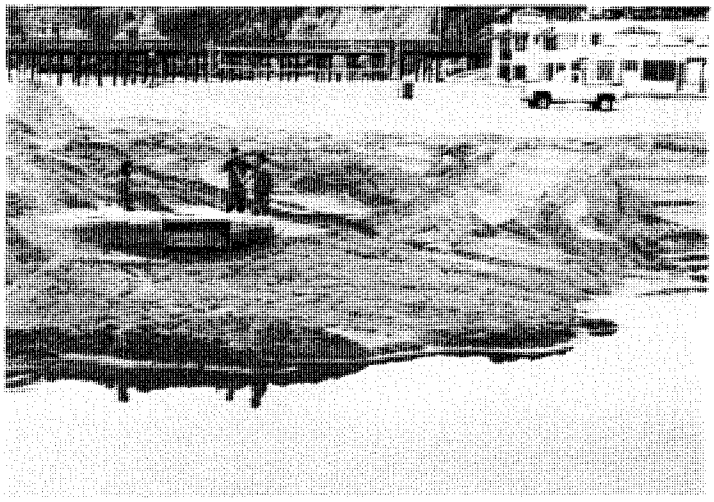
Lagoon Raking Completed 19May94



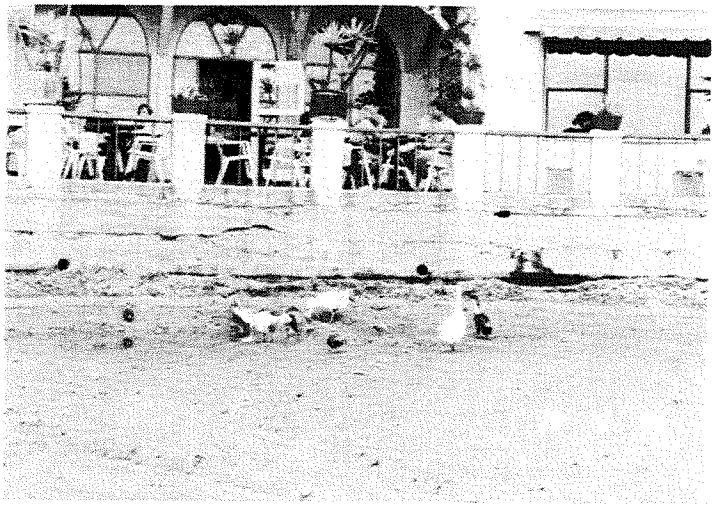
Visquine Layer Around Flume 19May

Bill Casalegno Getting It Done

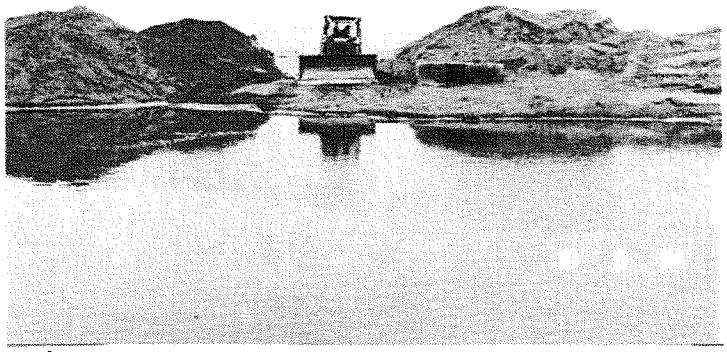
Covering the Visquine With Sand 19May



Visquine Covered 19May94



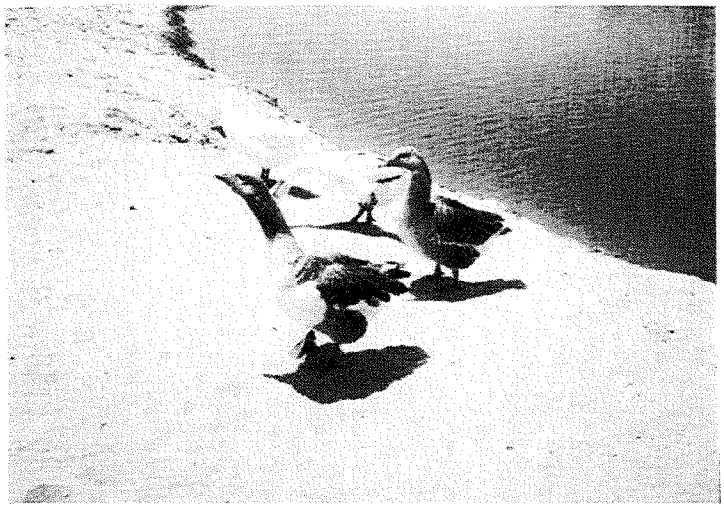
Geese Waiting for a Handout 19May



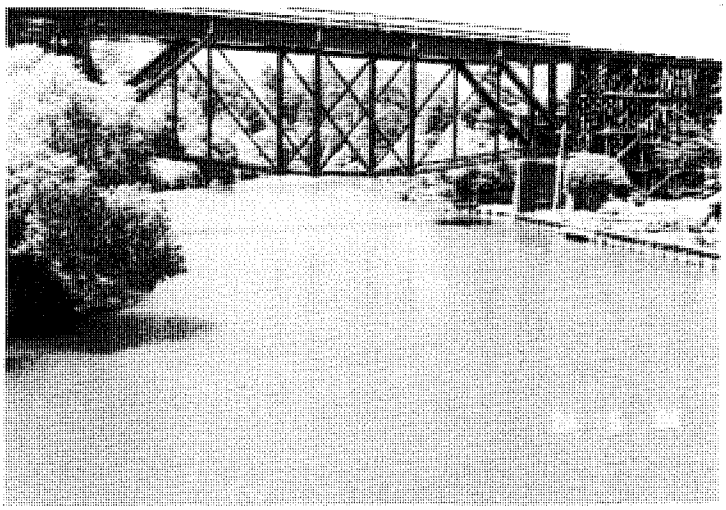
Final Sandbar Closure 19May94

Building the Sandbar 19May94

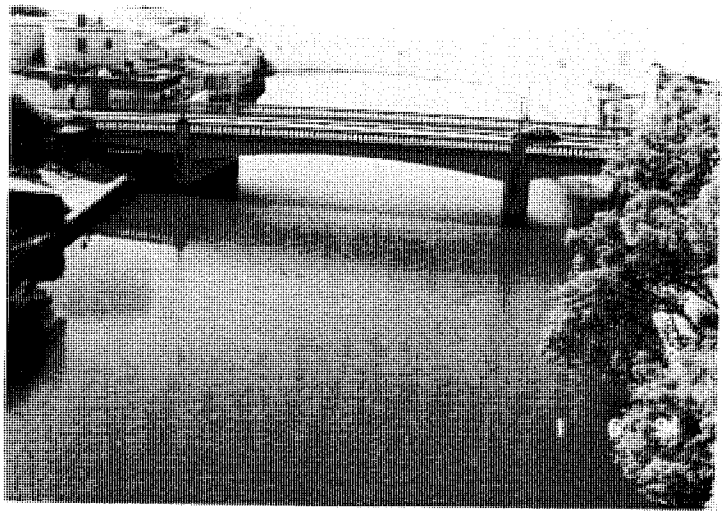
Reach 1 Before Memorial Day 24May



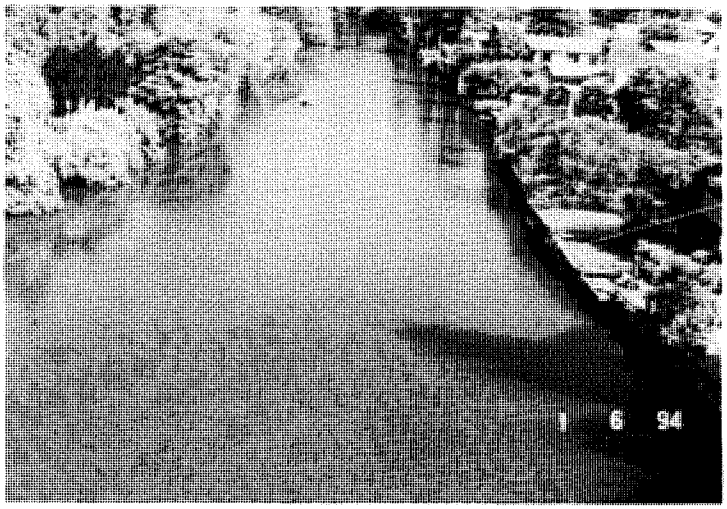
Geese Ready for Beach Crowd 24May94



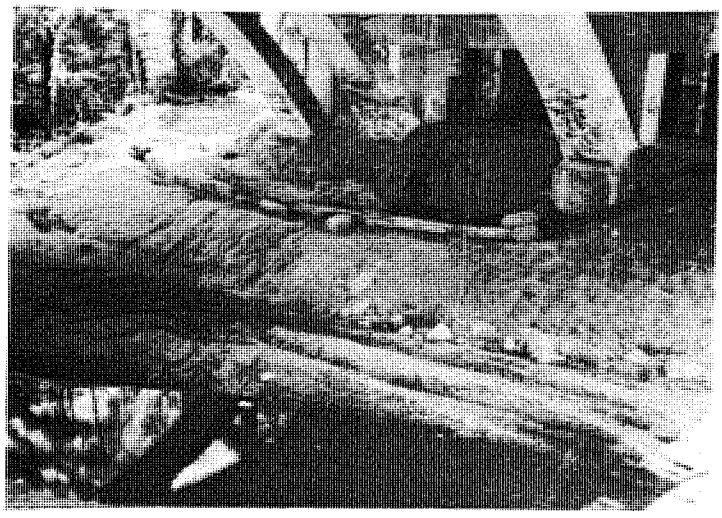
Reach 2, 24May94



Reaches 1 & 2, 1Jun94



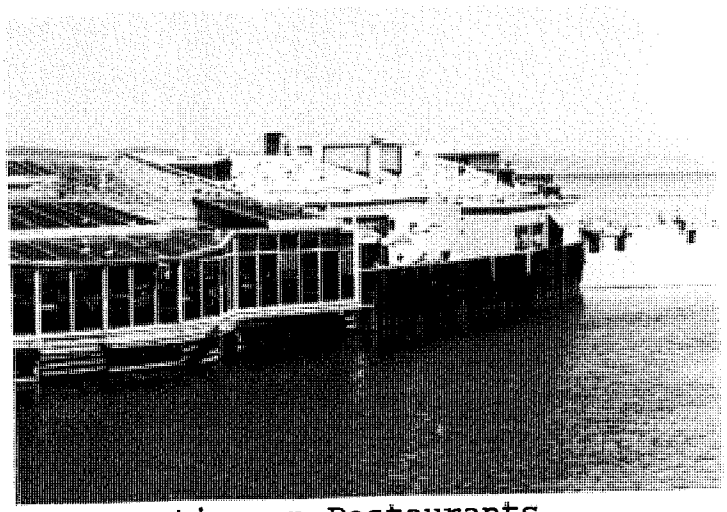
Reach 3, 1Jun94



Under Hwy 1, East Side 1Jun94

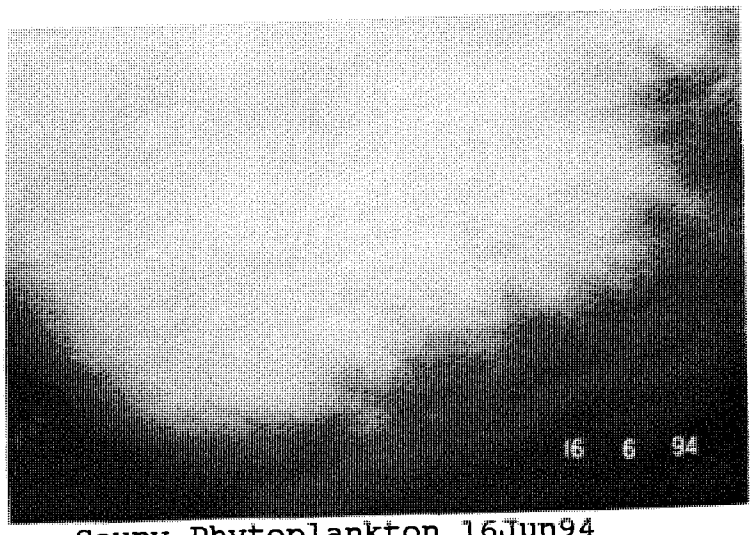
Erosion Control, East Side 1Jun94

Reach 1, 16Jun94

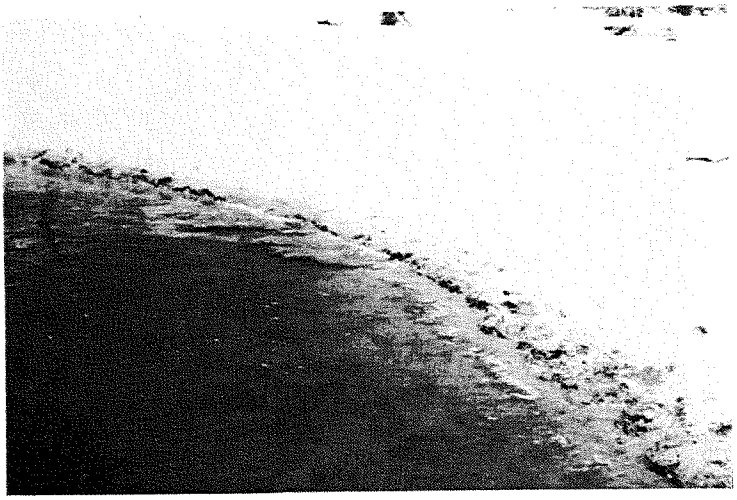


Gulls Roosting on Restaurants, Midday 16Jun94

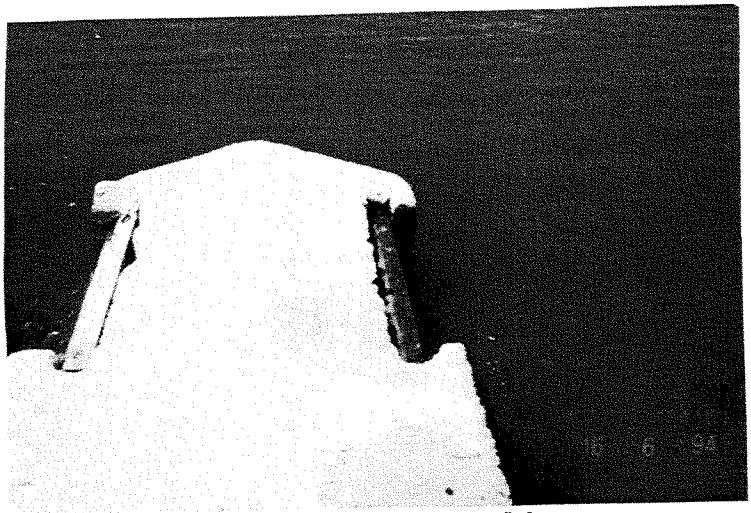
Filamentous Algal Growth 16Jun94



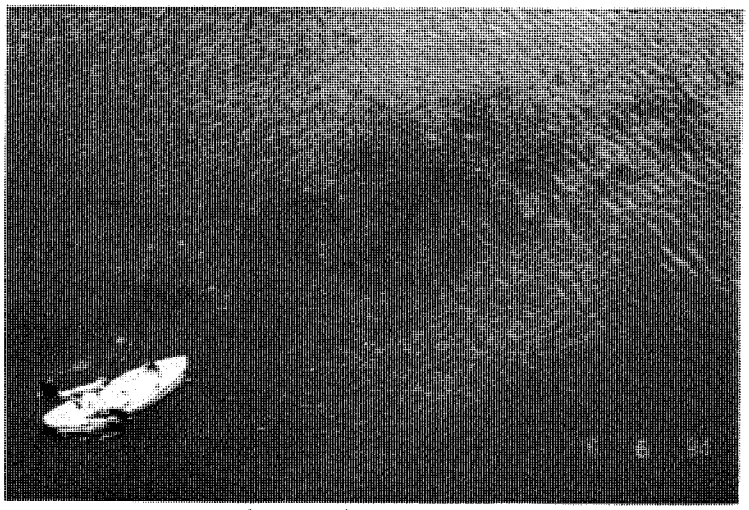
Soupy Phytoplankton 16Jun94



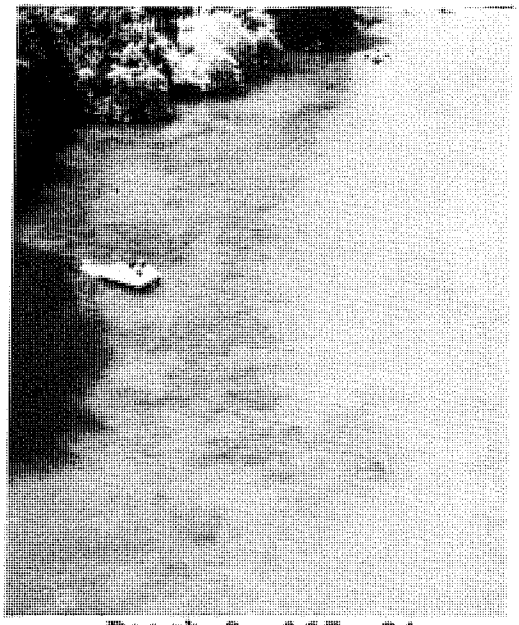
Surface Algae at Margin, 16Jun94



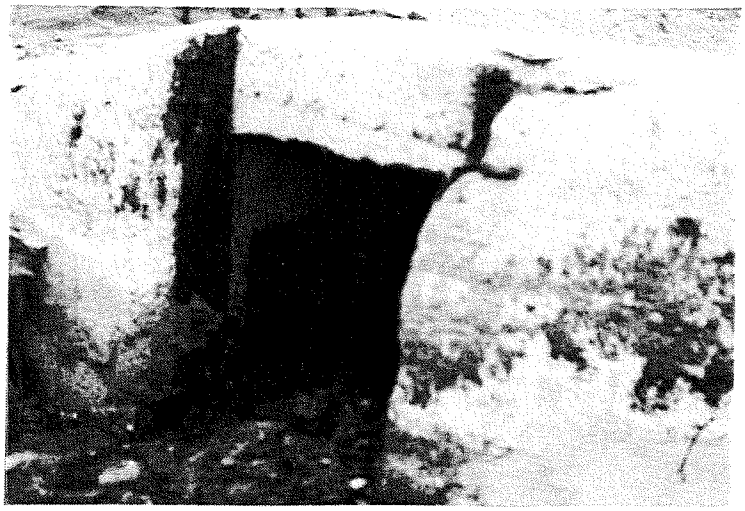
Boards in Place 16Jun94



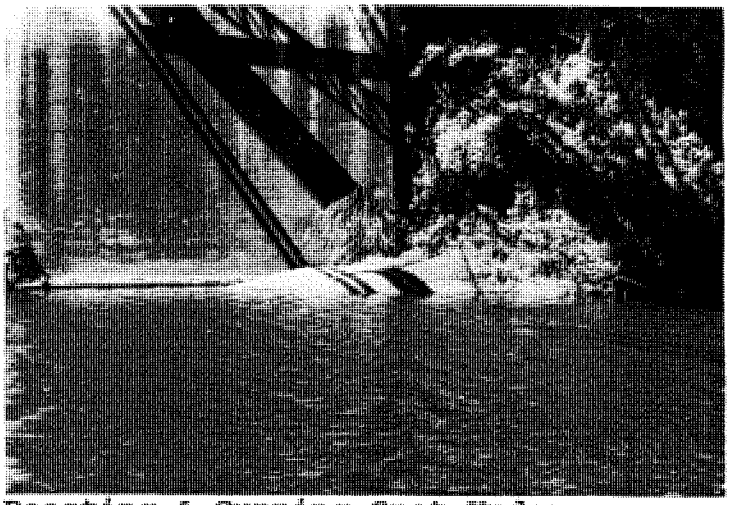
Algal Spires in Deep Channel, Rch 3
16Jun94



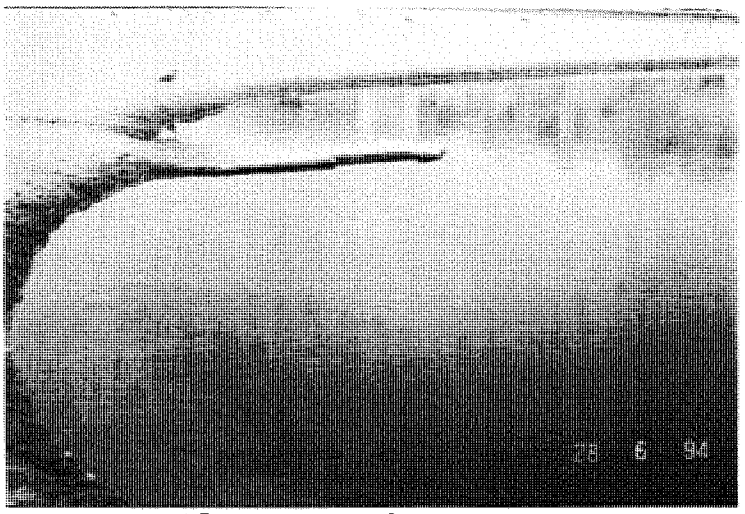
Reach 3 16Jun94



Flume Passable 16Jun94

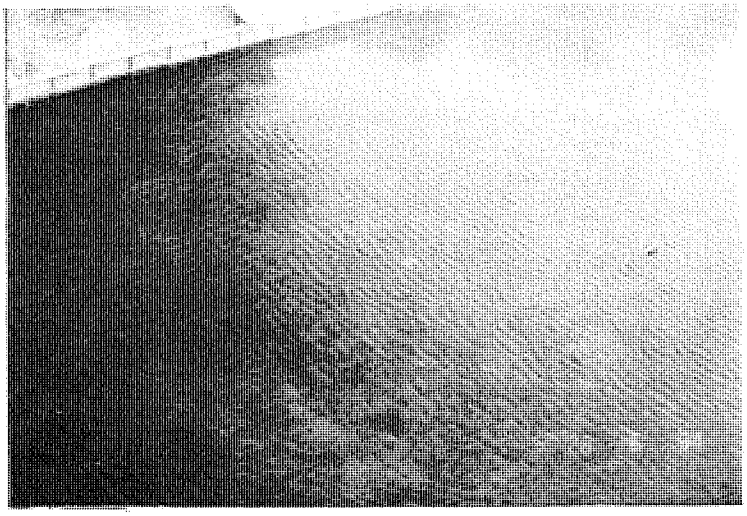


Roosting & Sunning Spot Under
Trestle 17Jun94



Flume, Reach 1 28Jun94

Flume Passable 28Jun94

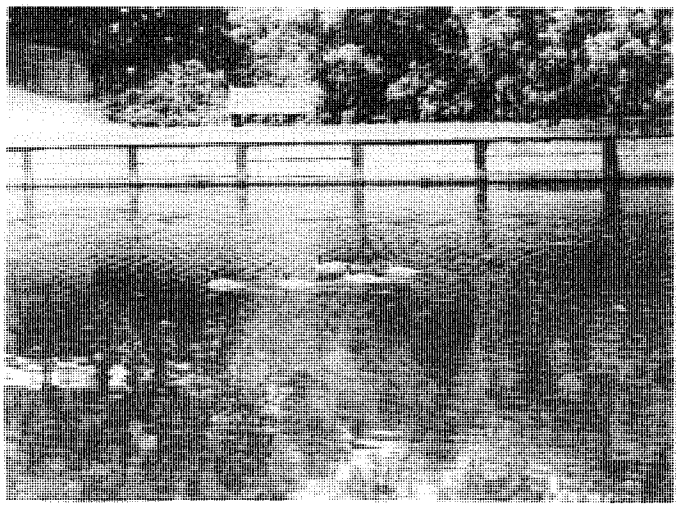


Reach 2 East Side 28Jun94

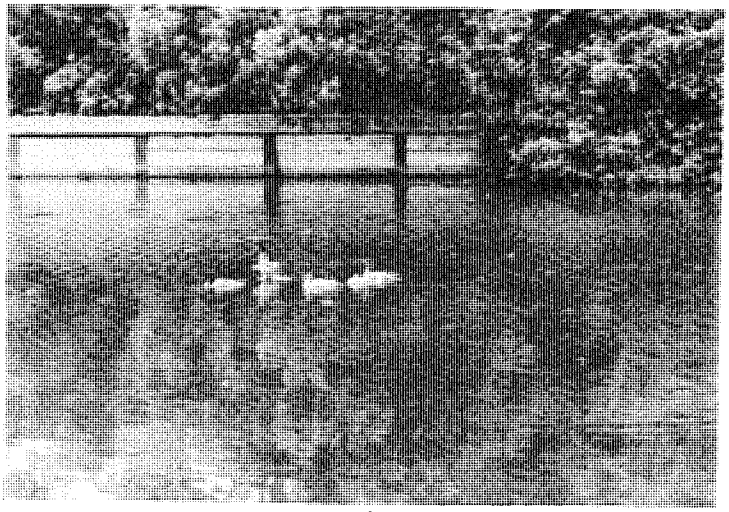
Reach 3 in Fog 28Jun94

1.75 - 2 cfs at Nob Hill 28Jun94

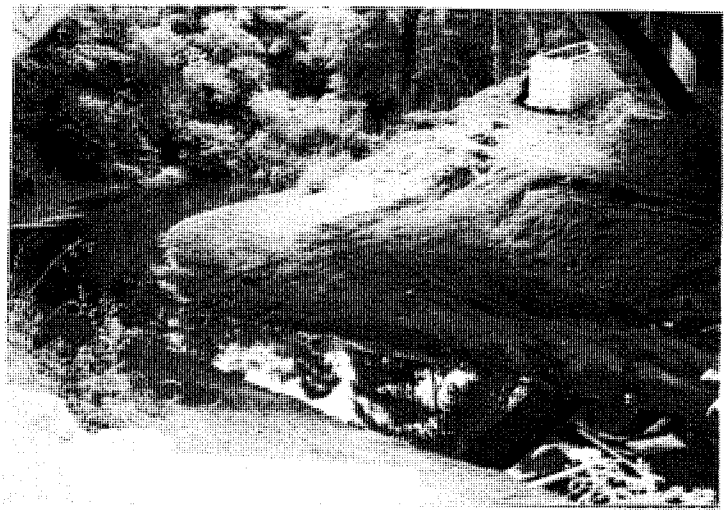
Ducks Roosting @ Venetian 7Jul



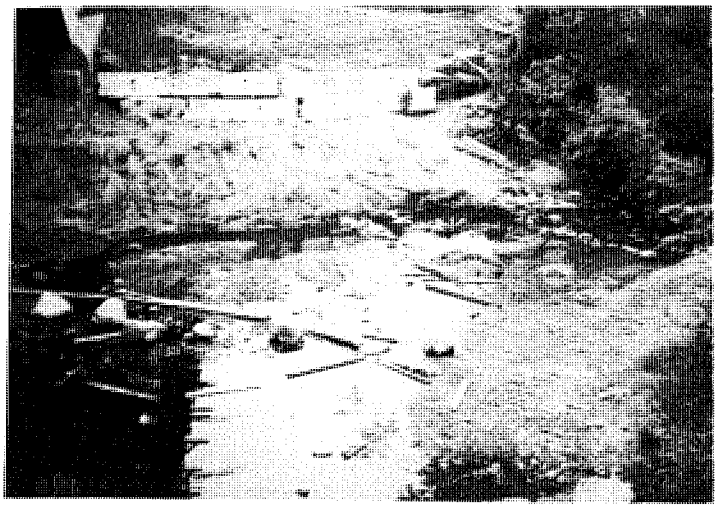
Mamma Merganser & Young, Rch 2 7Jul94



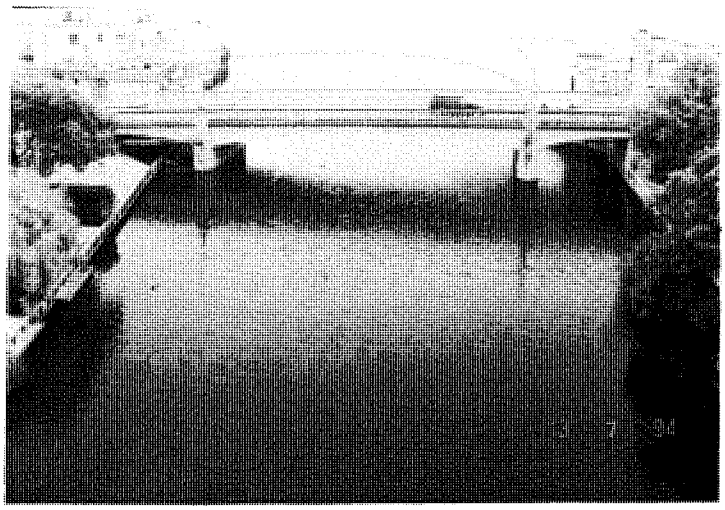
Merganser Frolics 7Jul94



Under Hwy 1 at Crossing 8Jul94

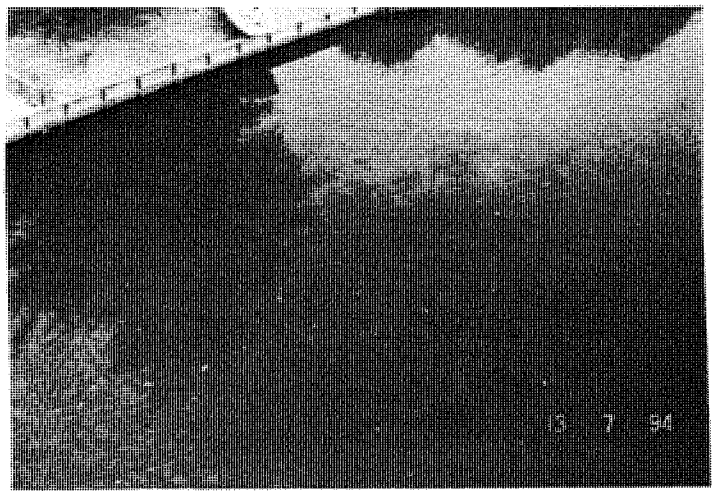


Downstream from Hwy 1 8Jul94

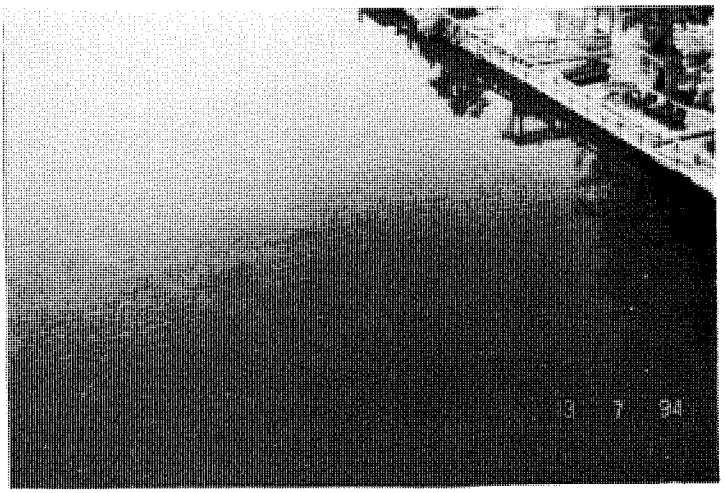


Reaches 1 & 2, 13Jul94

Flume with Little Algae, 13Jul94



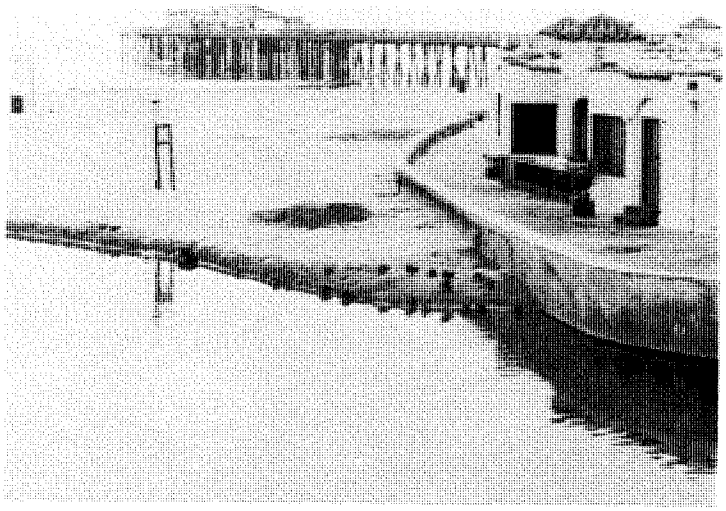
Reach 2, East Side 13Jul94



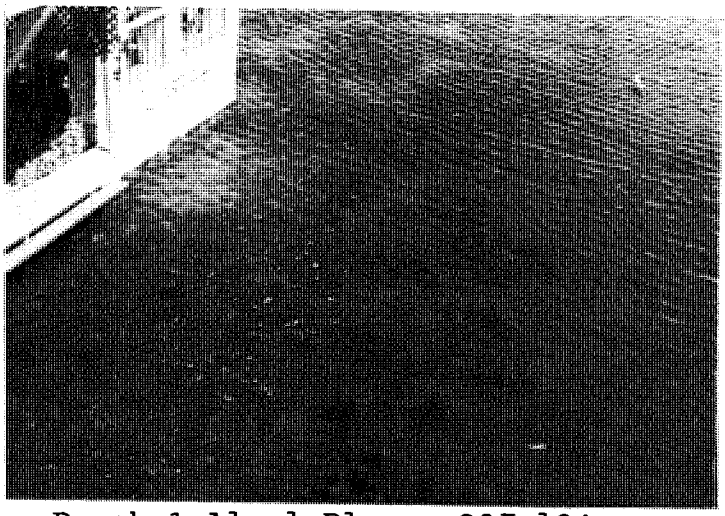
Reach 3, East Side 13Jul94

1.25 cfs at Nob Hill 13Jul94

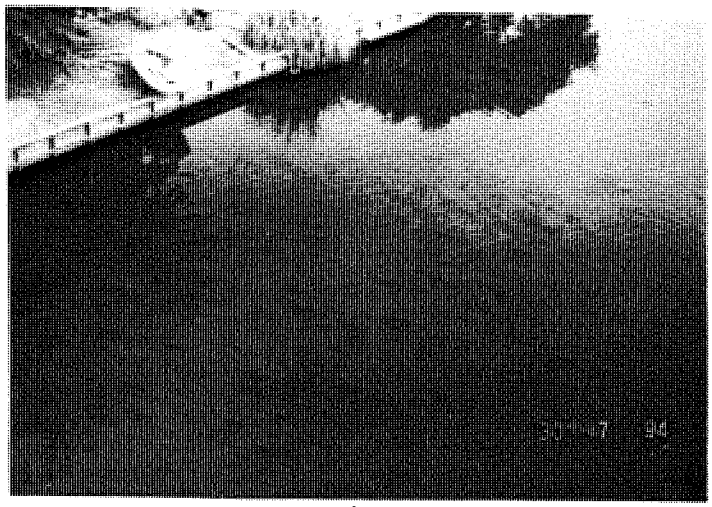
Flume Passable 13Jul94



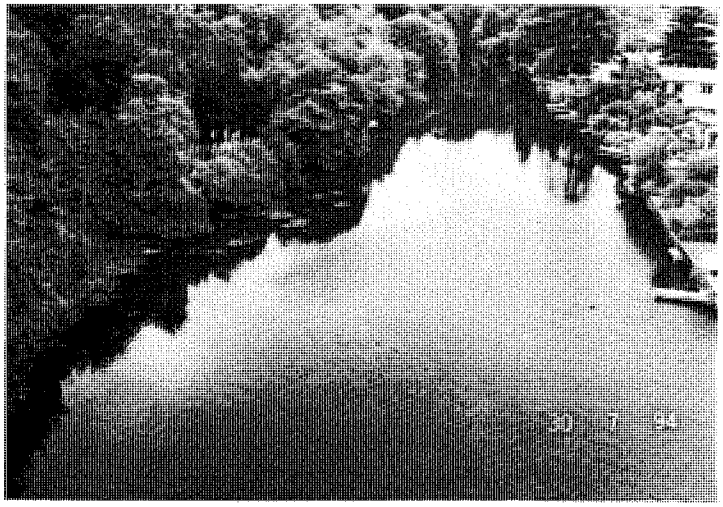
Ducks Roosting @ Venetian 14Jul94



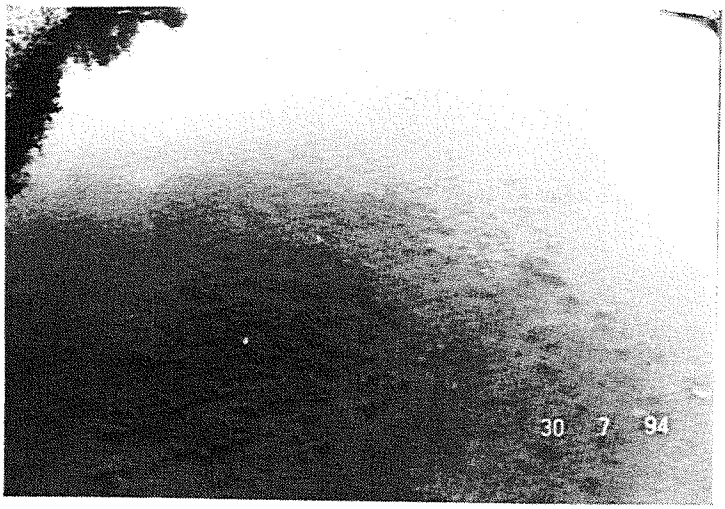
Reach 1 Algal Bloom, 30Jul94



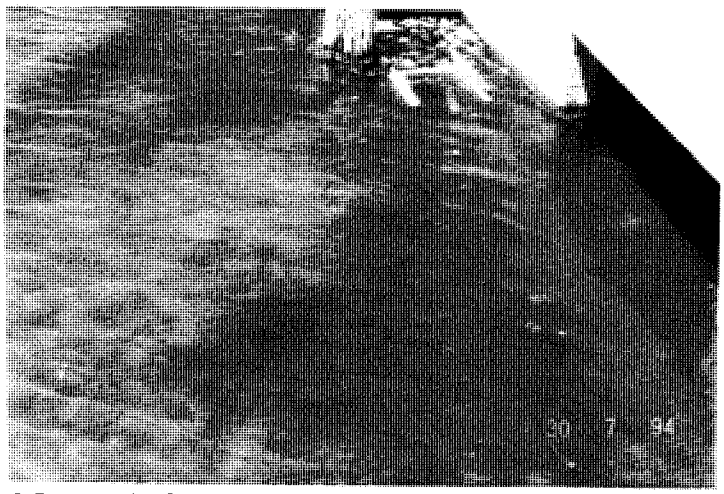
Rch 2, East Side Algae 30Jul94



Reach 3 & Surface Algae 30Jul94

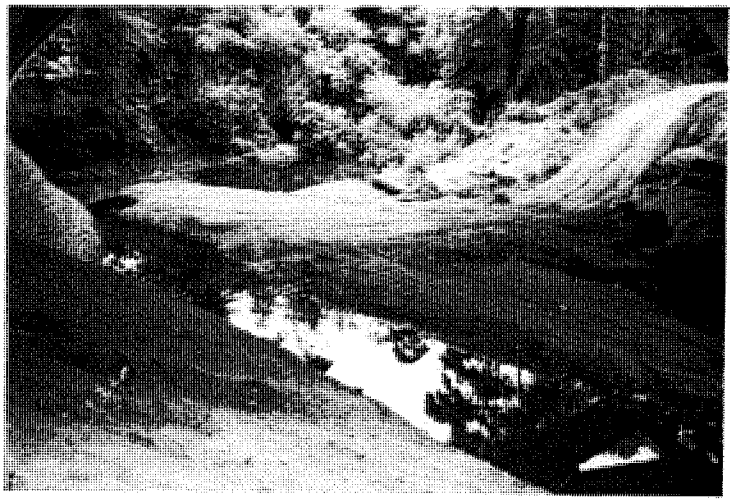


Reach 3 Algae 30Jul94

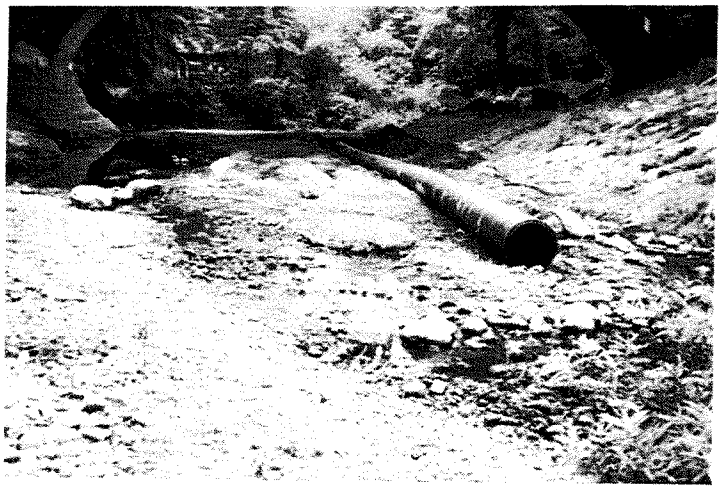


Noble Gulch Algal Bloom 30Jul94

Flume Sealed for Season 30Jul94

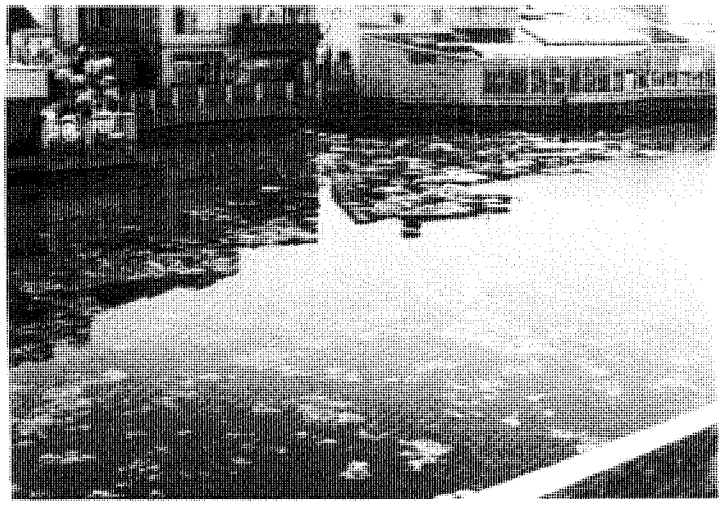


Gravel Dam Under Hwy 1 30Jul94

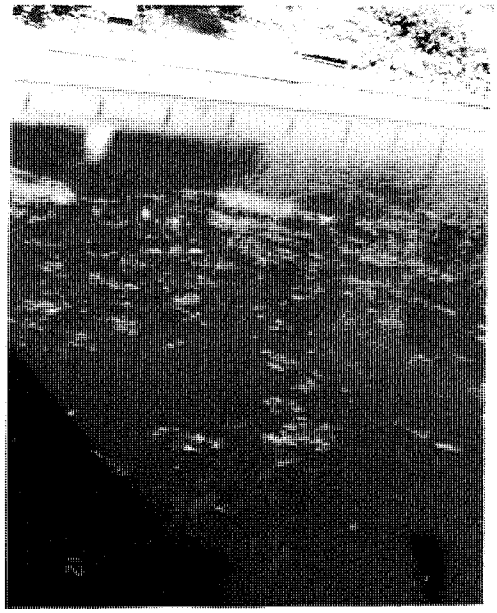


Culvert Impassable @ Hwy 1, 30Jul94

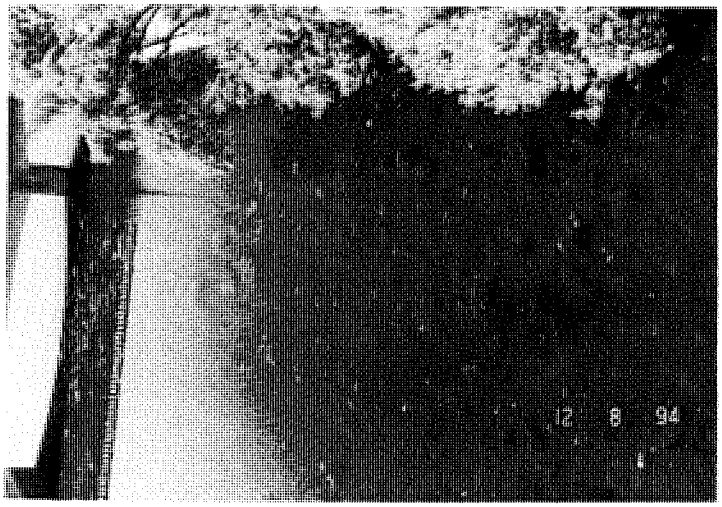
Reach 1, 12Aug94



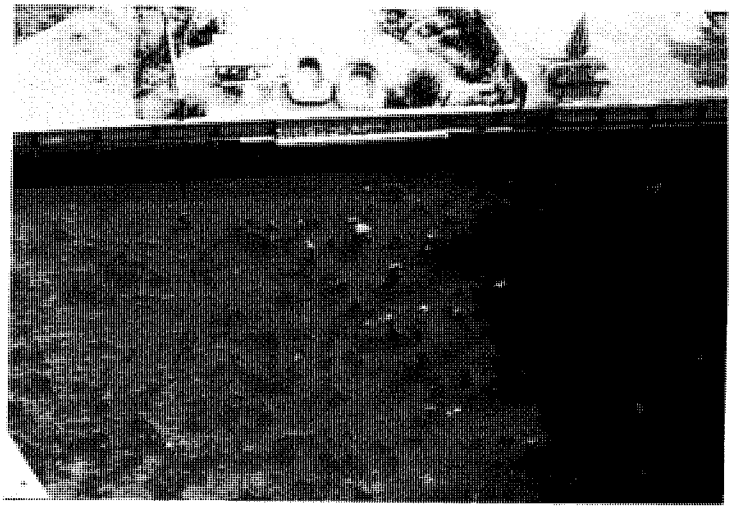
Reach 1, Surface Algae, 12Aug94



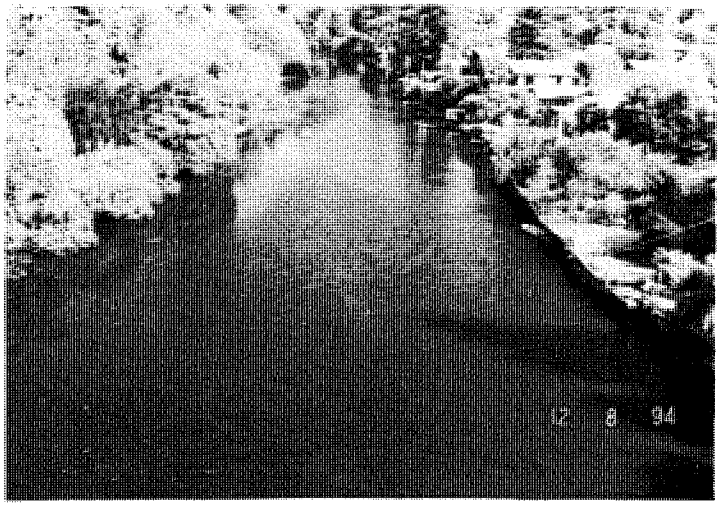
Reach 2, Looking West 12Aug94



Reach 2, West Side 12Aug94

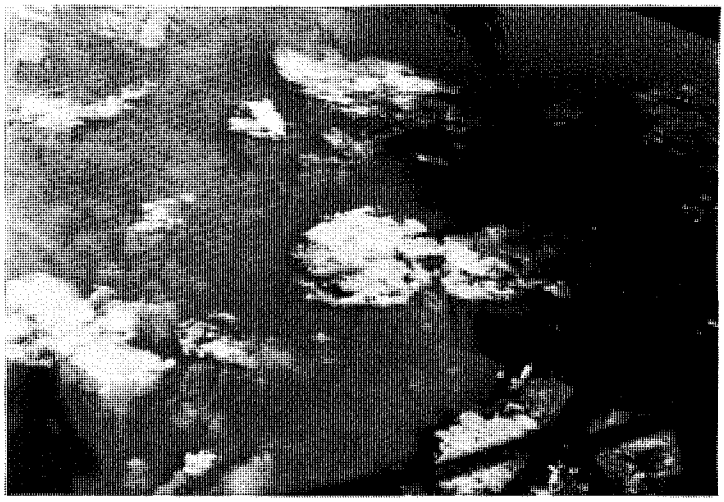


Reach 2, East Side 12Aug94



Reach 3 Less Surface Algae 12Aug

Noble Gulch Surf. Algae 12Aug94

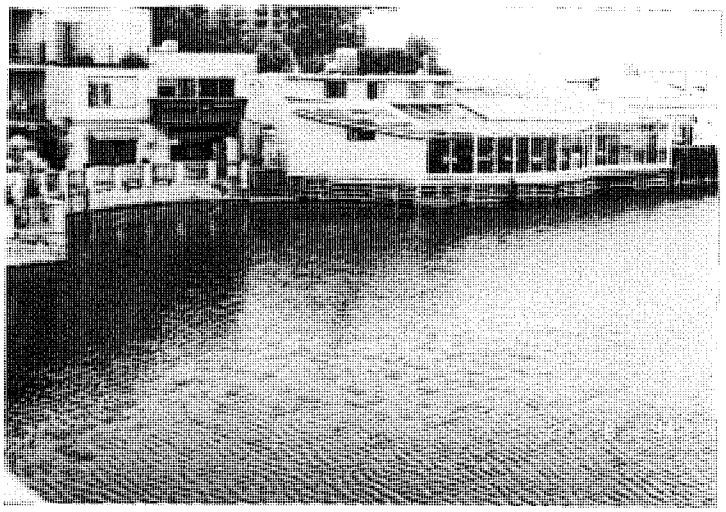


Surf. Algae Near Noble G. 12Aug94

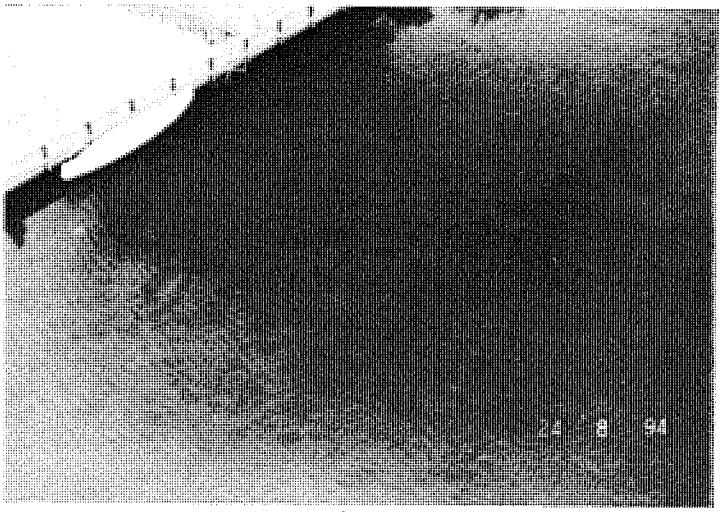
Approx. 0.25 cfs at Nob Hill 12Aug94

Reach 1, Lagoon Loosing Depth 24Aug

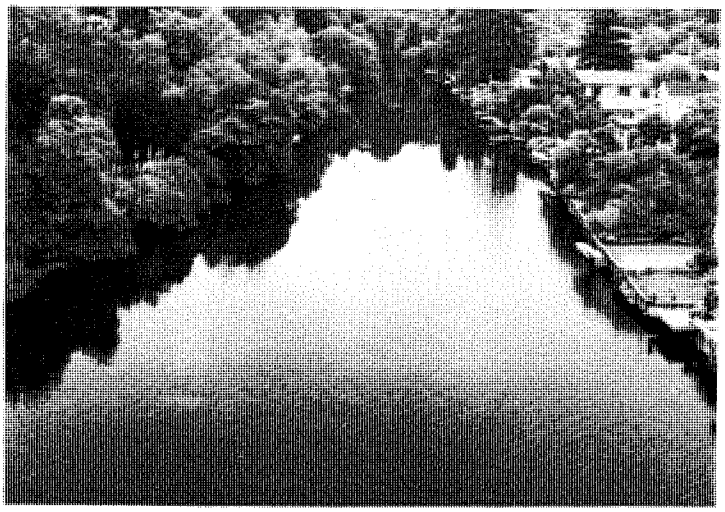
Flume, Reach 1, 24Aug94



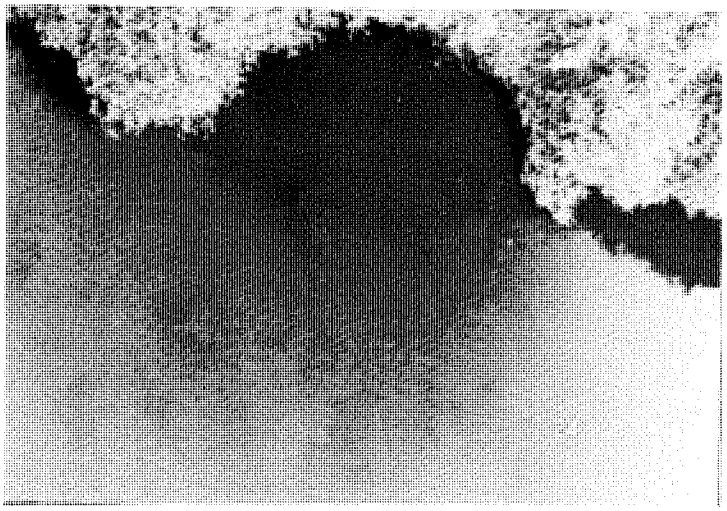
Reach 1, Surf. Algae Gone 24Aug94



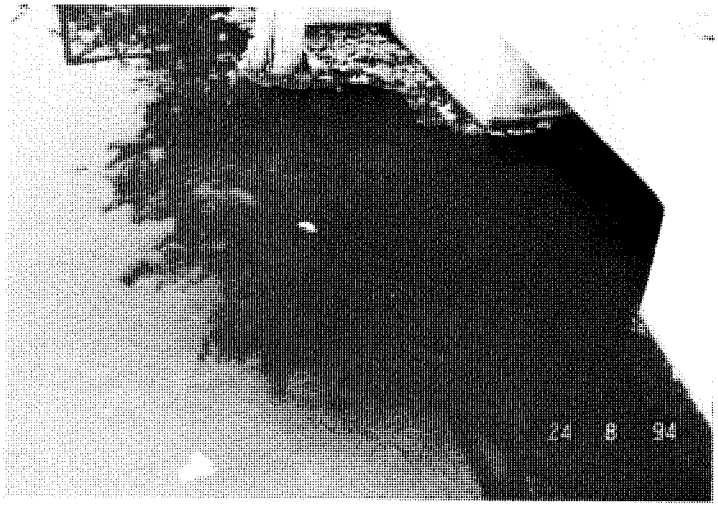
Reach 2, East Side 24Aug94



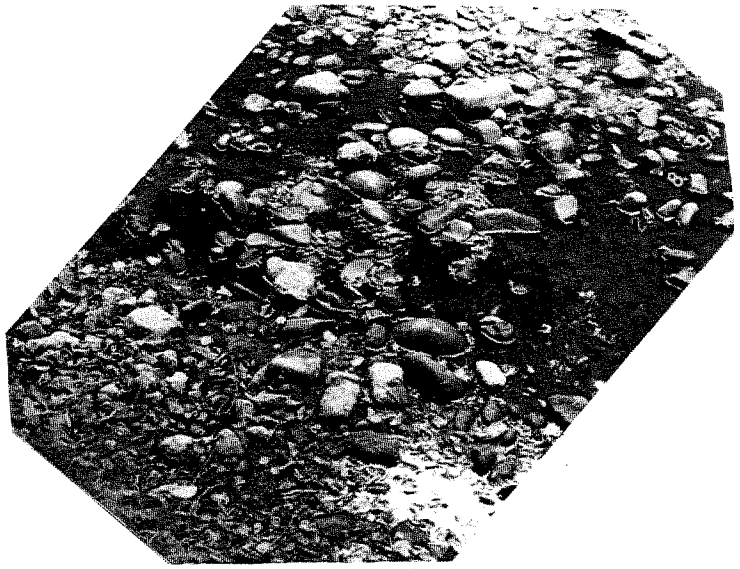
Rch 3, Algae at West Margin 24Aug94



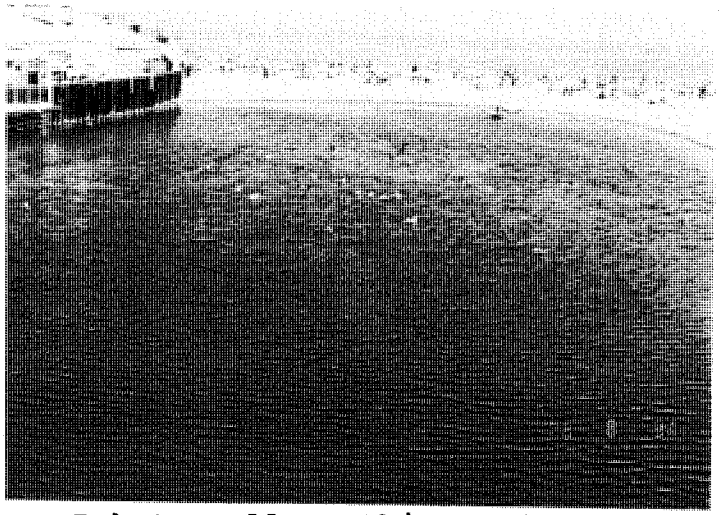
Reach 3, West Side 24Aug94



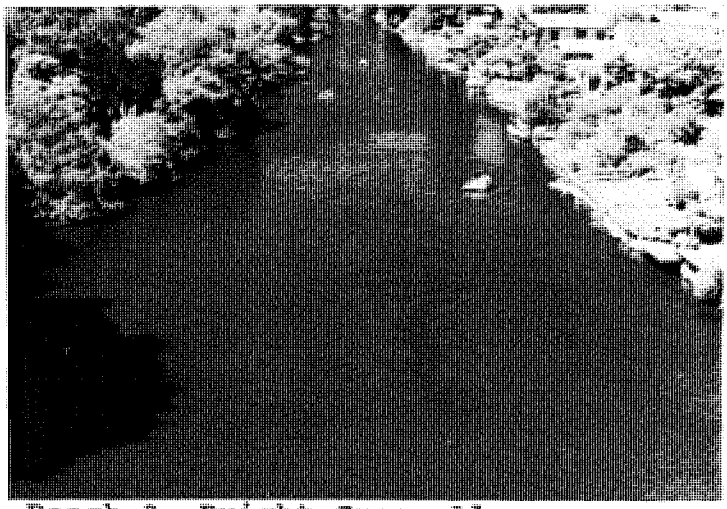
Mouth of Noble Gulch 24Aug94



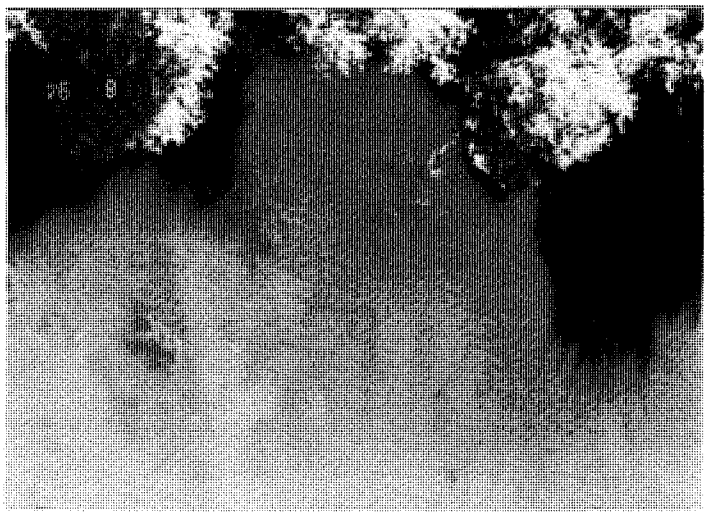
Approx. 0.25 cfs @ Nob Hill 24Aug



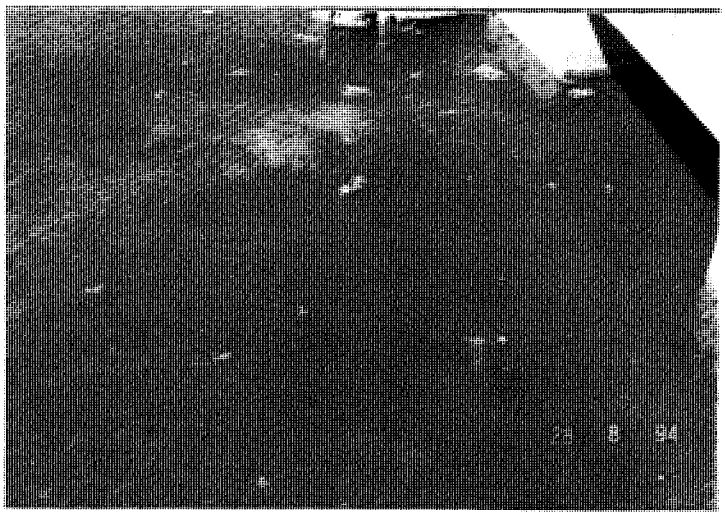
Rch 1, Gulls Bathing, Afternoon
28Aug94



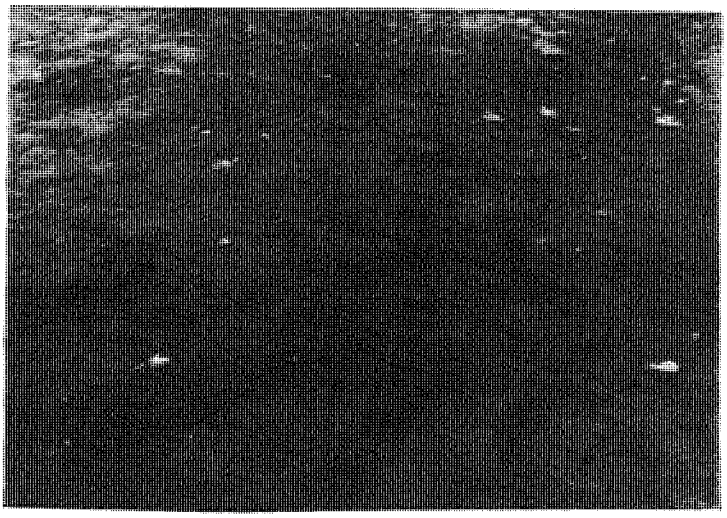
Reach 3, Bright Green Algae
28Aug94



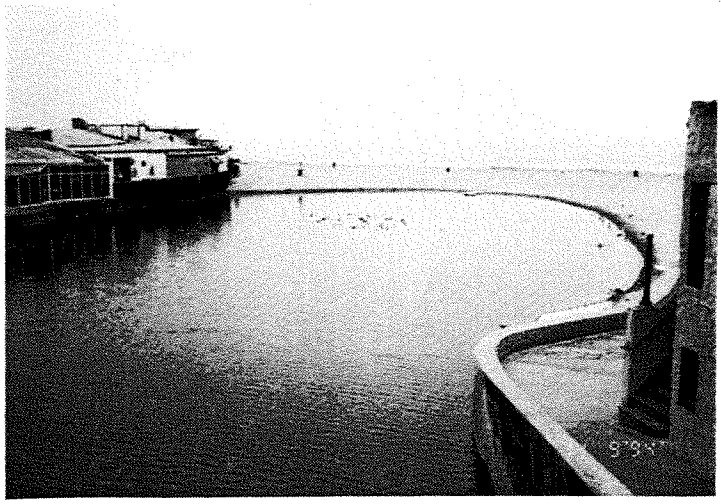
Reach 3, West Side 28Aug94



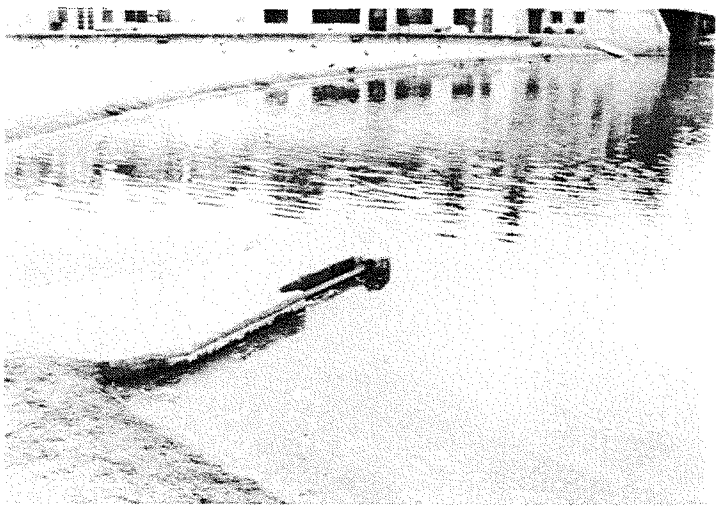
Mouth Noble Gulch 28Aug94



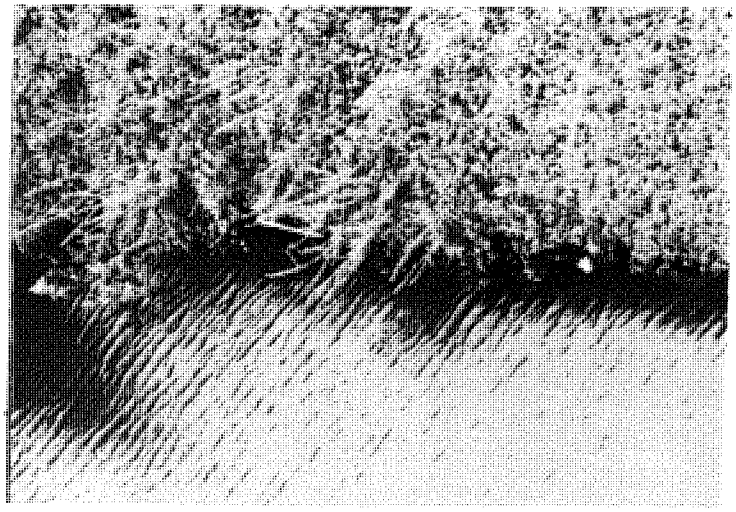
Near Noble Gulch, Rch 3, 28Aug94



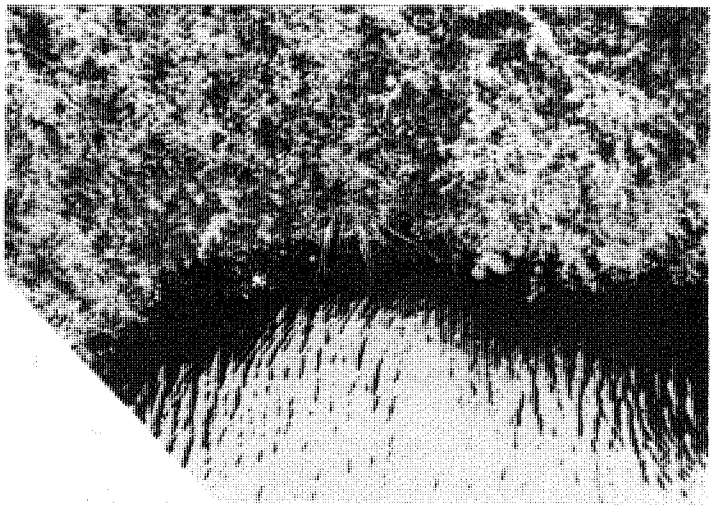
Rch 1 After Begonia Festival
14Sep94



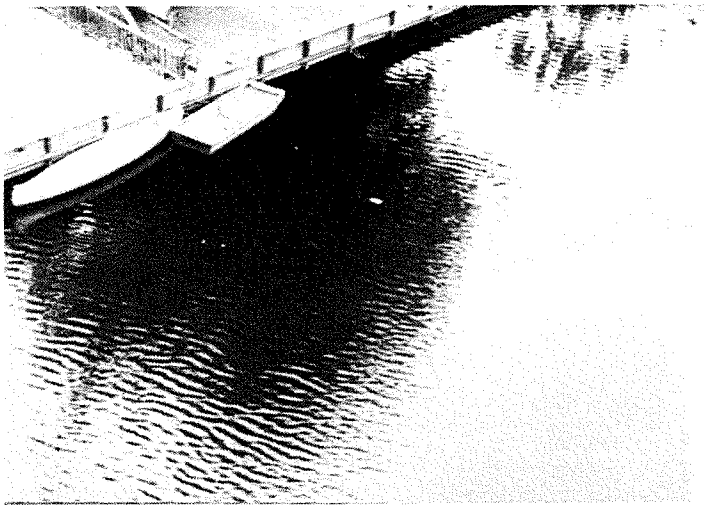
Lagoon Level Increased 14Sep94



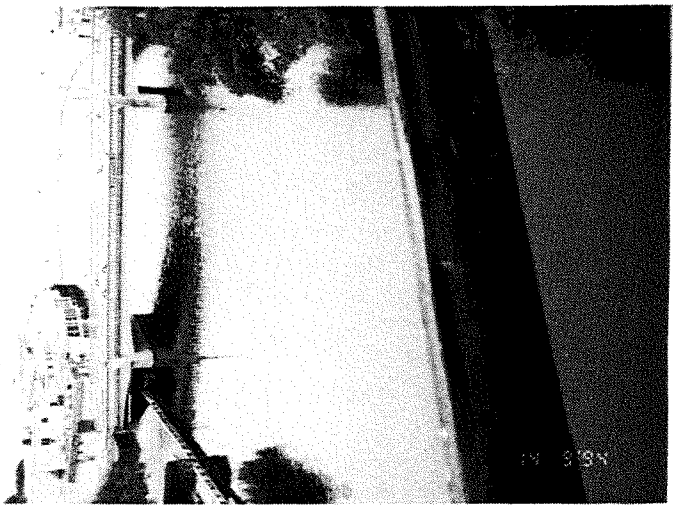
A Few Begonias, W.Side, Rch 2



A Few Begonias, W.Side, Rch 3

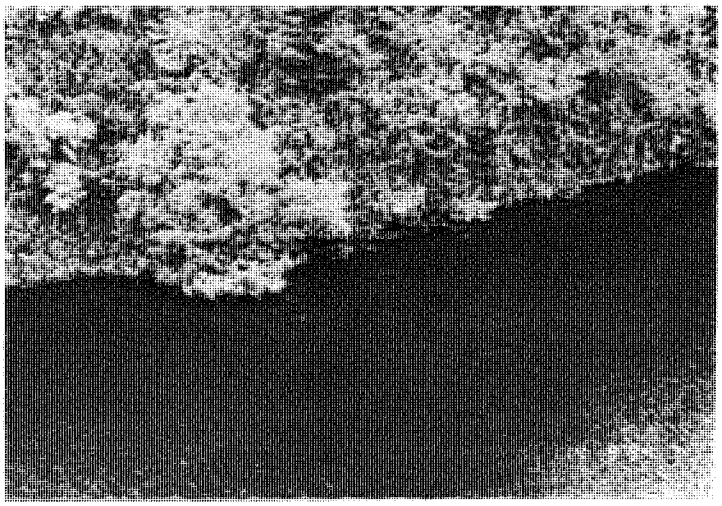


Reach 2, East Side 14Sep94

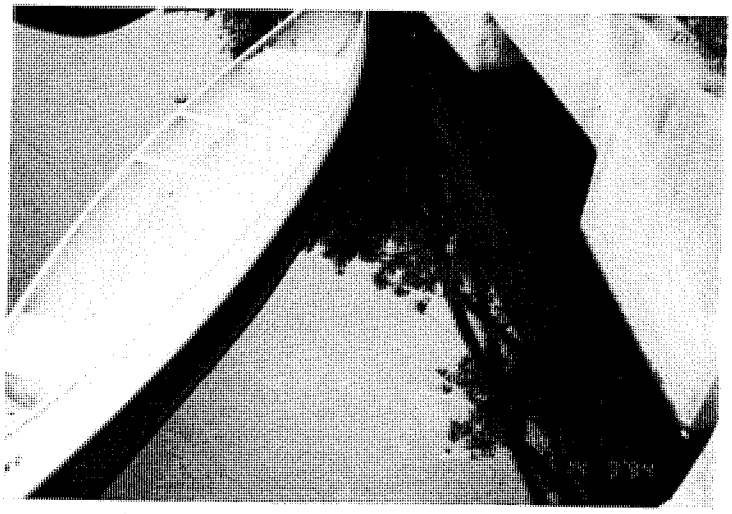


Reaches 1 & 2, After Begonia Festival 14Sep94

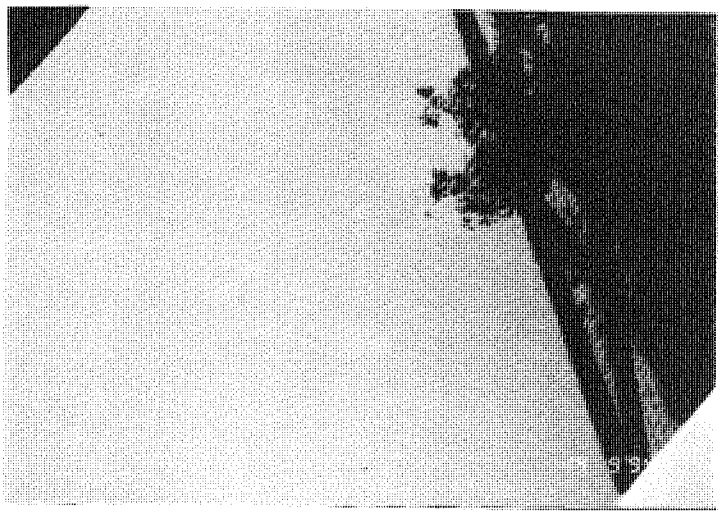
Reach 3 14Sep94



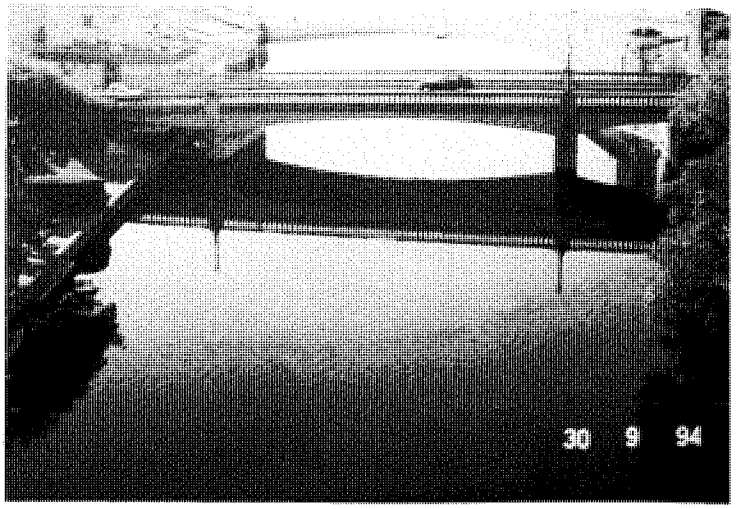
More Begonias, Rch 3, 14Sep94



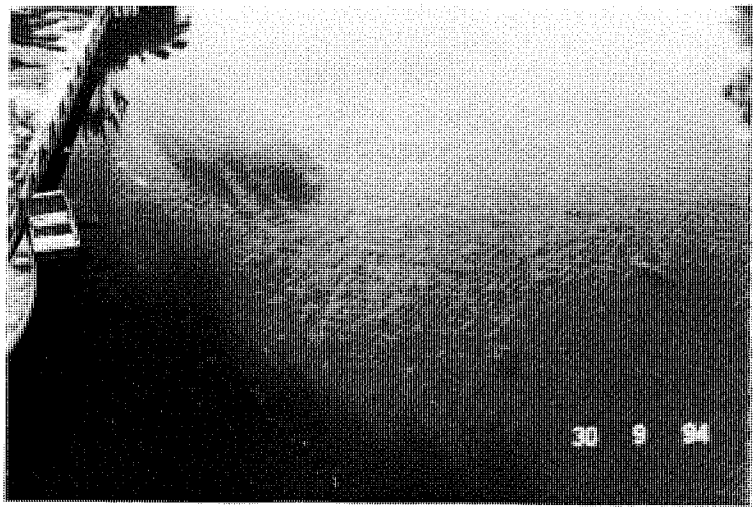
Surface Oil Spots, Noble G. 14Sep



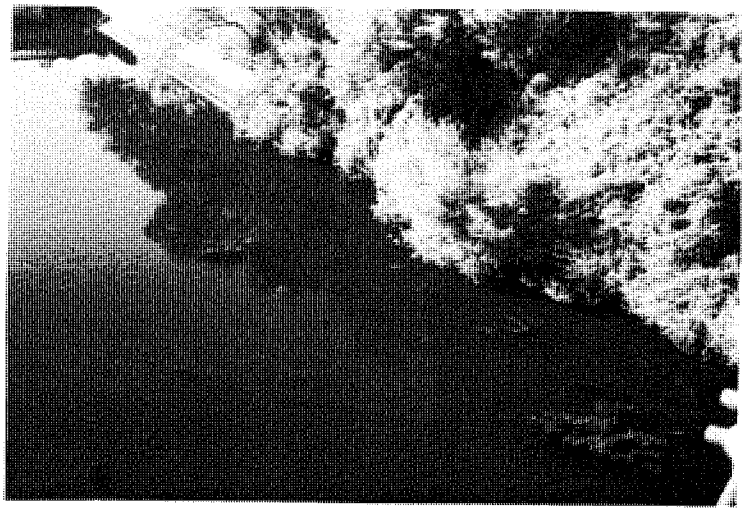
Surf. Oil Spots Near Noble G.14Sep94



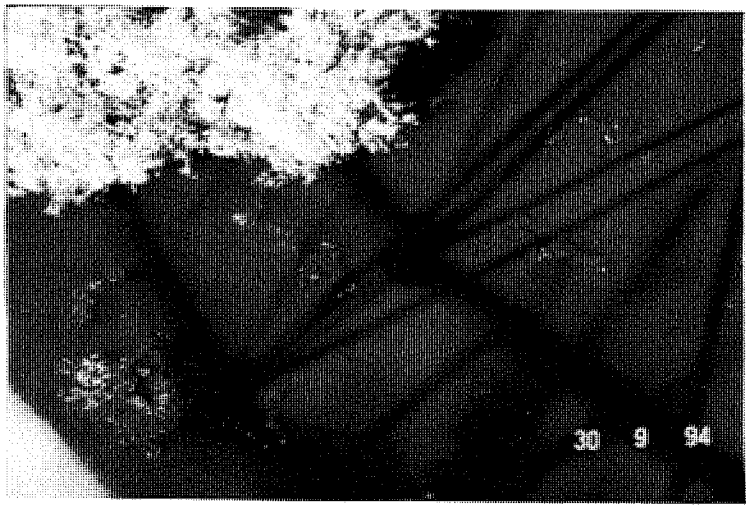
Reaches 1 & 2, 30Sep94



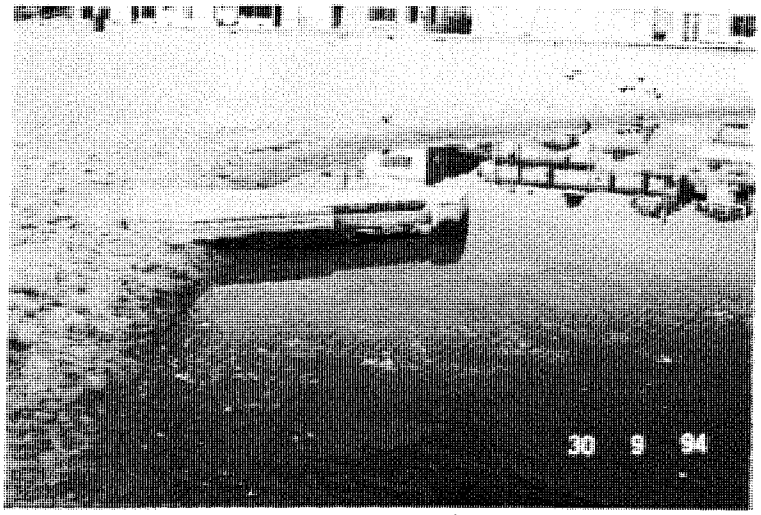
Rch 2, East Side, Algae Increase 30Sep94



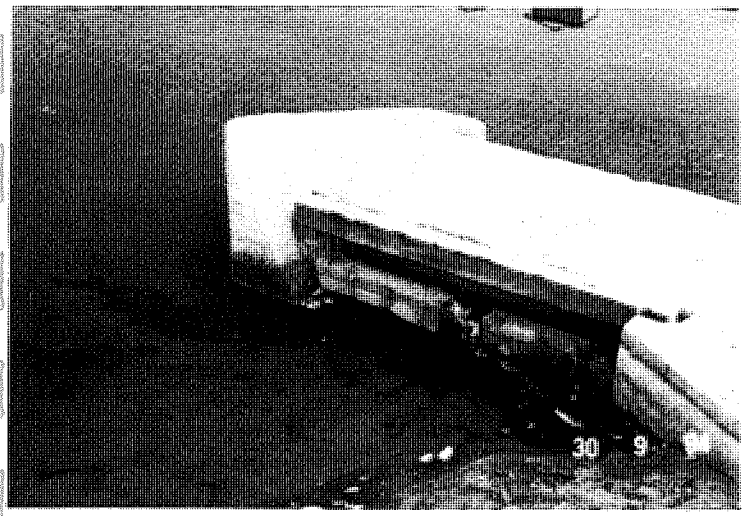
Rch 2, Surf. Algae, W.Side, Leaves Senescing 30Sep94



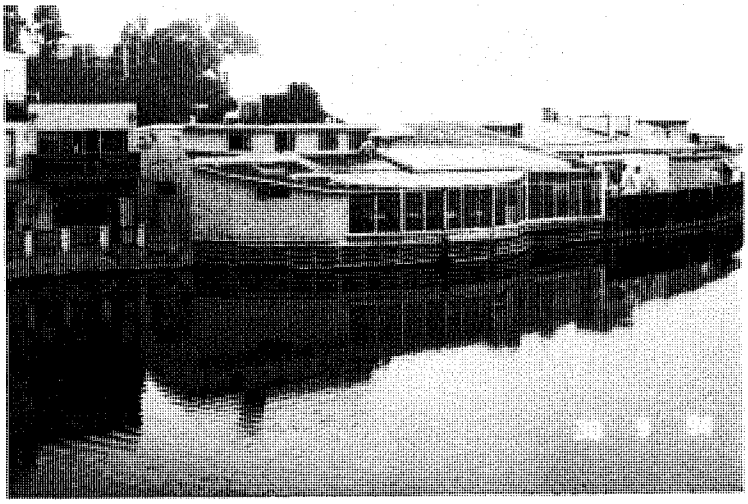
Rch 3, Surf. Algae, W.Side 30Sep



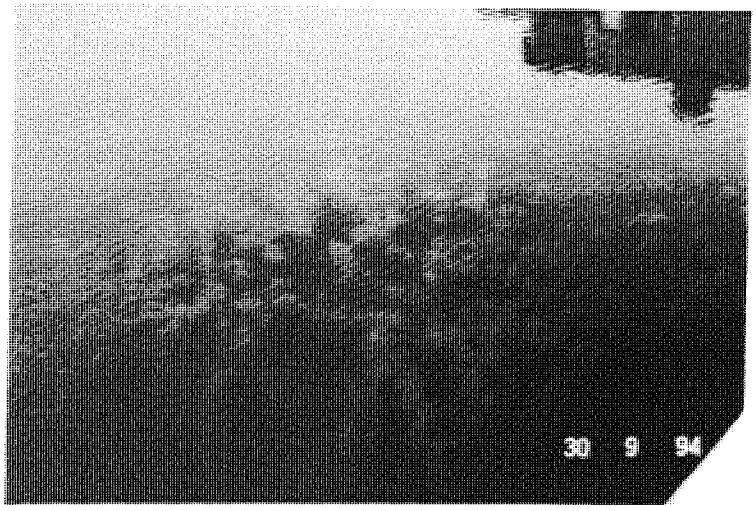
Lagoon Level Down, Oily Scum 30Sep94



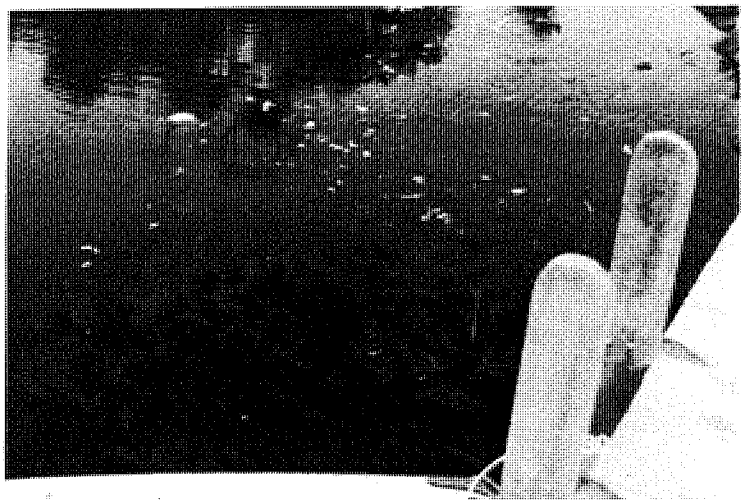
Notched Board In Place 30Sep94



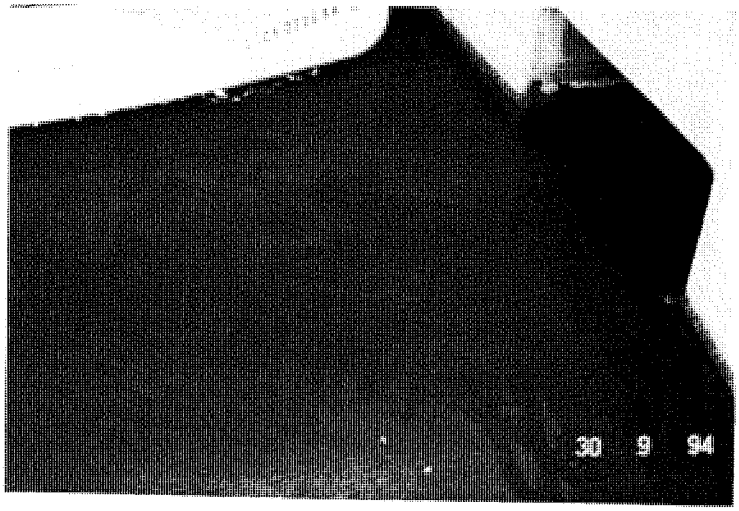
Reach 1 By Restaurants 30Sep94



Pondweed Hold-out, Rch 1 30Sep94



Pondweed Decline, Rch 3 30Sep



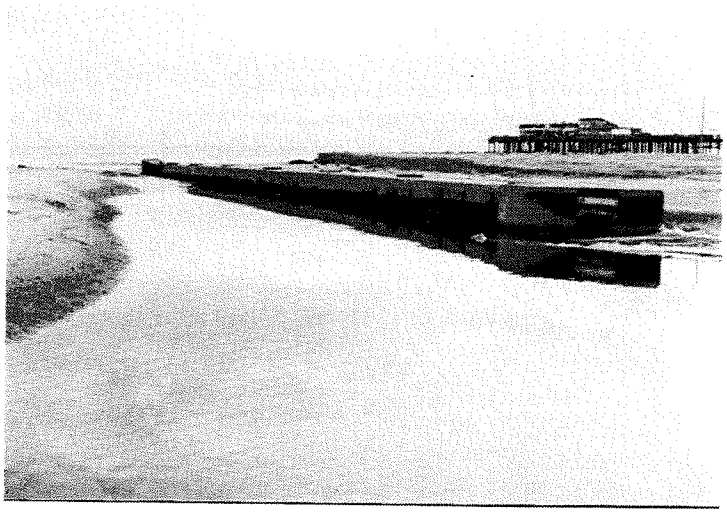
Mouth of Noble Gulch 30Sep94

Rip-rap Placement Under Porter St. Bridge, 30Sep94

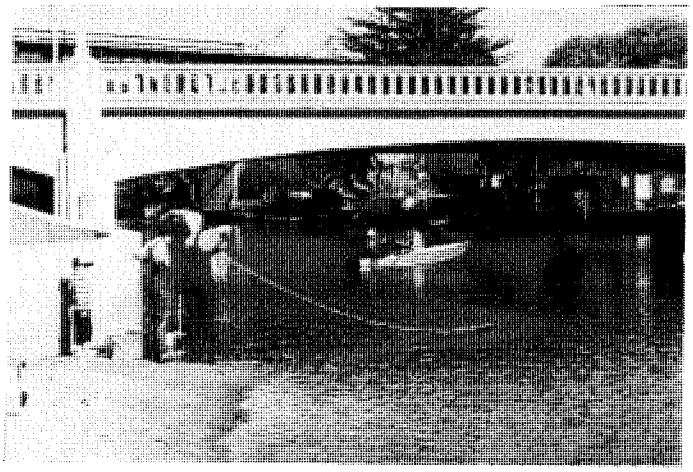
Mr. Hayford & Biologist Before Fish Sampling 16Oct94

Soquel Estuary After Sandbar Breach, 7Nov94

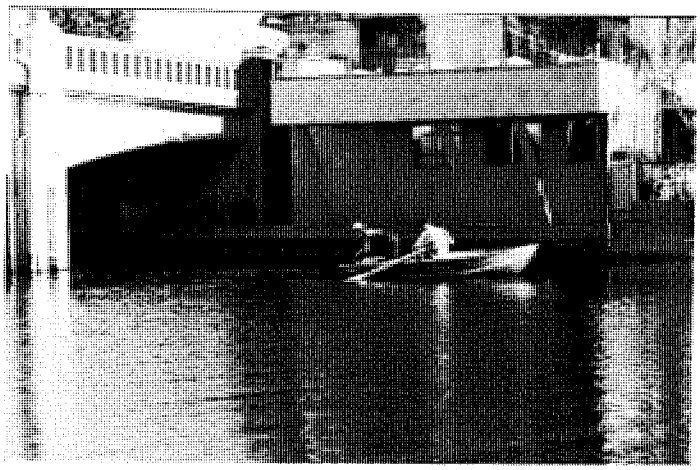
Soquel Estuary Near Flume 7Nov94



Outlet Channel After Sandbar Breach 7Nov94



Setting the Seine Under the Stockton Avenue Bridge 16Oct94

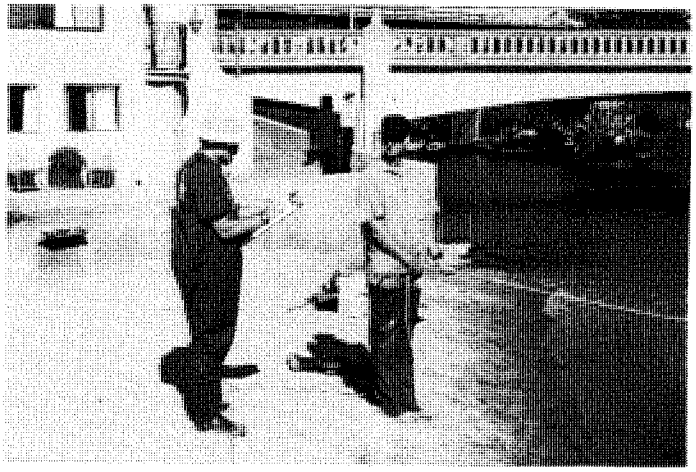


Paying Out Seine from Boat Below Sea Bonne Rest. 16Oct94

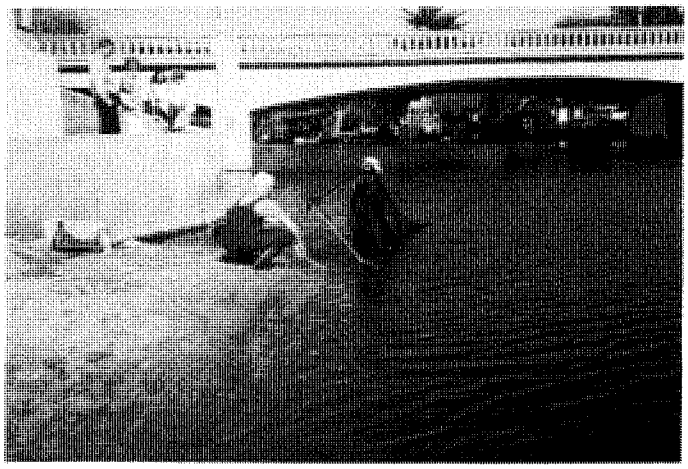
Paying Out Rope Near Margaritaville and Mr. Toot's 16Oct94
14Sep94

Return to the Beach to Pull in the Seine 16Oct94

Dillon Does Construction 16Oct94



Readying Data Sheet While Steve Waits to Pull Seine 16Oct



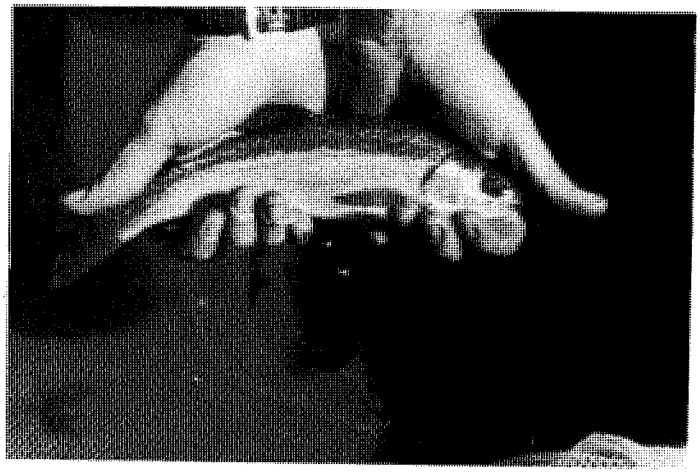
Jen Pulls in Seine, Keeping the Lead-Line Down on Bottom 16Oct94

Jen and Gretchen Pull In Seine Standing on Lead-Line 16Oct94

Readying to Beach the Center of the Seine with Bag in Steve's Hands

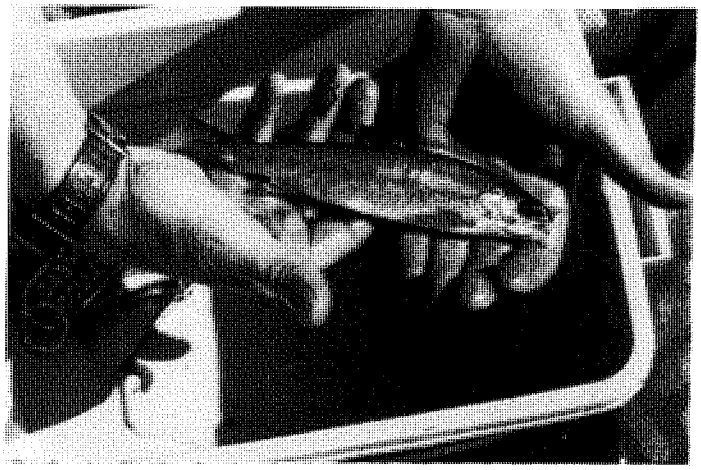
Captured Steelhead in Live-Car 16Oct94

Transferring Steelhead from Holding Pen to Live-Car for Measuring 16Oct

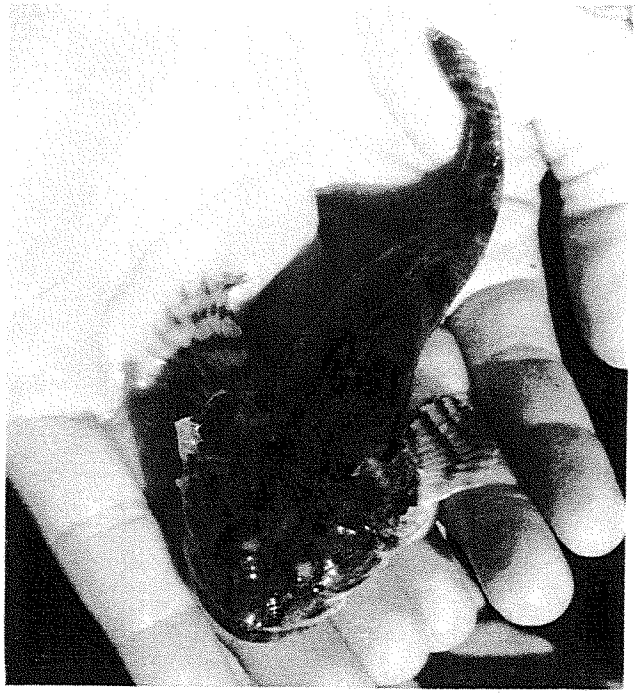


Steelhead Yearling 16Oct

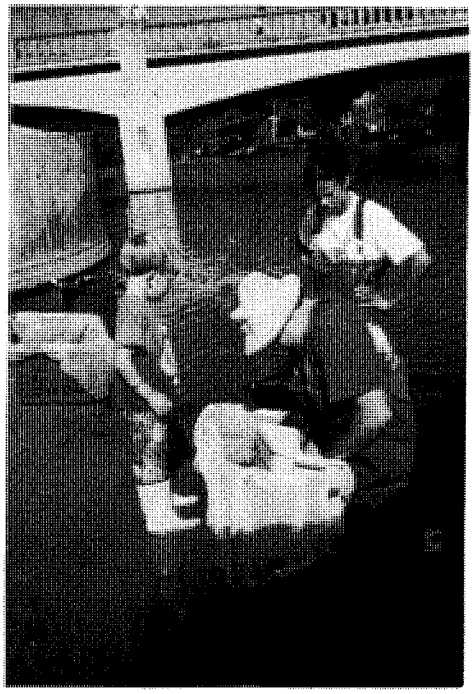
Lagoon-Grown Steelhead 160ct94



Steelhead With Black Spots From Parasitic Trematode 160ct94

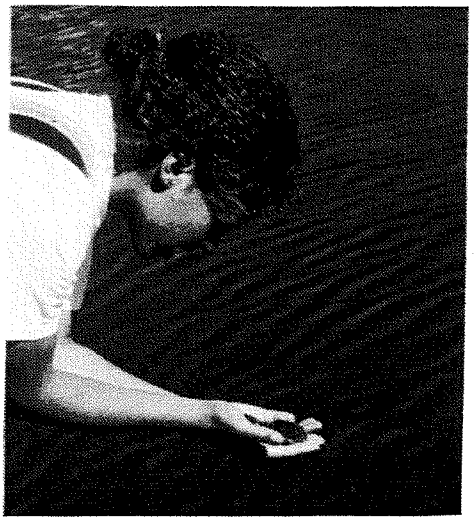


Staghorn Sculpin 160ct94



Measuring and Marking the Steelhead With Dillon & Gretchen 160ct

Measuring the Length of Steelhead 160ct94



Life Holds Life 160ct94

APPENDIX B.

FISH AND GAME AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION, 1994.

Notification No. 0374-93 TRP No._____

AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION

THIS AGREEMENT, entered into between the State of California, Department of Fish and Game, hereinafter called the Department, and City of Capitola of Capitola, State of California, hereinafter called the operator, is as follows:

WHEREAS, pursuant to Division 2, Chapter 6 of California Fish and Game Code, the operator, on the 28 day of April, 1993, notified the Department that he intends to substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed of the following water: Soquel Creek, in the County of Santa Cruz, State of California, S__-__ T__-__ R__-__.

WHEREAS, the Department (represented by Dennis Baldwin has made an inspection of subject area on the 28 day of April 28, 1993, and) has determined that such operations may substantially adversely affect existing fish and wildlife resources including: Salmon, steelhead, Tidewater gobies, non-game fish, riparian strip birdlife and animal life.

THEREFORE, the Department hereby proposes measures to protect fish and wildlife during the operator's work. The operator hereby agrees to accept the following recommendations as part of his work: Numbers 7, 10, 20, 21, 22 (649-2870) from the list of recommendations on the back of this page and the following special recommendations:

*THIS IS A THREE (3) YEAR AGREEMENT, VALID FOR THE TIME PERIODS: May 10, 1993 - October 15, 1993
May 10, 1994 - October 15, 1994
May 10, 1995 - October 15, 1995

1. All work in or near the stream or lake shall be confined to the period
2. This agreement does not take effect until the appropriate yearly fees have been received in the Regional Office and yearly approval has been received from the warden for the area of your project. It is the operator's responsibility to contact DFG at (707) 944-5520 for the fees for each year.
3. This project shall be limited to damming of Soquel Creek at the mouth, subject to the below conditions:
4. A new, straight line breech may be made. The existing channel shall be seined, with all fish being placed in the Lagoon, prior to a plug of sand being placed at the head of the outflow channel. Prior to the filling of any holes along the edge of the Lagoon, these areas shall be seined and netted off to prevent fish from re-entering the area.
5. Operator shall put the flume in operation during all construction and during all daily closures during construction.
6. All seaweed shall be removed from the channel bottom before damming occurs.
7. The steel shroud put in place in 1992, shall be placed on the flume. A minimum of 8-12 inches of water shall be maintained through the flume. The flume shall be kept open to the ocean until at least July 1 of each year. After final damming, no draw down will be allowed without prior DFG approval. Operator shall contact DFG prior to breeching unless flooding is imminent.

The operator, as designated by the signature on this agreement, shall be responsible for the execution of all elements of this agreement. A copy of this agreement must be provided to contractors and subcontractors and must be in their possession at the work site.

If the operator's work changes from that stated in the notification specified above, this agreement is no longer valid and a new notification shall be submitted to the Department of Fish and Game. Failure to comply with the provisions of this agreement and with other pertinent Code Sections, including but not limited to Fish and Game Code Sections 5650, 5652 and 5948, may result in prosecution.

Nothing in this agreement authorizes the operator to trespass on any land or property, nor does it relieve the operator of responsibility for compliance with applicable federal, state, or local laws or ordinances.

THIS AGREEMENT IS NOT INTENDED AS AN APPROVAL OF A PROJECT OR OF SPECIFIC PROJECT FEATURES BY THE DEPARTMENT OF FISH AND GAME. INDEPENDENT REVIEW AND RECOMMENDATIONS WILL BE PROVIDED BY THE DEPARTMENT AS APPROPRIATE ON THOSE PROJECTS WHERE LOCAL, STATE, OR FEDERAL PERMITS OR OTHER ENVIRONMENTAL REPORTS ARE REQUIRED.

This agreement becomes effective on when signed by both parties.

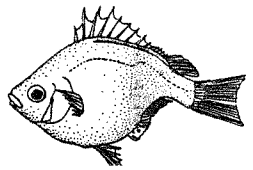
Operator Ed Morrison
Title Maint Supt.
Organization City of Capitola
Date May 3, 1993

Department Representative Dennis Baldwin
Title Patrol Lieutenant
Department of Fish and Game, State of California
Date May 3, 1993

APPENDIX C.

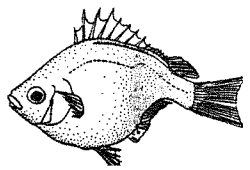
SANTA CRUZ COUNTY WATER MONITORING DATA FOR FECAL COLIFORM BACTERIA.

STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
S23	SOQUEL C @ NOB HILL	11-Jul-94		17	4020	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	25-Jul-94		19	60	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	08-Aug-94		16	60	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	04-Oct-94			560	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	22-Nov-94	01:00 PM	10	660	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	28-Nov-94		9	300	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	30-Nov-94		9	600	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	05-Dec-94		11	2080	CLEAR H2O,RAIN 12/4,HOLD TIME EXCEEDED.
S23	SOQUEL C @ NOB HILL	08-Dec-94		9	20	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	19-Dec-94		9	230	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	05-Jan-95			1000	BROWN WATER, RAIN 1/5/95.
S23	SOQUEL C @ NOB HILL	12-Jan-95			300	BROWN WATER, RAIN 1/11.
S23	SOQUEL C @ NOB HILL	25-Jan-95		12	60	BROWN WATER, RAIN 1/24.
S23	SOQUEL C @ NOB HILL	01-Feb-95		14.5	20	BROWN WATER.
S12	NOBEL G @ TUNNEL @ BAY	21-Mar-94	11:50 AM	14	0	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	28-Mar-94	12:50 PM	17	420	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	06-Apr-94	01:30 PM	15	700	
S12	NOBEL G @ TUNNEL @ BAY	12-Apr-94		14	380	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	19-Apr-94		16	2860	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	25-Apr-94		14	12200	CLEAR WATER, RAIN 4/25.
S12	NOBEL G @ TUNNEL @ BAY	09-May-94		16	940	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	16-May-94			920	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	23-May-94		16	1080	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	31-May-94		16	3020	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	06-Jun-94		18	3380	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	13-Jun-94		16	680	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	20-Jun-94		16	2140	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	27-Jun-94			2020	
S12	NOBEL G @ TUNNEL @ BAY	06-Jul-94		15	980	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	25-Jul-94		18	120	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	08-Aug-94		15	420	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	15-Aug-94			20	
S12	NOBEL G @ TUNNEL @ BAY	05-Jan-95			1100	BROWN WATER, RAIN 1/5/95.
S11	STORM DRAIN @ BLUEGUM(McDONALD	22-Sep-94			3120	FLOWING, NOBEL G DRAINAGE.
S08	SOQUEL C @ NOBEL G	01-Jun-94		20	1020	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	14-Jun-94		22	12100	CLEAR WATER, LAB COUNT BY EXTRAPOLATION.
S08	SOQUEL C @ NOBEL G	29-Aug-94		21	80	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	07-Sep-94		19	240	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	14-Sep-94		21	200	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	19-Sep-94			120	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	22-Sep-94			140	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	03-Oct-94			240	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	04-Oct-94			860	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	13-Oct-94			80	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	17-Oct-94		17	100	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	19-Oct-94			160	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	31-Oct-94		17	140	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	02-Nov-94		15	240	GREYISH WATER.
S08	SOQUEL C @ NOBEL G	21-Nov-94		15	120	CLEAR WATER.
S08	SOQUEL C @ NOBEL G	08-Dec-94		9	40	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	14-Jun-94			860	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	22-Sep-94			80	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	03-Oct-94			60	CLEAR WATER.



STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
S07	SOQUEL C @ TRESTLE	04-Oct-94			4020	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	13-Oct-94			120	GREYISH WATER.
S07	SOQUEL C @ TRESTLE	17-Oct-94		17	140	GREYISH WATER.
S07	SOQUEL C @ TRESTLE	19-Oct-94			220	GREYISH WATER.
S07	SOQUEL C @ TRESTLE	31-Oct-94		16	400	GREYISH WATER, SEAGULLS.
S07	SOQUEL C @ TRESTLE	02-Nov-94		15	1080	GREYISH WATER.
S07	SOQUEL C @ TRESTLE	21-Nov-94		15	220	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	28-Nov-94		9	360	CLEAR WATER.
S07	SOQUEL C @ TRESTLE	19-Dec-94		10	170	CLEAR WATER.
S04	SOQUEL C ABOVE STOCKTON B EAST	04-Oct-94			940	CLEAR WATER.
S02	SOQUEL C @ RESTAURANTS	31-May-94		20	3100	CLEAR WATER.
S01	SOQUEL C @ VENETIAN APTS.	31-May-94		20	2480	CLEAR WATER.
S01	SOQUEL C @ VENETIAN APTS.	07-Sep-94		19	160	CLEAR WATER.
S01	SOQUEL C @ VENETIAN APTS.	19-Sep-94			2480	CLEAR WATER, SEAGULLS.
S01	SOQUEL C @ VENETIAN APTS.	03-Oct-94			400	14 SEAGULLS, CLEAR WATER.
S01	SOQUEL C @ VENETIAN APTS.	04-Oct-94			620	40 SEAGULLS, CLEAR WATER.
S01	SOQUEL C @ VENETIAN APTS.	19-Oct-94			840	GREYISH WATER, PIGEONS.
S01	SOQUEL C @ VENETIAN APTS.	02-Nov-94		15	7200	GREYISH WATER, SEAGULLS.
S01	SOQUEL C @ VENETIAN APTS.	08-Dec-94		9	300	CLEAR WATER, MANY SEAGULLS.
S004	STORM DRAIN @ TRESTLE	22-Sep-94			ERR	COULD NOT BE OPENED.
S003	STORM DRAIN @ FOG BANK	22-Sep-94			14000	CLOSED OFF, OPENED ON RAINY SEASON.
S002	STORM DRAIN @ COYOTE CAFE	22-Sep-94			8800	DRAINS TO BEACH, STANDING WATER.
S001	STORM DRAIN @ BATHROOMS	22-Sep-94			12360	DRAINS TO BEACH, STANDING WATER.
S00	SOQUEL C @ FLUME INLET	21-Mar-94	12:10 PM	15	60	CHILDREN, CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	28-Mar-94	01:20 PM	17	260	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	06-Apr-94	01:00 PM	19	510	CLEAR WATER, SEAGULLS, CHILDREN.
S00	SOQUEL C @ FLUME INLET	12-Apr-94		18	190	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	19-Apr-94		19	1200	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	25-Apr-94		15	16120	BROWNISH WATER, SEAGULLS, RAIN 4/25.
S00	SOQUEL C @ FLUME INLET	03-May-94		19	880	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	09-May-94		17	800	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	16-May-94		17	1620	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	23-May-94		18	920	CREEK CLOSED OFF, CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	31-May-94		20	3320	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	06-Jun-94		21	1160	CLEAR WATER, 20 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	13-Jun-94		21	420	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	14-Jun-94		22	1620	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	20-Jun-94			1760	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	27-Jun-94		23	1040	42 SEAGULLS, CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	29-Jun-94		20	380	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	06-Jul-94		20	520	CLEAR WATER, 7 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	11-Jul-94		21	4020	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	20-Jul-94		21	2010	CLEAR WATER, 30 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	25-Jul-94		21	840	CLEAR WATER, 20 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	08-Aug-94		21.5	1040	CLEAR WATER, 20 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	15-Aug-94			560	
S00	SOQUEL C @ FLUME INLET	22-Aug-94			360	
S00	SOQUEL C @ FLUME INLET	29-Aug-94		21	1420	CLEAR WATER, 20 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	07-Sep-94		17	1360	CLEAR WATER, 16 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	12-Sep-94		20	1620	CLEAR WATER, 30 SEAGULLS.
S00	SOQUEL C @ FLUME INLET	14-Sep-94		20	4620	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	19-Sep-94			680	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	22-Sep-94			9680	CLEAR WATER, 15 SEAGULLS.

STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
S00	SOQUEL C @ FLUME INLET	03-Oct-94			1040	CLEAR WATER, 14 SEGULLS.
S00	SOQUEL C @ FLUME INLET	04-Oct-94			540	40 SEAGULLS, CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	13-Oct-94			160	GREYISH WATER, MANY SEAGULLS.
S00	SOQUEL C @ FLUME INLET	17-Oct-94		16	0	CLEAR WATER, SEAGULLS; CONFLUENT GROWTH.
S00	SOQUEL C @ FLUME INLET	19-Oct-94			1280	PIGEONS, GREYISH WATER.
S00	SOQUEL C @ FLUME INLET	31-Oct-94		16	1300	GREYISH WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	02-Nov-94		15	4800	GREYISH WATER, SEAGULLS.
S00	SOQUEL C @ FLUME INLET	07-Nov-94		16	5820	BROWNISH WATER, LAGOON OPEN, RAIN 11/6.
S00	SOQUEL C @ FLUME INLET	21-Nov-94		14	4020	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	28-Nov-94		10	220	CLEAR WATER.
S00	SOQUEL C @ FLUME INLET	30-Nov-94		14	4020	CLEAR WATER, MANY SEAGULLS.
S00	SOQUEL C @ FLUME INLET	05-Dec-94		12	2300	CLEAR H20,SEAGULLS,HOLD TIME EXCEEDED.
S00	SOQUEL C @ FLUME INLET	08-Dec-94		9	60	CLEAR WATER, MANY SEAGULLS.
S00	SOQUEL C @ FLUME	19-Dec-94		11	5460	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME	21-Dec-94		11	7000	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME	03-Jan-95			5200	GREYWATER, RAIN 1/3.
S00	SOQUEL C @ FLUME	05-Jan-95			2300	RAIN 1/5/95.
S00	SOQUEL C @ FLUME	11-Jan-95		13	1200	BROWN WATER, RAIN.
S00	SOQUEL C @ FLUME	12-Jan-95			500	BROWN WATER, RAIN 1/11.
S00	SOQUEL C @ FLUME	23-Jan-95		12	1800	BROWN WATER, RAIN 1/22.
S00	SOQUEL C @ FLUME	25-Jan-95		12.5	420	BROWN WATER,RAIN 1/24.
S00	SOQUEL C @ FLUME	30-Jan-95			280	BROWN WATER.
S00	SOQUEL C @ FLUME	01-Feb-95			220	BROWN WATER, HIGH TIDE.
S00	SOQUEL C @ FLUME	06-Feb-95		13	160	GREYWATER.
S00	SOQUEL C @ FLUME	13-Feb-95		12	820	CLEAR WATER.
S00	SOQUEL C @ FLUME	15-Feb-95			2100	CLEAR WATER, SEAGULLS.
S00	SOQUEL C @ FLUME	21-Feb-95		14	1780	CLEAR WATER.
S00	SOQUEL C @ FLUME	27-Feb-95		15	60	CLEAR WATER, 25 SEAGULLS.
S0	SOQUEL C @ FLUME OUTLET	01-Jun-94		19	500	CLEAR WATER.
S0	SOQUEL C @ FLUME OUTLET	08-Jun-94			2280	CLEAR WATER.
S0	SOQUEL C @ FLUME OUTLET	14-Jun-94			1440	CLEAR WATER.



STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
S25	SOQUEL C ABOVE SOQUEL DR.	25-Apr-94		13	9700	BROWNISH WATER, RAIN 4/25.
S25	SOQUEL C ABOVE SOQUEL DR.	01-Jun-94		16.5	200	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	14-Jun-94		18	1520	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	20-Jun-94		17	1640	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	27-Jun-94		20	1220	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	29-Jun-94			8000	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	14-Sep-94		20	100	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	04-Oct-94			520	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	19-Oct-94			ERR	DRY.
S25	SOQUEL C ABOVE SOQUEL DR.	02-Nov-94		14	60	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	22-Nov-94	12:42 PM	10	40	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR.	08-Dec-94		7	120	CLEAR WATER.
S25	SOQUEL C ABOVE SOQUEL DR	25-Jan-95		12	100	BROWN WATER, RAIN 1/24.
S25	SOQUEL C ABOVE SOQUEL DR	01-Feb-95		14.5	120	BROWN WATER.
S24	SOQUEL C BELOW SOQUEL DR.	25-Apr-94		13	9760	BROWNISH WATER, RAIN 4/25.
S24	SOQUEL C BELOW SOQUEL DR.	01-Jun-94		16.5	720	PIGEONS UNDER BRIDGE, CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR.	14-Jun-94		18	900	PIGEONS UNDER BRIDGE, CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR.	29-Jun-94			6540	CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR.	14-Sep-94		20	140	CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR.	04-Oct-94			580	CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR.	19-Oct-94			ERR	DRY.
S24	SOQUEL C BELOW SOQUEL DR.	02-Nov-94		14	0	CLEAR WATER, LAB ERROR.
S24	SOQUEL C BELOW SOQUEL DR.	08-Dec-94		7	40	CLEAR WATER.
S24	SOQUEL C BELOW SOQUEL DR	25-Jan-95		12	60	BROWN WATER, RAIN 1/24.
S235	SOQUEL C 300' UP SCHOOL BRIDGE	29-Jun-94			3060	CLEAR WATER.
S234	SOQUEL C 200' UP SCHOOL BRIDGE	29-Jun-94			3600	CLEAR WATER.
S233	SOQUEL C 100' UP SCHOOL BRIDGE	29-Jun-94			2920	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	31-May-94		18	7140	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	01-Jun-94		16.5	1720	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	07-Jun-94		19	2840	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	14-Jun-94		18	7200	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	20-Jun-94		17	1820	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	27-Jun-94		20	660	CLEAR WATER.
S232	SOQUEL C @ SOQUEL EL. SCHOOL	29-Jun-94			3220	CLEAR WATER.
S2301	STORM DRAIN @ NOB HILL	22-Sep-94			ERR	DRY.
S23	SOQUEL C @ NOB HILL	21-Mar-94	12:00 PM	13	70	2 DUCKS, CLEAR WATER.
S23	SOQUEL C @ NOB HILL	28-Mar-94	01:00 PM	15	400	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	06-Apr-94	01:15 PM	15	740	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	12-Apr-94		15	640	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	19-Apr-94		16	780	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	25-Apr-94		13	21960	BROWNISH WATER, RAIN 4/25.
S23	SOQUEL C @ NOB HILL	09-May-94		16	1300	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	16-May-94			1740	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	23-May-94		16	1120	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	31-May-94		17	3420	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	01-Jun-94		17	1760	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	06-Jun-94		18	4080	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	13-Jun-94		17	1600	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	14-Jun-94		18	14000	CLEAR WATER, LAB COUNT BY EXTRAPOLATION.
S23	SOQUEL C @ NOB HILL	20-Jun-94		17	1240	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	27-Jun-94			2480	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	29-Jun-94		18	780	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	06-Jul-94		16	1520	CLEAR WATER.

APPENDIX D.

DRAIN LINE TEST FOR RESTAURANTS CONTIGUOUS WITH SOQUEL CREEK LAGOON, 1994.

CITY OF CAPITOLA

Office of the
Building Official

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TO: Susan Westman, City Manager

FROM: Daniel J. Kostelec, Building Official DJK

DATE: May 16, 1994

SUBJECT: Drain Line Tests

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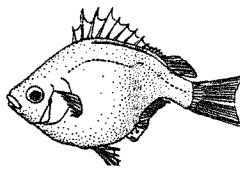
The restaurants contiguous with the Soquel Creek lagoon that have accessible plumbing systems have been tested for leaks and repaired as necessary. See attached inspection record.



DRAIN LINE TEST FOR RESTAURANTS
CONTIGUOUS WITH SOQUEL CREEK LAGOON 1994

RESTAURANT	INITIAL CONTACT	TEST DATE	COMMENTS	SIGN OFF
Beach House 207 Esplanade Linda Simpson 475-5846	LEFT MSG VOICE MAIL 4/15/94	5/6/94 5/7/94	JIMMIE SMITH PLUMBING 475-5700	5/12/93 MC
Ocean View 209 Esplanade Perry Choy 475-0205		4/29/94	PORTFENDER PLUMBING 1-761-0644	4/29/94 DJK
Pizza My Heart 209(A) Esplanade Keith Holtaway 425-0882		4/29/94		4/29/94 DJK
Fog Bank 211 Esplanade Jim Williams 462-1881		4/29/94		4/29/94 DJK
Larry's 215 Esplanade Chip Venezzio 475-6215		4/29/94		4/29/94 DJK

APPENDIX E.

WATER QUALITY DATA AND GENERAL OBSERVATIONS OF BIRDS AND AQUATIC VEGETATION 24 MAY - 7 NOVEMBER, 1994.

Water Quality Data and General Observations of Birds and Aquatic Vegetation 3 June - 27 November, 1993

24 May 1994. The shroud was in place on the flume entrance and functioning well. No health warning signs were up on the beach yet. There was evidence of two pigeon nests on the railroad trestle. We had not seen nesting there in years past. No filamentous algae had begun growing yet. However, the water was murky with a planktonic algae bloom. There were no pigeons at the Stockton Avenue clearing in front of Mrs. Hubback's house now that she was gone. The flume inlet could not be seen related to boards in place due to the shroud. The gage height was 2.01, however, which was rated "fair." The flume exit had a depth of 1.5 feet with 5.5-6 cfs entering the lagoon. Smolt passage was excellent. The submerged hole in the boards was present for adult steelhead, according to Jim Turcotte. It was midday and the fog was just burning off.

Station: Flume at 1300 hr, fog burning off. Gage Height= 2.01

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	17.0	0.00	7.5	700
0.25	17.0	0.00	7.5	700
0.50	17.0	0.00	7.5	700
0.75	17.0	0.00	7.5	700
1.00	17.0	0.00	7.5	700
1.25(bot)	17.0	0.00	6.5	700

Station: Stockton Avenue Bridge, NE bridge thalweg, 1340 hr. Secchi depth to bottom.

surf	19.2	0.00	8.65	700
0.25	19.0	0.00	8.7	700
0.50	18.5	0.00	8.65	700
0.75	18.4	0.00	8.61	700
1.00	18.2	0.00	8.71	700
1.25	17.6	0.00	8.65	700
1.50(bot)	17.5	0.00	5.9	700

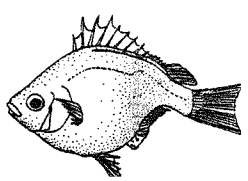
Station: Mouth of Noble Gulch, 1410 hr. Secchi depth to bottom.

surf	19.2	0.00	7.9	700
0.25	19.0	0.00	8.2	700
0.50	18.5	0.00	8.1	700
0.75	18.0	0.00	8.4	700
1.00(bot)	16.4	0.00	8.35	680

Birds in Reach 1: 4 geese. 28 gulls bathing. 4 pigeons on restaurant deck.

Birds in Reach 2: 7 pigeons on trestle.

Birds in Reach 3: 2 wild mallards. 2 domestic mallard mixes.



Conclusion: In 5 days after final sandbar closure and installation of the shroud, the lagoon was flushed of salt water except at the deeper holes at the Stockton Avenue Bridge. Water quality was excellent for aquatic organisms. Conductivity was typical of a freshwater lagoon. Water quality was good with cool enough water temperature (< 19 C) and oxygen levels were near full saturation. It was unusual for surface water temperature near the flume to be 2 degrees C lower than elsewhere. Oxygen levels were lowest at the flume and highest at Stockton Avenue.

1 June 1994. Soupy phytoplankton bloom. Secchi depth to bottom barely (1.6 meters). Shroud still in place. 6"x 6" notch on east side of flume inlet for smolts. Men were cleaning sidewalks with water. Surface algae at 1% level in Reaches 2 and 3. Water flowing into capped drain on Esplanade side. Water being pumped across the street to another capped drain. Saw 6 steelhead surface hits/min in reach 2 along with a sculpin swimming strangely near the surface. One turtle sunning itself on the trestle abutment, west side. They were demolishing the old Porter Street bridge. Stream flowing through one of two culverts. At Highway 1 there were no culverts and water was clear. Estimated flow at E. Walnut park of 4-5 cfs. Estimated flow at Nob Hill of 5-5.5 cfs.

Station: Flume at 0640 hr, Clear. Gage Height= 1.95

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond.
surf.	18.5	0.0	8.45	700
0.25	18.7	0.0	8.35	700
0.50	18.7	0.0	8.50	700
0.75	18.7	0.0	8.40	700
1.00	18.7	0.0	8.20	700
1.10(bot)	18.7	0.0	8.25	720

Station: Stockton Avenue Bridge, NE bridge thalweg, 0710 hr. Secchi depth to bottom.

surf	18.6	0.00	7.55	710
0.25	18.5	0.00	7.62	710
0.50	18.5	0.00	7.62	710
0.75	18.5	0.00	7.65	710
1.00	18.5	0.00	7.65	710
1.25	18.5	0.00	7.65	710
1.50(bot)	18.5	0.00	2.10	710

Station: Railroad trestle, 0755 hr.

surf.	18.2	0.0	7.65	700
0.25	18.0	0.0	7.60	700
0.50	18.0	0.0	7.60	700
0.75	18.0	0.0	7.60	700
1.00(bot)	18.0	0.0	4.90	700

Station: Mouth of Noble Gulch, 0826 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond.
surf	17.3	0.00	7.4	695
0.25	17.0	0.00	7.35	695
0.50	17.0	0.00	7.23	695
0.75	16.7	0.00	6.9	680
1.00(bot)	16.4	0.00	4.5	650

Birds in Reach 1: 4 geese. 1 wild mallard, 2 mallard mixes, 1 popcorn duck. Geese were feeding on natural food as was domestic mallard.

Birds in Reach 2: 11 pigeons on trestle. 8 swallows.

Birds in Reach 3: 11 wild mallards, with 2 mated pairs. 1 domestic mallard mix.

Birds on the Beach: 247 gulls.

Conclusion: Water quality conditions were fair to good for steelhead in all reaches except for oxygen below 5 ppm at the bottom at the bridge, trestle and Noble Gulch. This indicated higher rates of respiration near the bottom.

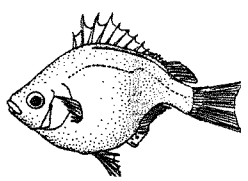
12 June 1994. It was a cool morning with air temperature at 13.8 degrees C and overcast. At an inflow to the lagoon down to 3.5-4 cfs, depth at the flume exit was 0.5 feet at low tide. The steelhead were feeding heavily with 150 hits/min in Reach 1 at 0700hr. Porter Street bridge construction looked good. It looked like someone had driven in the creek under Highway 1 for recreation. Large boulders lined the creek to prevent further disturbance. Plastic shield was broken on the no bird feeding sign at the trestle. Reach 3 had 13 steelhead hits/min.

Station: Flume at 0655 hr, Clear. Gage Height= 1.95 and no change from 12 days ago.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond.
surf.	20.5	0.1	8.40	780
0.25	20.5	0.1	8.50	780
0.50	20.5	0.1	8.35	780
0.75	20.6	0.1	8.45	780
1.00	20.6	0.1	8.40	780
1.25(bot)	20.6	0.1	8.35	770

Station: Stockton Avenue Bridge, NE bridge thalweg, 0730 hr.

surf	20.0	0.1	8.34	750
0.25	20.0	0.1	8.30	760
0.50	20.2	0.1	8.20	760
0.75	20.2	0.1	8.10	760
1.00	20.2	0.1	7.90	760
1.25	20.3	0.1	7.40	760
1.50(bot)	20.4	0.1	5.50	770



Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond.
Station: Railroad trestle, 0755 hr.				
surf.	19.8	0.0	7.80	770
0.25	20.0	0.0	7.70	770
0.50	20.0	0.0	7.60	770
0.75	20.0	0.0	7.50	770
1.00(bot)	20.0	0.0	5.55	770
Station: Mouth of Noble Gulch, 0810 hr.				
surf	19.0	0.00	8.8	730
0.25	18.8	0.00	8.85	730
0.50	19.0	0.00	8.8	730
0.75	18.0	0.00	7.1	710
1.00(bot)	18.0	0.00	6.2	700

Birds in Reach 1: 3 geese. 11 gulls bathing. 9 swallows. 9 wild mallards, 5 of which were older juveniles and 2 of which were younger juveniles. 2 popcorn ducks (George and Harry).

Birds in Reach 2: 12 pigeons on trestle. 8 swallows.

Birds in Reach 3: Geese and ducks had moved upstream from Reach 1. 3 black-crowned night herons.

Birds on the Beach: 335 gulls. 5 Brandt's geese pointed out by Ed Morrison right down by the surf. 2 crows. 16 pigeons. 1 black cat.

Conclusions: Oxygen levels were similar or better than previous monitoring. Water temperature was up 2 degrees C with a fair rating in Reaches 1 and 2 and good in Reach 3. The conductivity was increased from before. Gulls on the beach had increased. Pigeons that used to wait around at Mrs. Hubback's appear to be foraging on the beach instead.

16 June 1994. Arrived at 1010hr. pondweed and algae beginning to grow at Hubback's dock in Reach 3. It was 1 foot tall. The no bird feeding sign was gone from under the trestle to prevent further vandalism. One turtle seen on trestle abutment. A renter along the lagoon claimed that he saw 5 turtles there the previous day.

At 1420hr there were 145 gulls on the restaurant roof (Larry's Surf and Turf). 30 gulls bathing in Reach 1. Shrouds were removed and the gage height was an excellent 2.23. All the boards were in place on the west with one board out on east. 1.25 inches deep over boards. Floating algae at the flume (1% of Reach 1). Algal spires beginning at Stockton Avenue bridge, Reach 2. Reach 2 with algal forest in deepest center of creek with algae 6" to 2 feet and 35% of bottom. Surface algae 1% of surface in Reach 2. In Reach 3 the algae forest was on west side and 30% of bottom. A little shorter (0.5-2 feet) than Reach 2. Surface algae less than 1%. 8 mallards seen in Reach 3. The

algae getting an early start this year, however, with more ooze on the bottom at sandbar closure than the previous year.

28 June 1994. With 1.75 - 2 cfs entering at Nob Hill, the flume entrance was more than 1 foot and the exit was 0.4 feet deep with adequate steelhead smolt passage. All boards were in place at the flume entrance as I had requested, with no notch. Water depth over the lip of top board was 1.5 inches. Gage height was an excellent 2.22. There was considerable fish cover under overhanging willows on west side of the lagoon with it full like this. Air temperature of 13.7 degrees C. No fog the previous two days. Steelhead feeding heavily with 400 hits/min in Reach 1 at 0720hr, 220 hits/min in Reach 2 at 0730hr and just 3 hits/min in Reach 3 by 0808hr. Mergansers and pied-billed grebes attracted to Reaches 1 and 2 by steelhead feeding. Turned foggy by 0800hr. Was getting supersaturated oxygen levels, which were unexpectedly high. Changed membrane on oxygen probe, which did not change readings. Could not see bottom in Reach 1, but Reaches 1 and 2 completely covered with filamentous algae mostly with pondweed coming on.

Station: Flume, 0630 hr. Weather overcast. Gage height = 2.22.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.7	0.00	12.60	760
0.25	21.0	0.00	11.56	760
0.50	21.0	0.00	11.63	760
0.75	21.0	0.00	12.40	760
1.00(bot)	21.0	0.00	9.80	760

Station: Stockton Avenue Bridge, 0730hr. Cannot see bottom.

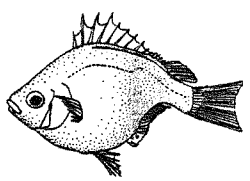
Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.6	0.00	12.0	770
0.25	21.0	0.00	12.0	770
0.50	21.0	0.00	12.0	770
0.75	21.0	0.00	12.0	770
1.00	21.0	0.00	11.8	770
1.25	21.0	0.00	11.2	770
1.35(bot)	21.0	0.00	5.92	770

Station: Railroad trestle, 0750 hr.

surf.	20.5	0.00	11.0	750
0.25	21.0	0.00	11.2	750
0.50	21.0	0.00	11.2	750
0.75	21.0	0.00	11.2	750
1.00(bot)	21.0	0.00	8.25	750

Station: Mouth of Noble Gulch, 0810 hr.

surf.	19.8	0.00	10.3	770



0.25	20.0	0.00	10.2	770
0.50	20.0	0.00	10.3	780
0.75	20.0	0.00	10.1	790
1.00(bot)	19.0	1.00	3.3	2330

Birds on the Beach: 570 gulls. Many Heermann's gulls (gray with orange bill). 10 pigeons.

Birds in Reach 1: 3 domestic ducks. 1 mother and 2 young wild mallards. 3 other immature wild mallards. 16 gulls bathing. 1 mother merganser and 4 young trying to catch feeding steelhead. 2 pied-billed grebes also fishing. No geese this morning.

Birds in Reach 2: 10 pigeons on the trestle. 2 wild mallards.

Birds in Reach 3: 11 wild mallards.

Conclusions: Steelhead could feed actively in fairly warm water due to the high oxygen levels. Algal density was at a stage where it was producing much more oxygen during the day than it was using at night. There was quite an in-flux of gulls, particularly the Heermann's gull. They segregated out from the other gulls. Having the lagoon as deep as possible prevented overheating on those sunny days. There was also more cover for fish. Even so, water temperature was 1-2 degrees C warmer than the previous year at this time. There was evidence of pollution at Noble Gulch with the higher conductivity and poor oxygen concentration at the bottom.

7 July 1994. The gage height was still at 2.21, which was good with an estimated 1.5 cfs entering the lagoon at Nob Hill. Air temperature was a very warm 68 degrees F at 0700hr. It was foggy yesterday and today. No surface algae in Reach 1, 2% in Reaches 2 and 3. Noble Gulch had 5% surface algae. The pondweed was coming on strong, covering 2/3 of the lagoon with algae attached. The mother merganser was still present with her 4 young in Reach 1.

Birds in Reach 1: 1 mother merganser with 4 young. 14 mallards roosting on sand near Venetian Court. Some were immature.

Birds in Reach 2: 2 popcorn ducks on Trestle pilings.

Birds in Reach 3: 1 green-back heron near trestle. 1 kingfisher. Mergansers moved up into Reach 3. 5 swallows.

13 July 1994. Streamflow at Nob Hill down to an estimated 1.25 cfs. Flume quite passable to smolt steelhead with inlet depth of 1.6 feet and outlet depth of 0.5 feet. There was sand deposition inside the flume, however. 1 inch over top board at flume inlet. Steelhead hitting the surface at 0615hr. Ducks seem hungry. Pondweed and algae well below surface. Jim Turcotte mentioned mats being washed off at Japanese Restaurant up Noble Gulch. I

asked Turcotte to add a board at the flume. The Gage height was 2.17, which was at the upper end of the fair rating. The weather had been overcast and foggy for the past 2 weeks

Station: Flume, 0615 hr. Weather overcast. Gage height = 2.17.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	16.5	0.00	9.2	780
0.25	17.0	0.00	9.15	780
0.50	17.5	0.00	9.2	780
0.75	17.7	0.00	9.1	780
1.00(bot)	18.5	0.00	6.15	770

Station: Stockton Avenue Bridge, thalweg north side, 0645 hr.

surf.	19.5	0.00	8.25	780
0.25	19.8	0.00	8.23	770
0.50	19.8	0.00	8.27	770
0.75	19.8	0.00	8.24	770
1.00	19.8	0.00	8.04	770
1.25	19.8	0.00	7.95	770
1.45	19.8	0.00	4.60	770

Station: Railroad trestle, 0703 hr.

surf.	19.0	0.00	7.50	770
0.25	19.0	0.00	7.35	770
0.50	19.2	0.00	7.30	770
0.75	19.2	0.00	7.38	770
1.00(bot)	19.3	0.00	4.55	750

Station: Mouth of Noble Gulch, 0715 hr.

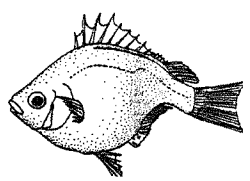
surf.	18.0	0.00	8.5	770
0.25	18.0	0.00	8.5	770
0.50	18.0	0.00	8.35	770
0.75	18.0	0.00	8.20	770
1.00	17.7	0.08	7.84	1800
1.05(bot)	18.1	1.00	1.16	2350

Birds on the Beach: 275 gulls on beach. Approximately half were Heermann's gulls. 10 pigeons.

Birds in Reach 1: At 0615hr: 21 gulls bathing. 4 geese. 4 wild mallards. 3 popcorn ducks. At 0710hr: 15 mallards, 3 popcorn ducks and 5 mergansers. 10 pelicans flew by at surf line.

Birds in Reach 2: 6 wild male mallards. 1 domestic mallard. 5 mergansers (mother with 4 large young). 1 green-back heron. 8 pigeons on trestle.

Birds in Reach 3: 7 wild mallards. 4 geese moving upstream.



Conclusion: Water temperature good, but very good near the flume. Cannot explain the cooler water at flume. Evidence of oxygen depletion at all stations. But not excessive except at Noble Gulch where there was still evidence of pollution and very poor oxygen levels near the bottom. The algae and pondweed have really died back due to the foggy weather and presumed heavy foraging by ducks. Oxygen levels were good except at bottom where it was fair to poor.

30 July 1994. Streamflow has dropped to an estimated 0.5-0.7 cfs at Nob Hill, and the flume has become difficult to pass steelhead. Estimated streamflow at Walnut Street Park was 0.2 cfs. However, this is a month past the July 1 date that the flume had to be passable until. Flume inlet depth of 1.2 feet and exit 0.3 feet but kelp choked. Inside of flume may have considerable sand. It has been very foggy throughout July except for 3-4 days in the morning. Water temperature was fair but in the upper part of that category. More sun would have cooked the lagoon. Pondweed appeared to die back with more algae present than before. There was a heavy algal bloom at Noble Gulch with 20% of the surface covered with floating algae. Steelhead were feeding in Reaches 1 and 2 at 0640hr at 140 hits/min. Mergansers were still feeding in Reach 3 at 0850hr.

Under the Highway 1 bridge there was a 24" diameter plastic culvert in a gravel dam. But the culvert was not functioning. Fish passage was blocked to the lagoon. I notified Dennis Baldwin of Fish and Game of the problem. He stated that he would request that a visquine barrier be placed over the gravel dam to prevent water passage and cause more water to go through culvert. I spoke to Ed Morrison about sealing up the cracks in the inlet flume boards to prevent leakage.

Station: Flume, 0640 hr, overcast. Gage height 2.00.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	21.0	0.00	9.83	820
0.25	21.0	0.00	9.75	820
0.50	21.0	0.00	9.85	820
0.75	21.0	0.00	9.55	820
0.95(bot)	21.0	0.00	6.70	820

Station: Stockton Avenue Bridge, north side thalweg. 0710hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.8	0.00	9.40	850
0.25	20.9	0.00	9.50	850
0.50	21.0	0.00	9.55	850
0.75	21.0	0.00	9.15	850
1.00	21.0	0.00	8.90	850
1.25	21.0	0.00	8.75	850
1.50(bot)	21.0	0.00	5.40	850

Station: Railroad trestle, 0730 hr.

surf.	20.5	0.00	9.20	850
0.25	20.7	0.00	9.10	850
0.50	20.8	0.00	9.10	850
0.75	20.8	0.00	8.30	850
0.90(bot)	20.8	0.00	5.90	840

Station: Mouth of Noble Gulch, 0743 hr

surf.	19.8	0.00	8.85	880
0.25	20.2	0.00	8.85	900
0.50	20.2	0.00	8.95	890
0.75	19.6	0.00	8.74	790
1.00(bot)	19.0	0.00	1.90	1450

Birds on the Beach: 300 gulls. 28 pigeons.

Birds in Reach 1: 3 mallards. 4 young mergansers without mother.

Birds in Reach 2: 1 mallard. 1 green-back heron. 1 pied-billed grebe. 5 pigeons on trestle.

Birds in Reach 3: 12 wild mallards. 1 feeding cormorant. 4 feeding mergansers at 0750hr. 4 geese up beyond Shadowbrook Restaurant. By 0820hr they at Venetian Court in Reach 1.

Conclusions: The lagoon was slightly warmer than this time the previous year. Fortunately the gage height was being maintained despite the reduced flow this year. The lagoon was about 1/4 foot shallower in 1994 compared to 1993, which was significant to the temperature regime in the lagoon. The oxygen levels were good and better than 2 weeks previously near the bottom. However, Noble Gulch at the bottom was still a problem spot for oxygen. It was unusual to see a cormorant in the lagoon in mid-summer.

12 August 1994. The gage height had dropped 0.2 foot to 1.79 with only an estimated 0.25 cfs entering the lagoon. Stream channel was dry at E. Walnut Street Park with a few isolated pools. Mr. Hayford stated that the stream had gone intermittent approximately 1 week before that. I had asked Ed Morrison a week earlier to put plastic sheeting over inlet boards to the flume to stop leaks between boards in order to maintain lagoon depth. This was done, but water was still leaking through. I asked Jim Turcotte to re-install the plastic to stop the leak. We were loosing lagoon depth. The visquine was placed over gravel dam under Highway 1 and was causing some water to pass through the culvert. Fish passage was questionable. However, by this time the stream was dry above Porter Street, and it was a mute point. Steelhead were feeding at 120 hits/min in Reach 1 at 0750hr at at 60 hits/min in Reach 2 at 0755hr. Surface algae was at its

highest point with coverages of 30% of surface in Reach 1, 20% of surface in Reach 2, 10% in Reach 3, 65% of surface at Noble Gulch and 15-20% adjacent Shadowbrook Restaurant in upper Reach 3 in early morning. By 1800hr no surface algae was seen in Reach 1 with 10% surface algae in Reach 2 and 25-30% of the surface covered in Reach 3. Apparently, the surface algae had been blown upstream. The entire bottom in Reaches 2 and 3 was covered with algae and pondweed. Reach 1 still had a sandy margin at the beach end. The lagoon gage height was 1.80 at the end of the day.

Station: Flume, 0720hr. Air temp. 17 C. Gage height 1.79.

Depth(m)	**Temp.(C) 0720hr/1746hr**	**Salin.(ppt)**	**Oxygen(ppm) 0720hr/1746hr**	**Cond. (umhos)**
surf.	21.0/23.5	0.00	10.6/13.9	920
0.25	21.0/23.5	0.00	10.5/14.2	920
0.50	21.0/23.5	0.00	10.5/14.2	920
0.75	20.8/24.8	0.00	2.55/11.2	920

Reach 1: 30% of the surface with floating algae. 85% of the bottom with algae and pondweed, 1-3 feet thick. 15% along margin bare sand.

Station: Stockton Avenue Bridge, 0735 hr/ 1757 hr

Depth(m)	**Temp.(C) 0735hr/1757hr**	**Salin.(ppt)**	**Oxygen(ppm) 0735hr/1757hr**	**Cond. (umhos)**
surf.	21.2/24.0	0.00	10.9/17.9	920
0.25	21.2/24.0	0.00	10.9/17.4	920
0.50	21.2/23.7	0.00	10.8/17.1	920
0.75	21.2/23.5	0.00	10.8/17.2	920
1.00	21.2/23.5	0.00	10.7/16.8	920
1.25	21.2/23.0	0.00	10.6/15.4	920
1.35	21.2/23.0 (bot)	0.00	6.7/10.9	920

Reach 2: 20% surface algae. 100% of bottom with algae + pondweed 1-3 ft.

Station: Railroad trestle, 0750 hr.

surf.	21.2	0.00	9.8	940
0.25	21.2	0.00	9.9	940
0.50	21.2	0.00	10.05	930
0.75	21.2	0.00	9.85	930
0.82(bot)	21.2	0.00	7.05	930

Station: Mouth of Noble Gulch, 0820 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	20.3	0.00	11.7	1050
0.25	20.3	0.00	12.1	1060
0.50	20.2	0.00	12.2	1040

0.75	19.5	0.00	9.7	1010
0.80(bot)	19.5	0.00	6.2	950

Reach 3: 10% of surface covered with algae downstream of Noble Gulch with 100% of bottom 1-2.5 ft thick. Above Noble Gulch with 10% surface coverage, bottom with algae 0.5 to 1.2 feet thick. At Noble Gulch had 65% surface algae and 100% of bottom 1-3 ft thick.

Birds on the Beach: 195 gulls. 31 pigeons.

Birds in Reach 1: At 0720hr 16 wild mallards, 4 geese and 3 popcorn ducks on beach at Venetian Courts, 3 wild mallards in water. At 0900hr at Venetian had 29 wild mallards, 3 popcorn ducks, 1 gray mallard, 4 geese.

Birds in Reach 2: 2 pied-billed grebes. 6 pigeons on trestle.

Birds in Reach 3: 6 wild mallards. 1 gray mallard, 1 green-back heron, 1 kingfisher.

Conclusion: This was the warmest morning water temperature thus far. The day was sunny. Water temperature increased between 2.5 and 3 degrees C. Though considerable oxygen depletion was evident at the bottom near the flume at dawn, conditions were better at Noble Gulch. By the end of the day, oxygen levels were supersaturated. Algae on the surface was at an all-summer high. Warm water temperatures and sunny skies were probably the reason. The number of wild mallards was at a season high as well. A green-back heron had definitely taken up residency at the lagoon for the first summer that we had observed.

24 August 1994. Overcast but not foggy. Flume entrance of 19 inches but outlet clogged with sand and a trickle coming out. Gage height 1.72. Air temperature of 15.8 C. People feeding gulls/geese and ducks at Venetian Court at 0800hr. Approximately 0.25-3 cfs. Leaves beginning to turn yellow on cottonwoods across from Noble Gulch. Occasional steelhead hit in Reach 2 at 0800hr.

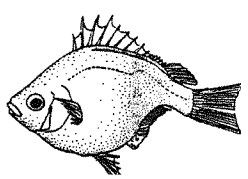
Station: Flume, 0700 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	21.3	0.02	9.36	1050
0.25	21.2	0.02	9.12	1070
0.50	21.3	0.02	9.05	1060
0.68(bot)	21.2	0.02	7.05	1040

In Reach 1, no algae near at surface. 80% of bottom with algae 0.5-1 foot thick. one large 10-foot diameter clump of pondweed with algae.

Station: Stockton Avenue Bridge, 0725 hr.

surf.	21.2	0.02	8.90	1070



0.25	21.2	0.02	8.83	1070
0.50	21.2	0.02	8.80	1070
0.75	21.2	0.02	8.50	1070
1.00	21.2	0.02	7.90	1070
1.20	21.2	0.02	4.85	1060

Station: Railroad Trestle, 0750 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf	21.0	0.02	6.30	1100
0.25	21.0	0.02	6.24	1100
0.50	21.0	0.02	6.25	1100
0.75	21.0	0.02	6.20	1100
0.80(bot)	21.0	0.02	4.12	1100

Reach 2: 2% surface algae, 15% algae and pondweed 1.5-2.5 feet thick, 30% algae 0.5 feet high, remainder thin film 1 inch thick.

Station: Mouth of Noble Gulch, 0810 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	20.5	0.01	9.10	1040
0.25	20.4	0.01	8.90	1050
0.50	20.0	0.01	9.00	1050
0.75	19.7	0.01	8.80	1080
0.80(bot)	19.8	0.01	1.30	1070

Reach 3: 5% surface algae, 10% pondweed and algae 2-3 feet high, 30% algae 0.5 feet high. Remainder a thin film 1 inch thick algae.

Noble Gulch: Algae 100% of bottom 0.5 ft thick and half very bright green. Half was brown. 5% surface algae at the Gulch, 10% upstream. No pondweed.

Birds on the Beach: 248 gulls (about 50 Heermann's gulls). 11 pigeons.

Birds in Reach 1: 4 bathing gulls early. 4 geese and 1 wild mallard at Venetian early. By 0900hr there were 15 wild mallards at Venetian court on sand.

Birds in Reach 2: 3 pied-billed grebes, 1 mother mallard with 3 sub-adult.

Birds in Reach 3: 3 pied-billed grebes (may have been from Reach 2), 1 green-back heron, 1 kingfisher. 2 popcorn ducks far up the reach.

Conclusion: The algal and pondweed blooms of two weeks ago have crashed. Lagoon depth still decreasing with lagoon depth 0.4 feet lower than previous year with a more filled in lagoon. Oxygen still good, but interestingly lower at the trestle than

elsewhere. Still considerable oxygen depletion at bottom near mouth of Noble Gulch. Water temperatures about the same as the previous year at this time. Water conductivity steadily increasing through the summer and higher than previous summer. Where have the mergansers gone. Bird-feeding at Venetian Court attracted ducks very significantly from all over the lagoon.

14 September 1994. Overcast and then foggy. Gage height of 1.96 with slight flume leakage. 3 days after the Begonia Festival. Air temperature of 12 C - cooling off in the morning. Only 0.1 cfs flowing in at Nob Hill. Oil slick on surface in 3-6 inch spots covering 2% of surface. In Reach 3 had a central lane 50 feet wide with 50% bare sand. Evidence of procession of Begonia Festival. Algae and pondweed more common on either side of lane. 15% of Reach 3 with algae and pondweed 0.5-2.5 feet high. A few flower petals along east margin under overhanging willows in Reach 2 and 3, 150 feet on either side of the trestle. Steelhead hitting surface at 10-20 hits/min in Reach 1 at 0640hr.

Station: Flume, 0640 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.5	0.01	9.8	1200
0.25	19.5	0.01	9.8	1200
0.50	19.5	0.01	9.8	1200
0.75	19.5	0.01	9.25	1200
0.85(bot)	19.5	0.01	6.60	1200

In Reach 1 1% surface algae. Too dark to see bottom.

Station: Stockton Avenue Bridge, 0703 hr.

surf.	19.5	0.03	8.93	1220
0.25	19.8	0.02	9.02	1220
0.50	20.0	0.02	8.82	1220
0.75	20.0	0.02	8.80	1220
1.00	20.0	0.02	8.60	1220
1.25	20.0	0.02	8.38	1220
1.35	20.0	0.02	4.70	1200

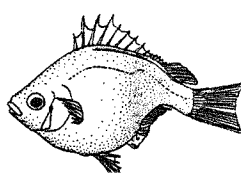
In Reach 2 2% surface algae, 70% of bottom with algae only .2-.3 feet thick, 15% with algae and pondweed 2-2.5 feet high.

Station: Railroad trestle, 0729 hr.

surf.	19.6	0.02	6.25	1220
0.25	19.7	0.02	6.10	1220
0.50	19.8	0.02	5.95	1220
0.75	19.8	0.02	5.80	1220
.95(bot)	19.5	0.01	3.15	1190

Reach 3 refer to initial description above.

Station: Mouth of Noble Gulch, 0742 hr.



surf.	18.9	0.02	4.75	1220
0.25	18.8	0.02	4.75	1220
0.50	18.8	0.02	4.75	1220
0.75	18.4	0.02	4.75	1220
1.00(bot)	18.5	0.02	1.20	1190

At Noble Gulch with no surface algae and 80% of bottom with algae 0.2-0.3 feet thick.

Birds on the Beach: 304 gulls and 13 pigeons.

Birds in Reach 1: One great blue heron near flume. 26 gulls bathing. 4 geese, 3 popcorn ducks 2 wild mallards, the one gray mallard.

Birds in Reach 2: 1 kingfisher, 2 pied-billed grebes, 4 of the original family of 7 wild mallards.

Birds in Reach 3: 3 pied-billed grebes and 1 kingfisher.

Conclusions: The lagoon depth finally came up after sealing the inlet boards. Oxygen definitely lower due to the Begonia Festival but not a problem except at the bottom at mouth of Noble Gulch. It has been low there for some time. Oxygen ratings at dawn were fair, though about half the concentration at mouth Noble Gulch as before the Festival. Other sites were similar to previous monitoring time in late August. Water temperatures similar to last year at this time. It was unusual to see a great blue heron at the lagoon, though not the first time. Still no mergansers but more pied-billed grebes than before. Lagoon beginning to cool off from the summer. It was good that they left the boards in place on the flume for the Festival rather than lower the lagoon level. With the very low inflow to the lagoon, it would have taken a long time to raise the lagoon after putting the boards back.

30 September 1994. Weather clear and cool. Gage height 1.32. 1 board out on west with second notched. Screen over opening. Only 0.05 cfs entering the lagoon. Mr. Hayford first noticed the coots on 29 September. Pondweed was turning brown. Caltrans contractors placing riprap under Porter Street Bridge. No fish passage there. Raw fill under Highway 1 bridge. No passage there either.
Station: Flume, 0700 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.0	0.00	10.2	1210
0.25	19.0	0.00	10.2	1210
0.50	19.0	0.00	10.1	1210
0.65(bot)	18.9	0.00	7.6	1210

In Reach 1, no algae near at surface. 65% of bottom with algae

to 1 foot thick. 15% algae and pondweed to near surface.

Station: Stockton Avenue Bridge, 0720 hr.

surf.	19.6	0.02	8.05	1240
0.25	19.6	0.02	7.95	1240
0.50	19.5	0.02	7.80	1240
0.75	19.3	0.02	7.65	1230
0.85	19.2	0.02	5.10	1220

Station: Railroad Trestle, 0740 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf	19.0	0.02	5.59	1230
0.25	19.0	0.02	5.60	1230
0.50	19.0	0.02	5.79	1230
0.70(bot)	18.8	0.02	3.95	1230

Reach 2: 0% surface algae, 20% algae and pondweed 1.5-2.0 feet thick, 60% algae 0.5 feet high.

Station: Mouth of Noble Gulch, 0755 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	18.2	0.02	7.40	1220
0.25	18.2	0.02	7.45	1230
0.50	18.2	0.02	7.30	1240
0.75(bot)	18.3	0.02	1.70	1280

Reach 3: 5% surface algae, 20% pondweed and algae 2 feet high, 10% algae tufts. Remainder of bottom mostly brown.

Noble Gulch: 70% of bottom with algae tufts to 8 inches. No surface algae.

Birds on the Beach: 179 gulls.

Birds in Reach 1: 8 bathing gulls. 4 geese near the restaurant. 10 mallards, 5 coots, 1 pied-billed grebe.

Birds in Reach 2: 2 pied-billed grebes, 8 coots. 8 pigeons on trestle.

Birds in Reach 3: 1 pied-billed grebe, 3 domestic ducks feeding, 10 wild mallard in upper Reach 3.

Conclusion: With pondweed dying out and decomposing and algae not very thick, morning oxygen levels were lower than previously in the summer. Even so, oxygen levels were good in Reaches 1 and 3 and fair in Reach 2. More oxygen depletion near the bottom to make it poor at the bottom at Noble Gulch mouth. The coots returned to Capitola. San Juan Capistrano has its swallows; Capitola has its coots. I asked Morrison to put the boards back

in to raise the lagoon. He had been anticipating a storm that did not materialize. The banks under Highway 1 were ill-prepared for an early storm.

10 October 1994. It had rained on 4 October (Tuesday), and there was a fish kill reported on 8 October (Saturday). I was notified that day by Ed Morrison. However, I could not monitor the lagoon in early morning until Monday. Steelhead and staghorn sculpin had died. At 0730hr on 8 October, Chris Crum of the City collected and removed approximately 15 steelhead and 2 staghorn sculpins from the lagoon. That afternoon, Tom Mader counted approximately 28 more steelhead and 1 staghorn sculpin dead. On 10 October, I counted 38 dead juvenile steelhead, one dead adult steelhead, and 9 staghorn sculpin. On 10 October the gage height was 1.88 and the water was turbid from the previous storm and pollutants washed into the lagoon. The bottom was not visible. According to Ed Morrison, during the 4 October storm, one board was out on each side of the flume inlet. During the storm the lagoon level increased to approximately 6 inches above the flume's top surface. Another board was removed after the storm to drain the scum off the surface. Then it was replaced. This was the first fish kill that Mr. Morrison had seen since he started working there, many years ago.

Station: Flume, 0800 hr. Data taken 20 feet from flume and shore.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	17.6	0.00	3.65	580
0.25	17.6	0.00	3.50	580
0.50	17.6	0.00	3.32	580
0.75	17.6	0.00	3.35	580
1.00	17.6	0.00	3.05	580
1.10	17.5	0.00	2.00	580

Station: Stockton Avenue Bridge, 0855 hr.

surf.	18.0	-	2.95	-
0.25	18.0	-	2.96	-
0.50	18.0	-	2.96	-
0.75	18.0	-	2.90	-
1.00	18.0	-	2.80	-
1.25	18.0	-	0.85	-

Station: Railroad Trestle, 0913 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf	18.3	0.00	2.50	620
0.25	18.5	0.00	2.45	620
0.50	18.5	0.00	2.35	620
0.75	18.5	0.00	2.30	620
0.90(bot)	18.5	0.00	1.80	620

Station: Mouth of Noble Gulch, 0926 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	18.2	0.00	3.48	640
0.25	18.2	0.00	3.30	630
0.50	18.0	0.00	3.10	630
0.75	18.0	0.00	3.05	630
0.90(bot)	18.0	0.00	0.50	650

Birds in Reach 1: 25 bathing gulls. 5 mallards. 37 pigeons in a flock on the beach in late morning.

Birds in Reach 2: 1 kingfisher on trestle. 2 coots. 9 pigeons on the trestle.

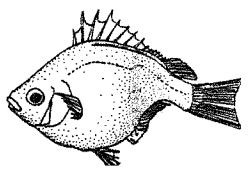
Birds in Reach 3: 2 pied-billed grebes, 1 green-back heron, 2 popcorn ducks, 24 coots.

Conclusion: The low oxygen levels a week after the rain indicated that oxygen depletion was the cause of the fish kill. We suspected that turbidity of the lagoon killed off the algae because light could not penetrate. No photosynthesis could occur to produce oxygen. Apparently, decomposable organic compounds, leaves, etc. were washed into the lagoon during the first storm of the season. This was a particularly large first storm, compared to previous years. The flume took the flow and the sandbar remained intact as planned. It appeared that after about 4 days of bacterial decomposition, the conditions had become anoxic in certain areas of the lower Reach 1, which killed fish that did not leave the area. We do not believe mortality was caused by a chemical pollutant that poisoned the fish because only a few fish died. Our recommendation to Ed Morrison was to lower the lagoon level 6 to 8 inches so that light could penetrate to the bottom to stimulate algae production. Photosynthesis would then produce oxygen to improve oxygen levels and relieve fish stress. This was done. No more fish were observed dead after the Monday monitoring.

14 October 1994. Lagoon oxygen levels were measured to see if they were high enough to allow steelhead sampling without stressing the fish.

Station: Stockton Avenue Bridge, 0815 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf	-	-	6.5	-
0.25	-	-	6.45	-
0.50	-	-	6.40	-
0.75	-	-	6.40	-
1.00	-	-	6.35	-
1.10	-	-	4.60	-



Conclusion: Lowering the lagoon level allowed photosynthesis to occur on the bottom. This lead to more elevated oxygen levels which were more than adequate for the steelhead. Sampling could take place.

23 October 1994. Gage height = 1.66. Weather mostly clear with thin clouds to south.

Station: Flume, 0800 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf	15.0	-	9.7	-
0.25	15.0	-	9.75	-
0.50	15.0	-	9.68	-
0.75	15.0	-	9.58	-
1.00	15.0	-	6.50	-

Conclusion: Oxygen levels were back to pre-storm levels that had occurred prior to 4 October.

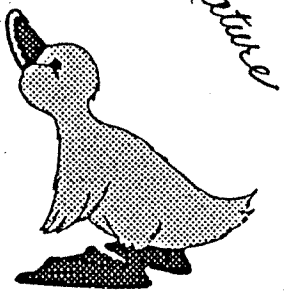
5-6 November 1994. The sandbar breached Saturday night or Sunday morning on these dates. I was notified on Monday, 7 November by Ed Morrison. He felt that someone had artificially facilitated the breach. When the lagoon is sufficiently full, very little effort with a shovel can initiate the breach. Unfortunately, there had not been a pre-cut notch in the sandbar to initiate the breach. This was only the second storm of the season. Two boards had been removed on either side of the inlet prior to the storm. This opening was not large enough to allow the flume to take the flow.

7 November 1994. The stream channel through the sandbar was along the east side of the flume and 10-11 feet wide near the surf at 1700hr. It appeared that the lagoon elevation had reached 1-2 feet above the piling bolt before breaching.

APPENDIX F.

EXPLANATION FOR NOT FEEDING THE BIRDS.

Please Respect Nature



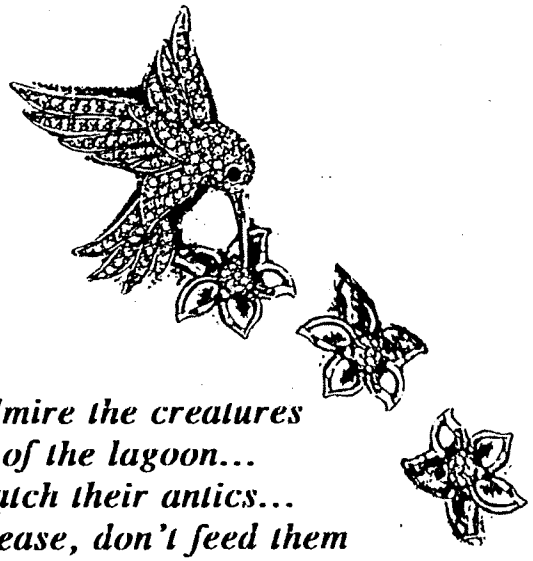
A plea

to all of you

who appreciate

the Capitola Lagoon...

Please do not feed the ducks and birds



Admire the creatures of the lagoon... watch their antics... but please, don't feed them "people" food!

There are very good reasons for the City of Capitola's ordinance prohibiting bird feeding:

Giving wild ducks food meant for humans is detrimental to their health. (The brown and white mottled ducks and the brown ones with green heads are both wild mallards.) Domestic ducks, wild ducks, geese, pigeons and gulls learn to rely on these handouts as a primary food source. Most of the snacks offered - such as bread and chips - are of poor nutritional value to the birds, particularly compared to food found naturally in the lagoon.

If they aren't given "people" food, waterfowl will feast on nourishing natural edibles in the lagoon, along the beach and in the ocean. Natural grazing by ducks and geese on the lagoon's plant life, with its associated insects and crustaceans, is also important for the lagoon's health and ecology. If allowed to forage naturally, ducks and geese will literally regulate the amounts of algae in the lagoon, preventing unsightly floating algae mats and retaining the oxygen in the water - oxygen that the thousands of steelhead trout living in the lagoon depend upon for their survival.

Bird feces deposited or washed into the lagoon cause high coliform bacteria counts, thereby creating a health hazard. Bird-feeding contributes greatly to the bacterial problem by attracting unnaturally high numbers of ducks, gulls and pigeons to the lower lagoon.

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We truly appreciate your cooperation in not feeding the birds. The lagoon and its wildlife will be healthier without our handouts.


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