2004 SOQUEL CREEK LAGOON MANAGEMENT AND ENHANCEMENT PLAN UPDATE

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HISTORICAL BACKGROUND—DEVELOPMENT OF THE 1990 MANAGEMENT AND ENHANCEMENT PLAN

The Soquel Creek Lagoon has been a defining feature for the small coastal city of Capitola since the turn of the century and has been associated with a rich tradition of recreation, pageantry, and community participation. The community has long appreciated the aesthetic and recreational benefits of the lagoon and has included it in the traditional Begonia Festival. The businesses along the Esplanade in Capitola Village depend on the aesthetic and recreational attraction of the nearby lagoon and beach. The Capitola Public Works Department has traditionally constructed a sandbar across the mouth of Soquel Lagoon before Memorial Day weekend, in preparation for summer beach use and the Begonia Festival at summer's end.

The City's concrete box culvert, known as the "flume," has been central to lagoon management for at least 50 years. This key structure has allowed the City to construct the sandbar and create a lagoon each year. The present flume was constructed in the 1950's to drain water from the lagoon to the Monterey Bay after the sandbar was in place.

In 1988 the City of Capitola was faced with a challenge to manage the mouth of Soquel Creek in a different way. The California Department of Fish and Game (CDFG) requested that the City develop a lagoon management plan that would protect the lagoon's wildlife and fisheries habitat. This would be the first plan of its kind and could potentially be a model for other coastal cities facing similar habitat management challenges.

The City desired a plan to reduce fecal coliform bacteria in the summer lagoon to a level that would allow swimming. The community wanted a plan that would allow the traditional Begonia Festival to continue. The lagoon-side restaurants and nearby businesses needed a plan that would ensure an attractive lagoon. The pedal boat concessionaire needed continued access to the lagoon for boat launching and storage. A primary management goal of the Plan was to protect habitat for steelhead salmon, tidewater goby, and native waterbirds.

Former lagoon management practices were no longer appropriate. Alternatives were needed that would remain friendly to business concerns and recreational needs while protecting the environment and the aesthetic beauty of the lagoon. Bluestone (copper sulfate) was no longer a management option for preventing algal blooms that used to fill the lagoon with mats of floating, filamentous algae. Nor could heavy equipment be used in the inundated channel to contour the lagoon bottom, construct the sandbar, or clear out seagrass and kelp in the inundated area of the lagoon.

Prior to the existing 1990 Soquel Creek Management Plan, much of the kelp and seagrass that had washed into the lagoon prior to sandbar closure had been buried under sand in the lagoon bottom. The pedal boat operator had been allowed to adjust the lagoon level at the flume inlet as needed. As a result, decomposition of the buried plant matter increased bacterial and nutrient levels in the lagoon and the lagoon level fluctuated almost daily, commonly several inches below the maximum level possible.

There was concern that the plumbing under restaurants that overhung the lagoon may have been leaking wash water and sewage into the lagoon. Substantial algal blooms with sizable algal mats floating on the lagoon surface commonly occurred without the use of bluestone. The County Environmental Health Department monitored the fecal coliform counts in the lagoon each week and found them regularly far beyond the legal limit for safe human contact with the lagoon's water.

Other human influences on the lagoon had included the daily washing of gull excrement into the lagoon from the glass panels on the roof of one restaurant (panels now removed). Sidewalks, patios, and decks along the Esplanade business loop had been washed off daily, resulting in the rinse water and some food refuse emptying into the lagoon.

In developing the 1990 Plan, a questionnaire was circulated among the businesses, residents, and visitors to Capitola to first inform them about the importance of the lagoon's plant life to fish and waterfowl, of the kinds of animals that depend on the lagoon, and of the sources of fecal bacteria (which prevents swimming). They were asked about whether algae and pondweed needed to be removed or reduced and what the best alternative would be for potential removal of aquatic plants. They were asked what were acceptable levels of management related to sandbar construction, sandbar breaching, and lagoon deepening. They chose among several educational and recreational opportunities to be provided by the lagoon. The responses helped to define worthwhile goals and acceptable methods of achieving them.

The management concerns of residents and regulatory agencies [California Department of Fish and Game (CDFG), California Coastal Commission, U.S. Fish and Wildlife Service (USFWS), U.S. Army Corps of Engineers] were explored. Public advisory meetings were held and attended by representatives from fishing, surfing, and environmental groups, the County Environmental Health Department, the County Environmental Planning Department, the local water district, the CDFG and the USFWS, the Monterey Bay Salmon and Trout Project, the Capitola Public Works Department, and the City's Planning Director. Seniors and creekside residents took an active role.

Ultimately, the 1990 Management Plan was to provide adequate environmental protection to enable issuance of future permits associated with sandbar construction and the Begonia Festival

from the U.S. Army Corps of Engineers, the California Coastal Commission, and the California Department of Fish and Game. The Management Plan was to be a dynamic, evolving document that could be modified; refined, and expanded after subsequent monitoring and as new solutions were needed for unforeseen problems.

The success of the 1990 Plan and its implementation was derived from the method of developing the Plan. The Plan was based on sound scientific information. Water quality was measured at stations throughout the lagoon in 1988 and 1989. A biological inventory was taken of lagoon-associated animals and vegetation. A vegetation map was prepared from the beach to Highway 1 along both sides of the creek.

Sizable populations of steelhead salmon (*Oncorhynchus mykiss*) and tidewater gobies (*Eucyclogobius newberryi*) were found in the lagoon during those drought years. For example, in fall 1988, lagoon sampling from the Stockton Avenue Bridge to the beach yielded 147 large juvenile steelhead and an adult, as well as at least 107 tidewater gobies and 4 other fish species. However, summer water temperatures sometimes approached the upper tolerance limit of juvenile steelhead. Exotic, invasive plants were common along the upper lagoon and in the creek's riparian corridor. Waterfowl were dominated by domestic, instead of native, ducks and geese (many of which were discarded pets) that relied heavily on food handouts from people visiting and working near the lagoon, as well as from well-meaning residents. Pigeons (rock doves) roosted on the railroad trestle and were also fed by residents and visitors. Hundreds of gulls roosted on the restaurants' rooftops each afternoon once the beachgoers arrived, foraging among garbage on the beach and relying on the lagoon for a source of freshwater bathing.

The 1990 Plan explained the habitat requirements of sensitive species and the physical processes that affect habitat conditions. The Plan provided specific guidance to optimize habitat quality, while considering community concerns. Educational and enhancement projects were developed subsequent to adoption of the Management Plan. Among these were educational units for use in local schools, a stream care guide for creekside residents, and lagoon-side interpretive signs explaining the biological value of the lagoon and its inhabitants. The Coastal Conservancy provided funding for Plan implementation, enhancement projects, and monitoring. The Friends of Soquel Creek was founded to protect the lagoon's environmental quality. This group continues to assist in annual fish censusing, hold meetings, and distributing a newsletter.

The original 1990 Management Plan prescribed how to construct the sandbar, when to make the flume passable for steelhead migration, and how to breach the sandbar in the fall in an emergency to prevent flooding. The Plan prescribed how to maximize survival of smolting steelhead as they passed through the lagoon. It provided guidelines to protect young steelhead using the summer lagoon as nursery habitat. The plan recommended ways to minimize the pollutants entering the

lagoon after early fall rains. There was a section on algae and pondweed control and reducing nutrient inputs, which called for the removal of domestic geese and ducks and the cessation of human feeding of birds. Rules were developed for clean-up after the Begonia Festival. Ways to reduce fecal coliform bacteria in the lagoon were itemized. Concerns about the sewer line capacities were voiced by the City to the County Sanitation District to minimize sewage spills. Strategies to reduce pet excrement along the lagoon path were developed. The over-population of domestic waterfowl was to be reduced. The City was to request that owners of Esplanade restaurants install devices on rooftops to discourage gull roosting and, thus, reduce gull fecal matter washed off roofs into the lagoon. The value of the riparian corridor and need for its protection were expressed.

Twelve years later, many of these original concerns have been addressed. A number of enhancement projects have been completed (**Appendix A; page 96**). Water temperature and oxygen levels have been maintained within the physiological tolerance of steelhead. This has been possible by maximizing lagoon depth and by reducing nutrient inputs sufficiently to prevent plant production to the point of nighttime oxygen depletion. Drain lines under restaurants contiguous with Soquel Lagoon are annually tested for leaks and repaired as necessary. Because nutrient inputs have been reduced, surface algal mats no longer develop as frequently and to such an extent. If floating algae is deemed excessive in summer, it is manually skimmed off the lagoon surface. The flume inlet has been modified with a hole cut in its ceiling to maximize lagoon depth and improve outflow during early fall storms. The lagoon habitat has improved greatly for native waterfowl, as evidenced by their increased numbers.

Now, kelp and seagrass are raked out of the lagoon by hand crews prior to summer sandbar closure. Fish are rescued from the lateral channel that passes through the beach before the sandbar is closed and the beach is prepared. Shrouds are installed on the flume inlet to pull saltwater off the lagoon bottom and out to the Bay. A cooler freshwater lagoon is created for a thriving steelhead nursery area. The City has succeeded each year in satisfying the requirements of a U.S. Army Corps Permit, a Coastal Commission Permit, and a California Department of Fish and Game Streambed Alteration Agreement to construct the sandbar. The Friends of Soquel Creek continue to advocate for quality management of the lagoon and watershed.

Despite the successes of the original Plan, each year has brought new challenges, requiring additional management recommendations. Constructed sandbars have been washed away by late storms. In late December of 1991, the sandbar breached prematurely; it closed again because of a lack of rain and the local community experienced the aftermath of rotting kelp. Critically warm water temperatures and heavy algal blooms in the upper lagoon occurred in 1992 due to low stream inflow, many sunny days without morning fog, and shallow conditions resulting from poor lagoon level management at the flume inlet. The algal build-up clogged the flume in 1992,

resulting in premature sandbar breaching. There was a fish kill after early fall storms brought pollutants and high turbidity to the lagoon in 1994. Vandalism to the flume nearly drained the lagoon in 1995, and vandalism has continued. In 1996, initial efforts to construct the sandbar were negated by a storm on May 16. The work had to be re-done in late May, after Memorial Day weekend. There was a sewage spill when a pressurized sewage main broke in Capitola Village in 1996, requiring rapid partial draining of the lagoon to dilute the pollutants. There were two sizeable tidal over-washes into the lagoon in 2001, creating especially warm water temperatures that year.

NEED FOR A MANAGEMENT PLAN UPDATE

Many new management techniques have been learned during the execution of the original plan and now need to be added to the Plan and implemented to assure future success. Moreover, increased familiarity with the lagoon has brought to light previously unrecognized areas of concern that need attention. Some prior recommendations still need to be addressed. Coho salmon have been lost from the watershed, and there is a desire to restore this species. There is now an awareness of watershed issues that affect the lagoon. The intent of the Plan Update is to focus attention on the value of the lagoon and its surrounding riparian corridor with renewed efforts to better manage activities that impact the lagoon and to provide avenues for improving lagoon and watershed health.

Additionally, the Rispin Mansion parcel provides a unique opportunity for ecologically sensitive development. This Plan Update is intended to provide guidance for any future development adjacent to the creek and lagoon. The City has shouldered responsibility for protecting habitat conditions in the lagoon and lower Soquel Creek. However, habitat quality is affected by activities throughout the watershed. The City can now mandate active engagement with these other participants. Streambank erosion in the Nob Hill area is degrading the local environment. Pollutants continue to enter the lagoon from Noble Gulch and street runoff. The flume at the beach remains vulnerable to tampering and vandalism. The flashiness of runoff from early fall storms makes it increasingly difficult to prevent premature breaching of the sandbar.

Future management goals encompass better operation of the flume for improved management of the lagoon depth during summer and quicker response in opening the flume for early stormflows to protect the sandbar from premature breaching. Other areas of concern include a failure to reduce fecal coliform counts sufficiently to allow human contact in the lagoon. The lagoon and the beach have been routinely closed due to high fecal coliform counts in the past, motivating the City to reduce pollution wherever possible. The lagoon is located in the center of Capitola Village next to the beach. It is subject to urban pollutants from early fall storm runoff, restaurants, and

fecal contributions from shorebirds and pigeons. Reduced pollution remains a management goal.

The lagoon is at the downstream end of the watershed and is subject to forces throughout the watershed that influence the rates of stream inflow and sediment input, as well as water temperature of incoming streamflow. Increased development in the upper watershed's remaining open space may significantly increase winter runoff and flooding in Capitola. The likelihood of woody material reaching the Stockton Avenue Bridge has greatly increased because the two upstream bridges in Soquel Village have been enlarged with new free-span designs that will pass more wood. Water demand will increase with human population. For Capitola residents to protect habitat values and the present character of the lagoon, as well as to protect their creekside property from flooding, mechanisms must be created to encourage and facilitate Capitola residents to actively engage entities that shape the watershed. Those entities include the Santa Cruz County Planning Department and Board of Supervisors, the Zone 5 Flood Control District, the California Department of Forestry, land developers, logging interests, and the Soquel Creek Water District.

The community desire to restore coho salmon to the watershed and protect steelhead habitat will require Capitola residents to address watershed issues. Soquel Creek baseflow is frequently compromised in summer, particularly during years of drought. As water usage increases, an effective communication process is needed to inform water users of when streamflow is critically low and extreme water conservation is required to prevent de-watering of the stream and loss of lagoon habitat. The central reach of the watershed most likely to support coho salmon is currently too warm. Restoration of large shade trees to the riparian corridor from the Olive Springs Quarry downstream to the Moores Gulch confluence on mainstem Soquel Creek will be required to lower water temperatures.

Soquel Creek is a valuable natural resource supporting a diversity of natural habitats and a great variety of aquatic and terrestrial species. The Management Plan Update provides recommendations to protect wildlife and fishery habitat in the face of potential threats. Although the lagoon margin is largely developed on the east side, there is still opportunity for further development on the west side on the City-owned Rispin Mansion parcel. The present condition of the Rispin Mansion's roof and drainage system lead to concentrated and erratic overland stormflow onto the steep slope below. The limited riparian corridor immediately upstream of the lagoon may be threatened by proposed development between Nob Hill and Highway 1. Highway 1 will soon be widened to further encroach on the little remaining riparian corridor in Capitola. Streambank erosion on the west side, with the flood terrace falling away, is rapidly reducing the cottonwood forest. The degree of riparian shading and spawning conditions upstream of the lagoon will impact lagoon water quality and steelhead fry produced to seed the lagoon.

An educational program is essential for an informed public wishing to protect the lagoon. The program must explain watershed mechanisms, ecological relations between species, and the habitat values at the lagoon and within the watershed. The health of Soquel Lagoon would benefit from a program within the City government to seek out funding opportunities for environmental education and projects to improve and protect habitat conditions.

REMAINING MANAGEMENT CHALLENGES IN THE LAGOON

- Fecal coliform counts need to be reduced sufficiently to prevent beach closings by reducing inputs of fecal coliform bacteria to the lagoon. (However, there is no guarantee that preventative measures would reduce the lagoon's coliform counts enough to satisfy the safety standards for human contact in the lagoon. The bottom of the lagoon serves as a sink for bacteria; wading could stir up the bacteria resting in the bottom and raise the coliform bacterial counts despite any reduction in fecal inputs.)

- The flume inlet remains vulnerable to vandalism, which leads to draining of the lagoon and subsequent steelhead mortality. A method is needed to secure the flume inlet against vandalism while allowing convenient adjustment of the inlet opening.

- The lagoon and sandbar remain vulnerable to premature breaching by small, early stormflows. It is necessary to maintain an intact sandbar and lagoon until regular winter storms ensure streamflow sufficient to maintain an open sandbar for the winter and provide a transition zone between freshwater and saltwater for juvenile steelhead leaving the lagoon. Early rains are washed quickly into the lagoon by surface runoff from impermeable rooftops and parking lots.

- Recreational wading in the shallow margins of the lagoon may prove harmful to the habitat of the federally protected tidewater goby.

- Significant quantities of gray water and oily slicks consistently empty into the lagoon from Noble Gulch (**Alley 1995; 1996**). Elevated algal growth and oxygen depletion are consistent at the mouth of Noble Gulch. This indicates elevated nutrient inputs and probably associated bacterial contamination.

- Pigeons roosting on the railroad trestle still contribute unknown amounts of fecal bacteria to the lagoon. Poor water quality has been detected under the trestle.

- Riparian habitat continues to disappear along the creek without adequate protection from development and encroachment of non-native vegetation.

- During the first fall rains, pollutants from surface runoff are washed rapidly into the lagoon from street surfaces through storm drains. This pollution results in the death of plant life due to turbidity, increased biological oxygen demand, and oxygen depletion. Existing and future commercial businesses are potential sources of point and non-point pollution during the dry season when cleaning water enters storm drains and in winter with storm drain run-off.

- A minimum baseflow in Soquel Creek is necessary to provide adequate passage for fish and to maintain low water temperatures; this baseflow may be compromised in summer, particularly during years of drought.

- Gulls, finding ample garbage on the beach, roost on Esplanade roofs, from where they continue to contribute fecal contamination and nutrients to the lagoon.

- The Stockton Avenue Bridge presents a high potential for creating jams of woody material during heavy stormflows. The bridges at Soquel Avenue and Porter Street have been reconstructed as free-spans to increase freeboard, increasing the likelihood that large wood will reach Stockton Avenue. Reconstructing the bridge to a free-span design to increase its freeboard and eliminate piers that collect wood could alleviate potential jamming and associated flooding. Other retrofitting options shall also be explored short of replacing the bridge to alleviate the danger. Past flood control measures have included cutting large woody material into small pieces, which reduces its inherent value of providing shelter for fish and wildlife.

- Sedimentation, erosion, and lack of rain percolation will increase with further development up the valley, creating an increased flood hazard for the City of Capitola and increased filling of the lagoon with silt to degrade fish habitat. The lagoon is on the receiving end of the sediment generated upstream. Higher winter peak flows may eventually require additional flood control measures. Flood control levees were constructed along the lower San Lorenzo and Pajaro rivers. The riparian corridor, wetlands and aquatic habitat have become degraded as a result.

NATURAL RESOURCES IN SOQUEL CREEK, THE LAGOON AND THE RIPARIAN CORRIDOR

The summer lagoon provides a very productive nursery for juvenile steelhead, encompassing the lower 0.6 miles of the Creek. Although the lagoon is shallow (0.5–2.5 meters deep) and warm in summer, the abundance of food allows juvenile steelhead to grow rapidly in relatively high numbers compared to steelhead production in the next 6.5 miles upstream in the mainstem Creek. In most years, all of the juveniles grow to smolt size (large enough to out-migrate to the bay) during their first summer of life. The lagoon typically produces a significant 10–35% of the smolt-sized juveniles in the mainstem Creek each year (**Alley 2001**). Construction of the sandbar in early summer and proper operation of the flume allow the lagoon to rapidly convert to freshwater (**Photos 1-5; pages 14-16**). A freshwater environment free of a bottom layer of saltwater ensures conditions cool enough for steelhead rearing. The flume through the beach allows the lagoon water level to be maximized and facilitates saltwater movement out of the lagoon when its shrouds are in place (**Photos 6 and 7; page 17**). Manual removal of decomposing plant material (kelp and seagrass) from the estuary prior to sandbar closure reduces biological oxygen demand and nutrient input, minimizing the eutrophication in the summer lagoon (**Photos 8 and 9; page 18**) that would encourage larger algal blooms and greater oxygen depletion at night.

Photo 1. Sandbar Construction Typically Done Before Memorial Day Weekend

Photo 2. Public Works Personnel Prepare the Flume Inlet Prior to Sandbar Closure

Photo 3. Shallow Soquel Creek Estuary at Low-Tide, Prior to Sandbar Construction in May 2003, Reaches 2 and 3 Above Stockton Avenue

Photo 4. Shallow Soquel Creek Estuary at Low-Tide, Prior to Sandbar Construction in May 2003, Reach 1 below Stockton Avenue Bridge

Photo 5. Newly Installed Opening on the Ceiling of the Flume Inlet in 2003

Photo 6. Shrouds on Flume Inlet, Prior to Begonia Festival, September 2001

Photo 7. Flume Exit to the Monterey Bay in August 2001

Photo 8. Reaches 1 and 2 of Soquel Lagoon Downstream of the Trestle, with Stockton Avenue Bridge Separating the Reaches

Photo 9. Reach 3 of Soquel Lagoon, Looking Upstream from the Trestle with Fish Cover Barges On the Left in Summer 2001

Fish and Wildlife Associated with the Lagoon

Extensive lists of wildlife species are in the original Management and Enhancement Plan. In this Plan Update only the more common aquatic and water-related species are noted.

The primary fish species of interest in the summer lagoon is the anadromous (uses both the sea and the stream in different life stages) steelhead salmon (**Photo 10; page 20**) (Federally listed as Threatened). The lagoon provides valuable nursery habitat for juvenile steelhead that are spawned mostly in the lower reaches of Soquel Creek. Juveniles grow rapidly in this productive lagoon environment and have maintained a fairly stable summer density of between 400 and 1,000 smolt-sized fish (**Figure 3**; page 160). In 1999, an estimated 928 smolt-sized steelhead were reared in Soquel Creek Lagoon. Our monitoring of Soquel Creek upstream of the lagoon in 1999 (**Alley 2000**) indicated that the lagoon production of smolt-sized steelhead was equivalent to that from more than 4.5 miles of stream habitat upstream. Lagoon production represented nearly 1/3 of the smolt-sized steelhead production in the lower 7.2 miles of mainstem Soquel Creek. In 1993, when the lagoon steelhead population reached 2,800, it likely represented 10% of the smolt-sized steelhead production in the Soquel Creek watershed. The lagoon provides valuable habitat when properly managed.

The steelhead density in the summer lagoon is very dependent on the amount of seeding from spawning near the lagoon. There is likely more spawning activity in the lower creek in winters with fewer storms than wetter winters when more adults spawn higher in the watershed. Spawning habitat, steelhead nests (redds), and adult steelhead have been observed in spawning glides between Nob Hill and Highway 1.

The last capture of tidewater goby (Federally and State listed as Endangered) occurred in the fall of 1997 when one goby was captured prior to the torrential stormflows of the El Niño winter of 1997-98. The absence of over-wintering habitat makes this species vulnerable to being washed out of Soquel Lagoon during high stormflow winters, such as the El Niño winter of 1997–1998. With the wooden bulkheads in place, backwater areas out of the winter current are extremely limited, making Soquel Lagoon a difficult location for a sustaining tidewater goby population. However, this species may re-colonize from a nearby lagoon in the future, such as Corchoran Lagoon to the west or Aptos Lagoon from the east. Tidewater goby had become abundant in the lagoon during the drought of 1987-91 (more than 400 rescued in 1987), presumably due to the low winter stormflows that made it easier for gobies to remain in the estuary. Other common fish species using the summer lagoon include Sacramento suckers (*Catostomus occidentalis*), prickly sculpin (*Cottus asper*), staghorn sculpin (*Leptocottus armatus*), threespine stickleback (*Gasterosteus aculeatus*), and starry flounder (*Platichthys stellatus*). The last confirmed

capture of coho salmon (*Oncorhynchus kisutch*) was an adult in 1992. Adult steelhead pass through the estuary (sandbar open to the bay) during the winter spawning migration. Smolting juvenile steelhead out-migrate to the ocean through the estuary from March through June. Some may travel out through the flume in early summer after the sandbar is closed.

Photo 10. Coastal Steelhead Salmon

The Western pond turtle (*Clemmys marmorata*) is commonly observed at the lagoon, usually sunning itself on the trestle abutments or on any large downed trees in the lagoon. The red-eared slider (*Chrysemys scripta*) has also been observed.

Although the foothill yellow-legged frog (*Rana boylei*) (**Photo 11; page 21**) is common in the lower valley reaches of the creek from Bargetto's winery upstream, it is uncommon at the lagoon. The California red-legged frog (*Rana aurora draytonii*) (**Photo 12; page 21**) has been sited in the Soquel Demonstration State Forest in recent years, but would be an unusual visitor to the current lagoon. Pacific treefrogs (*Hyla regilla*) are common.

Photo 11. Well-Camouflaged Foothill Yellow Legged Frog in Soquel Creek, August 2002

Photo 12. California Red-legged Frog in Santa Rosa Creek, San Luis Obispo County

A host of common native waterfowl and other birds commonly utilize the summer and fall lagoon. Common piscivorous (fish-eating) birds include common merganser (*Mergus merganser*) during the breeding season (**Photo 13; page 22**), red-breasted merganser (*Mergus serrator*) after the breeding season, pied-billed grebe (*Podiceps auritus*), green-backed heron (*Butorides striatus*), black-crowned night heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*), egrets [both great (*Casmerodius albus*) and snowy (*Egretta thula*)], belted kingfisher (*Ceryle alcoyon*), and cormorants (*Phalacrocorax spp.*). The Western grebe (*Aechmophorus occidentalis*) has occasionally been observed. Mallards (*Anas platyrhynchos*), black phoebes (*Sayornis nigricans*), rock doves ("pigeons") (*Columba livia*), and swallows (*Tachycineta spp.*) are common throughout the summer. American coots (*Fulica Americana*) appear in the fall. Various gulls bathe, for the most part, in the lower lagoon, including the California (*Larus californicus*), Heermann's (*Larus heermanni*), and Western gulls (*Larus occidentalis*). The brown pelican (*Pelecanus occidentalis*) has utilized the lagoon on occasion.

Photo 13. Common Mergansers on Feeding Patrol in Soquel Lagoon in Summer 2002

<u>Plant Life in the Riparian Corridor and Identifying Riparian Areas</u>

Soquel Creek and adjacent vegetation are valuable natural resources, supporting a diversity of natural habitats and a great variety of aquatic and terrestrial species. The riparian corridor along Soquel Creek also provides a valuable visual and aesthetic resource. It provides open space and

recreational resources and makes up a portion of the City's urban forest. The vegetation along the creek offers many benefits to City residents, including opportunities for nature study, landscape painting, and nature photography.

The City of Capitola Local Coastal Plan (LCP) (**1981**) mentions Soquel Creek's extensive riparian corridor as invaluable wildlife habitat that requires protection and enhancement. It states that the woodland along the west bank of Soquel Creek in Capitola's coastal zone is one of the three best examples of riparian corridors in Santa Cruz County. However, the LCP does not define riparian vegetation. The term "riparian" is commonly used to define vegetation that lives along waterways in a streamside corridor, but the extent of the corridor may be defined differently in regulatory contexts compared to ecological contexts (**Photo 14;** page 24). There is a lack of consistency in the defining and delineation of riparian areas in the botanical literature, in general. At the California Riparian Systems Conference held in Davis, California in 1988, there was note taken of a definition of riparian vegetation based on soil conditions and the need to define riparian vegetation in ecological and functional terms to protect aquatic environments. According to Gregory and others (**1988**) at the conference, "from an aquatic perspective, riparian zones are defined functionally as three-dimensional zones of direct interaction with aquatic ecosystems, extending outward from the channel *to the limits of flooding* and upward into the canopy of streamside vegetation. Examples of critical functions of riparian vegetation for stream ecosystems include shading, bank stabilization, uptake of nutrients, input of leaves and needles, retention of particulate organic matter during high flows, and contribution of large wood." According to Gregory and others (**1988**), "Most often management agencies adopt operational definitions of riparian zones that are based on hydric soils and unique terrestrial plant associations. If management agencies adopt perspectives of riparian zones that do not address critical ecosystem processes, the integrity of riparian resources cannot be insured." Hydric soil is wet long enough to periodically produce anaerobic conditions, thus influencing the growth of plants. Hydric soils are associated with wetlands.

Identification of wetland species along waterways has been important in delineating riparian areas by some scientists. The U.S. Fish and Wildlife Service has categorized plant species according to their use of wetland conditions (**Table 1**; page 24). Categories range from obligate wetland species that only exist in wetland settings to obligate upland species that seldom live near wetlands. There are facultative-wet wetland species that usually live near wetlands, but not always, and facultative upland species that usually live in uplands, but sometimes are found in wetland settings.

Photo 14. A Portion of Mainstem Soquel Creek with a Healthy Riparian Corridor

Table 1. Categories of Wetland Indicator Status for Vascular Plants.

Code for Wetland Indicator Status	Wetland Indicator Status	Occurrence in Wetlands	Estimated Probability of Occurrence in Wetland
OBL	Obligate Wetland	Almost always.	99%
FACW	Facultative-wet Wetland	Usually occurs in wetland, but occasionally found in non-wetlands.	67-99%
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands.	34-66%
FACU	Facultative Upland	Usually occurs in non-wetlands, but occasionally found in wetlands.	1-33%
UPL	Obligate Upland	Occurs in wetlands in another region, but occurs almost always under natural conditions in non-wetlands in the regions specified.	<1%
NA	No agreement	The regional panel was unable to reach a unanimous decision on this species.	
NI	No indicator	Insufficient information was available to determine indicator status.	
NO	No occurrence	This species does not occur in the region.	

Shining (formerly yellow) willow (*Salix lucida* subspecies *lasiandra*) has an obligate wetland

(OBL) status. The following local species have facultative-wet wetland status (FACW), among others: arroyo willow (*Salix lapsiolepsis*), black cottonwood (*Populus balsamifera* subspecies *trichocarpa*), California box elder (*Acer negundo*), California sycamore (*Plantus racemosa*), red alder (*Alnus rubra*) and white alder (*Alnus rhombifolia*). Big leaf maple has a facultative (FAC) status. California bay laurel (*Umbellularia californica*) has a facultative (FAC) status. No status was given for California buckeye (*Aesculus californica*), coast live oak (*Quercus agrifolia*), valley oak (*Quercus lobata*), coastal redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*) or madrone (*Arbutus menziesii*). The following Internet path provides wetland indicator status of species in various genera by selecting wetland indicator status: ~~http://plants.usda.gov/plants/wetinfo.html~~. The following Internet website, http://www.nwi.fws.gov/bha/, allows downloading of the National List of Vascular Plant Species that Occur in Wetlands: http://www.nwi.fws.gov/bha/download/1996/national.pdf.

As of late, definitions and delineations of riparian areas tend to follow two approaches. One approach, and the one used in this Plan Update, focuses on identifying the vegetation that influences the aquatic environment and labels it riparian.

This approach to mapping riparian vegetation focuses on delineating the vegetative "zone of influence" on the aquatic environment and is commonly used by some botanists, regulatory agencies and most fishery biologists. It is the identification of ecological and physical processes that are *directed inward* toward the stream or lagoon from the nearby vegetation that guides delineation of the riparian area (or corridor). By this approach, riparian vegetation may be defined as was done by Meehan and others (**1977**) as "any extra-aquatic vegetation that directly influences the stream environment by providing shade, large debris, or fine litter." In this broad definition, trees growing above the floodplain on terraces and hill slopes are considered riparian if they influence shading and/or may be a source of energy and large woody material to the stream. Along these lines, Ehlers and de Guzman (**2002**) used the following definition developed by the National Research Council:

> **"Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect water bodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines."**

Ehlers and de Guzman (**2002;** http://www.coloradoriparian.org/GreenLine/V13-2/riparian.html and http://www.nap.edu.) emphasized that this definition includes the concept that riparian areas

have gradients in environmental conditions and ecological functions that include wetlands and portions of adjacent aquatic and upland environments in a zone of influence upon the aquatic environment. The influence diminishes further from the water. The term "riparian vegetation" in our Management Plan Update is intended to broadly include the vegetation that exists within the "Soquel Creek Ecosystem," including vegetation that contributes functional value to the creek/lagoon in terms of shade, leaves, nutrient retention/ cycling of organic litter, providing wood and offering erosion protection capable of modifying sedimentation processes.

In this Lagoon Management Plan Update intended to protect fishery habitat, we have chosen the broad, ecological and functional designation of riparian vegetation as it affects the aquatic environment. Riparian vegetation forms a linear corridor on both sides of the stream waterway (lotic aquatic environment) or surrounds the lagoon or lake (lentic aquatic environment). The riparian corridor must be protected to prevent degradation of the aquatic habitat. This riparian zone serves as the interface between the waterway and surrounding upland habitats. Riparian areas are often characterized by high species diversity (providing riparian habitat for both plants and animals) due to the presence of water, the use of their linear form as a movement corridor for wildlife, and the presence of nutrient-rich sediments and organic matter from floodwaters when floodplains are involved.

The National Marine Fisheries Service (now known as NOAA Fisheries) considers riparian areas in terms of how the vegetation influences the aquatic environment. NOAA Fisheries (**NOAA Fisheries 2000**) stated that,

> **"the existence of native vegetation along stream corridors is a condition that can support essential habitat processes such as temperature control, bank stability, stream complexity over time, the filtering of pollutants, or contributions of large logs and other woody debris to a stream."**

NOAA Fisheries uses a rule-of-thumb functional distance from a stream where activities in riparian areas should be limited because they may impact the properly functioning conditions for federally protected species, such as steelhead. As stated in their Citizen's Guide in Limit No. 12, "NMFS' determinations are significantly influenced by science indicating that essential habitat functions are affected to varying (but significant) degrees by streamside activities conducted within a distance equal to the height of the tallest tree that can grow on that site (known as the site potential tree height). The distance is measured not from the stream itself, but from the edge of the area within which a stream naturally migrates back and forth over time (the channel migration zone)." The term, "Properly Functioning Conditions," is defined in terms of the *natural processes and functions that lead to habitat conditions* that will meet the biological requirements of the federally protected fish (NOAA Fisheries **2000**).

A second approach to delineating and mapping riparian vegetation focuses on how the waterway and/or waterway's underflow influences the soil environment and supports the surrounding vegetation with water. The vegetation relying on this water is labeled riparian. The definition of riparian areas used by the U.S. Fish and Wildlife Service (**2002;** http://wetlands.fws.gov/Pubs_Reports/Riparian/Riparian.htm) in its National Wetlands Inventory efforts follows this approach. This process requires examination of hydrologic and hydraulic processes *directed outward* from the stream/lagoon to the nearby vegetation. In this case, riparian vegetation includes those species that grow adjacent to these watercourses and depend on this underflow for survival. It appears that "obligate" and "facultative-wet wetland" species (as defined in **Table 1,** page 24) would be included as riparian species, along with "facultative" species under some circumstances. Some species may be considered riparian vegetation in some circumstances even though they can grow elsewhere but are growing more vigorously with the shallow water table provided by the watercourse. The U.S. Fish and Wildlife Service used the following definition:

> **"Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctively different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland."**

By this definition, riparian plant species may be on the National Wetland Plant List (**Reed 1988**) or be true upland species expressing greater vigor due to increased water provided by the watercourse compared to upland situations. By this method, the botanist delineates the riparian area from three types of information; **1)** observing the extent of the assemblage of plant species that typically require underflow from standing or flowing water, **2)** examining the soil profile to assess the potential of the soil to allow lateral movement of water outward from the lake or stream (alluvial qualities, in other words) and **3)** comparing vigor of plants growing nearer the waterway with plant vigor further away. Along with this approach, some may also determine the width of the floodway that may be periodically scoured or deposited upon from winter stormflows to gain an idea of the extent of alluvial soils that would allow the movement of subsurface flow outward to the root zone of vegetation.

Through the U.S. Fish and Wildlife Service approach, the boundary of riparian vegetation along the Rispin Mansion parcel was determined to be at the 20-foot contour elevation in the latest Rispin Mansion Project Revised Draft EIR (**Denise Duffy & Associates, Inc. 2003**). It was determined that the obligate wetland species, shining willow (formerly yellow willow), and several

facultative-wet (FACW) wetland species, including black cottonwood, California box elder, California sycamore and red alder were rooted below the 20-foot contour line. The FEMA Floodplain and Floodway Boundary was at approximately elevation 26 feet, corresponding to the 100-year high water mark and the upper extent of stormflow influence. It was determined from soil corings in the steep canyon slope that above the 20-foot contour line there was hardened material comprised of siltstone and sandstone. It was determined that species above the 20-foot contour line were not dependent on the underflow of the stream, were not riparian, and constituted a mixed canyon woodland community of upland species that included California bay laurel, California buckeye, coast live oak and coastal redwood.

The Santa Cruz County Environmental Planning Department views riparian areas in terms of how they influence the aquatic environment, but emphasizes wet conditions. The recently completed (and well written) Santa Cruz County Stream Care Guide (**2003**) has the following to say about riparian corridors:

> **"The riparian corridor is the area adjacent to the stream that supports a plant and animal community adapted to flooding or wet conditions. Willows, alders, and cottonwoods are common riparian tree species. Redwood and Douglas fir often inhabit the riparian corridor, particularly in the upper reaches of the watersheds. All of these tree species contribute to bank stability, shade, undercut banks, and woody material within the stream."**

The riparian corridor is defined in the Santa Cruz County Stream Care Guide (**2003**) as follows:

- Lands extending 50 feet (measured horizontally) out from each side of a perennial stream. Distance is measured from the mean rainy season (bankfull) flowline.
- Lands extending 30 feet (measured horizontally) out from each side of an intermittent stream. Distance is measured from the mean rainy season (bankfull) flowline.
- Lands extending 100 feet (measured horizontally) out from each side of a lake, wetland, estuary, lagoon or natural body of standing water.
- Lands within an arroyo located within the Urban Services Line or Rural Services Line.
- Lands containing riparian woodland (cottonwood, sycamore, alder, box elder, etc.).

Prescription of set distances from the stream to delineate the riparian corridor provides uniformity and predictability from a regulatory standpoint. However, the extent of riparian vegetation may be more or less than those distances in any particular instance. These prescriptions are not based on biological or ecological relationships at any one location.

Compared to the riparian delineation method that focuses on water supply *directed outward* from the waterway to the plants, more upland species are included within the riparian when their influences *directed inward* upon the aquatic environment are considered. The riparian corridor is

sometimes wider when aquatic influences are the overriding consideration, instead of whether or not the plants are receiving underflow water from the waterway. Native deciduous trees common to the riparian corridor may include species of willow (*Salix spp.*) and alder (*Alnus spp.*), black cottonwood, California sycamore, big leaf maple (*Acer macrophyllum*), creek dogwood (*Cornus californica*), and California box elder. In steeper canyons, the riparian corridor may also include California bay laurel, California buckeye, coastal redwood, Douglas fir, madrone, coast live oak, valley oak and associated understory if they provide shade, contribute nutrients to the waterway from leaves, contribute large wood, encourage percolation of rain, and they resist sediment flow and overland runoff to the waterway on steep terrain. Non-native trees that may also frequent the riparian corridor include acacia (*Acacia spp.*) and blue gum eucalyptus (*Eucalyptus globulus*). If the overstory of tree species is homogeneous in an area, then it is distinguished as a riparian forest type, such as live oak riparian forest, with a typical association of associated understory species making up a community type. Several types of riparian forest combine to form the riparian corridor. On lower Soquel Creek, some riparian forest types are quite protracted in size, such as redwood riparian forest.

A riparian corridor occurs along much of Soquel Creek within the City, except where horticultural plantings exist on the east side of the lower lagoon (**Figure 1**; page 158). Where riparian vegetation exists on the east side, it is a very narrow corridor through the highly developed streamside parcels. Riparian vegetation typically grows at the bank-full flow line (high water mark for a stormflow likely to occur every 1.5 to 2 years) and extends above this line due to our wet winter months, high soil-moisture levels, and high groundwater levels. Four types of riparian forest/woodland/community have been documented along Soquel Creek, as listed in **Table 2** (page 30) and described in more detail in **Appendix B** (page 98). During the 2002 field surveys, the creek exhibited evidence of both scour and deposition. The high-water regime of a stream is an important component of the species composition along a watercourse, as most riparian plant species are adapted to colonizing recently disturbed (i.e., flooded, scoured, or depositional) portions of a watercourse.

When trees dominate the riparian corridor, it may be called riparian woodland. **Figure 1** (page 158) displays the distribution of the riparian woodland along Soquel Creek. Approximately 20 acres of riparian woodland occur along Soquel Creek, as listed in **Table 2**.

Table 2. Acreage of Primary Community Types along Soquel Creek.

Primary Community Type	**Acres (%)**
Riparian Woodland	
• Cottonwood–Willow Riparian Forest	8.12 (28.7%)
• Coast Live Oak Riparian Forest	7.44 (26.2%)
• Non-Native Riparian Forest	
• Eucalyptus-dominated Woodland	3.22 (11.4%)
• Acacia-Dominated Woodland	0.10 (0.3%)
• Redwood Riparian Forest	0.99 (3.5%)
• Remnant Riparian Tree(s)	0.12 (0.4%)
Subtotal	19.99 (70.5%)
Non-Native Woodland Groves	0.90 (3.2%)
Horticultural Plantings	7.45 (26.3%)
Total Acres	**28.34 (100%)**

Source: Biotic Resources Group, 2002

Plant community/vegetation types delineated in the base map (**Figure 1**; page 158) are general and preliminary and not intended for purposes of interpreting the City of Capitola Environmentally Sensitive Habitat Ordinance (Chapter 17.95 of the zoning ordinance). Boundaries of the riparian corridor are sometimes difficult to delineate due to the presence of non-native vegetation and the remnant, isolated distribution of some native riparian species. The City ordinance calls for more precise delineation of riparian boundaries on a case-by-case basis. The boundary of riparian vegetation is subject to interpretation. The term "riparian" in Figure 1 (page 161) in this Management Plan Update is intended to broadly define the extent of the "Soquel Creek Ecosystem," including vegetation that contributes functional value to the creek/lagoon in terms of shade, leaves, nutrients, woody material and erosion protection.

The general distribution of invasive plants in 2002 (**Figure 2**; page 159) was similar to that mapped in 1990; however, the density of invasive plants has increased. This was especially true for Cape (German) ivy and acacia, with more of both than was documented in 1990. It appeared that little was done to encourage landowners (including the City on City land) to remove invasive plant species and maintain the native riparian vegetation, as was encouraged in the adopted 1990 Plan. This is an appropriate time for the City to reach out to landowners and groups (including the Senior Center) to encourage compliance with the Management Plan. The City can require removal of invasives and enhancement of the riparian corridor as a condition of project approval for projects located adjacent to the riparian corridor.

The following invasive, non-native plant species have been documented along Soquel Creek, based on field surveys in 2001 and 2002 and a review of previous reports:

Trees

- Acacia (*Acacia* spp.)
- Monterey pine (*Pinus radiata*)
- Blue gum eucalyptus (*Eucalyptus globulus*)

Shrubs and Vines

- French broom (*Genista monspessulanus*)
- Pampas grass (*Cortederia jubata*)
- Cape ivy (*Delaireia odorata*) (previously referred to as German ivy (*Senecio mikanoides*)
- English ivy (*Hedera helix*)
- Himalayan berry (*Rubus procerus*)
- Nasturtium (*Nasturtium officinalis*)
- Honeysuckle (*Lonicera* sp.)
- Morning Glory (unknown species)
- Giant Reed (*Arundo donax*)
- Cotoneaster (*Cotoneaster spp.*)
- Periwinkle (*Vinca major*)

Rispin Parcel

The Rispin parcel, which borders Soquel Creek Lagoon, was visited in late February and early March of 2002 by the project manager and an erosion control specialist. This site had not been addressed in detail for the original Management Plan (**1990**), though its vegetation was classified and mapped in the 1990 Plan. Historic interest (since 1985) in this City-owned parcel as a potential site for development and the potential impacts of development on the lagoon necessitated its inclusion in the Management Plan Update. Future development at the Rispin site may potentially impact stream habitat in the winter and lagoon habitat in the summer without proper mitigation measures. **Appendix D** (page 117) contains a more complete description of existing conditions on the Rispin parcel.

At the time of observation in winter 2002, a steep, 65% slope separated the plateau where the Rispin Mansion (**Photo 15;** page 32) was situated and the floodplain that was adjacent to Soquel Creek Lagoon/ Estuary. Although no serious, recent erosion was observed, its potential is high during heavy rainfall due to the steep slope. A probable old mudslide scar was observed on the slope to the south of the Mansion. Several large blue gum trees (eucalyptus) grew on the

mudslide scar. It is recommended that no additional runoff be released onto the slope from any future development because of the high landslide potential. Effective mitigation measures should be in place prior to any construction of additional structures or parking areas on the Rispin parcel to prevent increased flashy runoff toward the creek, increased soil erosion, increased water pollution (particularly early in the rainy season), increased risk of slope failure, and increased sedimentation of Soquel Creek. Acceleration of any of these processes has the potential to negatively impact steelhead habitat in Soquel Creek Lagoon.

Photo 15. Rispin Mansion Overlooking Soquel Lagoon 8 March 2002

Storm drains on Wharf Road at the Clares Street corner apparently merge and connect to the buried culvert that runs downslope to the dissipater. All storm runoff from the library parking lot enters Wharf Road and flows into the same drainage system. In addition, storm water runs south down the street the full length of the Rispin parcel from the walk/bike path to the same drainage system. Rapid storm runoff from these impermeable surfaces cumulatively adds to the flashiness of stormflow in lower Soquel Creek. The drainage culvert from Wharf Road was exposed in places as it traveled downslope to an energy dissipater. A well-used trail paralleled the culvert down to the energy dissipater. This trail is likely to be used by anglers to gain access to the creek. There was evidence of runoff being directed down the upper portion of this trail.

Mature eucalyptus (blue gum) trees dominated the southern portion of the steep slope that

dropped sharply east, down to the floodplain beside the creek. Four Monarch butterflies were observed flying among the eucalyptus trees in February. Over-wintering Monarch butterfly habitat used for roosting is considered an environmentally sensitive habitat area (ESHA) (**California Coastal Commission 2001**), requiring protection under Section 30240 of the California Coastal Act. According to a Coastal Commission letter (**2001**), the area of the Rispin site south of the Mansion was considered Monarch butterfly overwintering habitat and portions of the area might be considered ESHA. Where the steep slope approached the stream channel in the absence of a floodplain at the south end of the parcel, eucalyptus trees were quite close to the channel (within 15–20 feet). The understory on the steep slope and portions of the floodplain was primarily ivy, periwinkle, and poison oak. Acacia dominated the floodplain terrace on the Rispin side, although small willow and alder were growing at the water's edge of the floodplain. Adjacent to the Mansion and slightly upstream, a grove of coast redwood was present on the steep slope. Adjacent to the Mansion on the upslope side of the redwoods was a big leaf maple within approximately 20 feet of the Mansion.

The tree canopy closure over the creek ranged from 42% downstream of the Mansion where the eucalyptus grove dominated, to 38% adjacent to the Mansion and redwood grove, and to 34% just upstream of the Mansion. These low canopy closure values resulted partially from the poorly developed riparian vegetation on the upper bluffs on the east side of the creek, across from the Mansion parcel. Between the Mansion and the southern end of the parcel, more than 60% of the shade canopy for Soquel Creek was provided by the eucalyptus grove; therefore, the grove was considered part of the riparian corridor.

The west bank, upstream of the Mansion, was very steep and potentially erosive, with the floodplain being on the east bank across the creek from the Mansion. The west bank was vegetated with big leaf maple, California buckeye, and a second grove of second-growth coast redwood. The presence of big leaf maple on the slope north of the Mansion and one within approximately 20 feet of the Mansion indicated that, prior to the existing eucalyptus grove, big leaf maple and possibly other canyon species, such as California buckeye and coast live oak, inhabited the slope adjacent to the Mansion where eucalyptus dominate.

The Mansion was constructed in 1921. Construction of the Mansion's foundation involved placement of retaining walls on the slope and backfilling behind them to create a level building site (**Haro, Kasunich and Associates, Inc. 2003**). However, there was no evidence of mass grading during construction, based on 1928 aerial photographs and soil corings (**Haro, Kasunich and Associates, Inc. 2003**). Based on the presence of riparian species growing on the slope to the north of the Mansion and our observations of the extent of the riparian corridor in aerial photographs of Soquel Creek taken in 1926 and 1952, it appeared that the original Mansion had been constructed within, or at least on the edge of, the riparian corridor that existed at that time.

In recent times there has been disagreement about the extent of the riparian corridor in the vicinity of the Mansion. In the Re-circulated Draft EIR for the Rispin Mansion and Mini-Park Projects (**Denise Duffy & Associates 2000**), it was stated by the botanist on the EIR team that "we concur with the flood plain and flood way boundary as shown on the site Plan map (1997) as the approximate demarcation of riparian habitat on the Rispin Mansion Parcel." California Coastal Commission staff (**2001**) disagreed with this delineation by stating "We do not believe that this delineation is sufficiently inclusive of the riparian species and vegetation that mark the western bank of Soquel Creek below the Rispin Mansion parcel. We suggest that this edge of riparian vegetation demarcation be adjusted up the slope accordingly. In fact, it is not clear to us that the riparian corridor has changed appreciably since the 1995 FEIR for this site: please explain why the current outer edge of riparian vegetation has been adjusted so dramatically from the much more inclusive 1995 Jones and Stokes assessment for this property." The authors of the 2004 Lagoon Plan Update are more inclusive than the botanist in the RDEIR (**2000**) in their mapping of riparian vegetation, consistent with this Plan's ecological emphasis. The native forest types adjacent to the Rispin Mansion were mapped as riparian by senior botanist, Kathy Lyons, in the original Management Plan (**1990**) and have also been mapped as riparian in this Plan Update (**Figure 1**; page 158).

Plant community types on the Rispin parcel included non-native riparian woodland (both eucalyptus- and acacia-dominated), redwood riparian forest, coast live oak riparian forest, cottonwood-willow riparian forest and non-native woodland. In addition, there were horticultural plantings. Riparian vegetation is considered critical habitat for the federally Threatened steelhead. Removal of riparian canopy over a stream is considered an adverse modification and is subject to review by the National Marine Fisheries Service (NMFS; also known as NOAA Fisheries) under the Endangered Species Act for projects requiring Army Corps 404 permits for modification of stream channels. Projects that do not entail stream channel modification, such as the proposed Rispin development, lack nexus with the Army Corps and NOAA Fisheries and are not typically reviewed by NOAA Fisheries.

There was a gap in the trees with an open area on the plateau to the north of the existing Rispin Mansion in 2002. It is conceivable that additional structures could be added to this area without adverse impacts to the established trees, stream shading or slope stability above the creek. However, proper safeguards would be required, and structures would need to be constructed away from the steep slope leading down to Soquel Creek. It is conceivable that existing coastal live oaks could be retained and additional trees could be planted while accommodating additional structures. The existing condition of the Mansion offers poor drainage, a weakened retaining wall and the absence of proper water retention that all threaten slope stability above the creek and lagoon. Renovation of the Mansion with properly engineered modifications could result in significant improvement and enhancement over existing conditions.

In February 2002, the west footing to the Peery Park Bridge was being undermined by an eroding slope beneath. Water was apparently draining from the slope beneath the footing. The drainage pipe leading from the walkway grate along the bicycle path (west side) emptied onto the slope above the creek. The grate was partially plugged with leaves.

The stream channel adjacent to the Rispin parcel is an important passageway for adult salmonids during spawning migration. It becomes part of the summer lagoon and is important rearing habitat for juvenile steelhead. This section, along the approximately 950 feet of creekside frontage of the Rispin parcel, was dominated by sand in February 2002, although there were two riffles adjacent to the Rispin parcel. The longest riffle began just downstream of the Peery Park bicycle/walkway bridge. A second riffle was located further downstream, just upstream of the bedrock exposed on the east bank and downslope of the Mansion. This exposed bedrock on the left bank created scour for a pool. Juvenile steelhead have been observed in the vicinity of the bedrock pool area within the summer lagoon. This bedrock pool has been a popular fishing location for adult steelhead and coho salmon in the past (**Ed Morrison, Capitola Public Works, pers. comm.**). Sub-optimal, but usable spawning habitat existed just above the second riffle, (downstream of the walk bridge). Adult steelhead were observed in the pool adjacent to the bedrock outcrop at Nob Hill in winter 2002 (**Jennifer Nelson, CDFG Fishery Biologist, pers. comm.**). CDFG personnel observed illegal snagging of adult steelhead in this pool and the pool beneath Highway 1 in 2002.

REGULATORY SETTING

The City of Capitola must possess permits from the Army Corps of Engineers, California Department of Fish and Game (CDFG) and the California Coastal Commission in order to construct the sandbar at the beach each year. A streambed alteration permit is required from the CDFG as the responsible agency. Any proposed project that may significantly alter stream channels by excavation or fill requires an Army Corps 404 permit, which necessitates a Section 7 consultation with NOAA Fisheries and the U.S. Fish and Wildlife Service. When the conditions required under the Section 7 consultation as expressed in a biological opinion are met by the permit applicant, then limited incidental take is authorized under the ESA. This consultation is required because special status has been applied to tidewater goby and steelhead as federally listed species with legal protection under the federal Endangered Species Act (ESA). The federal ESA prohibits federal agencies from authorizing or permitting actions that would result in biological jeopardy to Threatened or Endangered species, such as tidewater goby and steelhead.

The ESA makes it illegal for any person subject to the jurisdiction of the United States to take any species of fish or wildlife that is listed as endangered without specific authorization. The final 4(d) rules put into place the same take prohibitions for threatened steelhead, except for certain limits that apply to the activities specified in the rule. For a detailed discussion of take prohibitions go to http://swr.nmfs.noaa.gov/salmon.htm. A Citizen's Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast is available at that website. In that guide, NOAA Fisheries provides guidance on the kinds of activities that are likely to injure or kill threatened steelhead. This guidance is not regulatory. Included in these activities are the following:

- Constructing or maintaining structures like culverts, berms or dams that eliminate or impede listed species' ability to migrate or gain access to habitat."
- Removing water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding or other essential behavioral patterns.
- Constructing, maintaining or using inadequate bridges, roads or trails on streambanks or unstable hill slopes adjacent to or above a listed species' habitat.
- Conducting timber harvest, grazing, mining, earth-moving or other operations that substantially increase the amount of sediment going into streams.
- Conducting land-use activities that may disturb soil and increase sediment delivery to streams- such as logging, grazing, farming and road construction- in riparian areas and areas susceptible to mass wasting and surface erosion.
- Shoreline and riparian disturbances (whether in the river, estuary, marine or floodplain

environment) may retard or prevent the development of certain habitat characteristics upon which the fish depend (e.g., removing riparian trees reduces vital shade and cover, floodplain gravel mining, development, and armoring shorelines reduces the input of critical spawning substrates, and bulkhead construction can eliminate shallow water rearing areas).

NOAA Fisheries will not apply take prohibitions to municipal, residential, commercial and industrial (MRCI) development and redevelopment governed by and conducted in accordance with city, county or regional government ordinances or plans that NOAA Fisheries has found to adequately protect listed species. NOAA Fisheries must agree in writing that MRCI development ordinances and plans will conserve listed salmon and steelhead. One of the considerations is whether ordinances protect riparian areas well enough to attain or maintain properly functioning conditions (PFC) around all rivers, estuaries, streams, lakes, deepwater habitats and intermittent streams. NOAA Fisheries' determinations are significantly influenced by science indicating that essential habitat functions are affected to varying (but significant) degrees by streamside activities conducted within a distance equal to the height of the tallest tree that can grow on that site (known as the site potential tree height). The distance is measured from the edge of the area within which a stream naturally migrates back and forth over time (the channel migration zone). NOAA Fisheries adds that when projects include modifying a riparian site that has existing, non-native vegetation, it may be important to restore native vegetation on the site in order to recover the essential habitat functions.

Any proposed project which has potentially significant environmental impacts to the creek/lagoon and surrounding vegetation must comply with the California Environmental Quality Act (CEQA), the California Endangered Species Act (CESA) and the Native Plant Protection act (NPPA). The CDFG is a trustee agency in any CEQA review. The potential take of state listed Threatened, Endangered or Rare species is regulated by the California Fish and Game Commission. Tidewater goby was listed by the state as an Endangered species and has been present in the lagoon in the past. CDFG species of special concern must be considered in assessment of potential impacts and mitigation during CEQA analysis related to any potentially damaging project. Steelhead salmon are considered a species of special concern. Environmentally sensitive habitat areas (ESHA) are afforded protection under the California Coastal Act in the coastal zone. The City of Capitola has an environmentally sensitive habitat (ESH) ordinance, which is intended to protect riparian habitat and monarch habitat from impacts due to development.

Enhancement of the riparian habitat values of Soquel Creek is recommended in Local Coastal Program Policy 16 (City of Capitola General Plan, 1989) and the Local Coastal Program Land

Use Plan Policy VI–8 (City of Capitola, 1981). Chapter 17.95 of the City's zoning ordinance provides regulations for environmentally sensitive habitats.

In this 2004 Lagoon Management Plan Update, the riparian forest types making up the riparian corridor are interpreted broadly in ecological terms (**Figure 1**; page 158) as the vegetation that extends out from the stream channel to encompass the ecologically functional zone of influence upon the stream as envisioned by Meehan and others (**1977**), Gregory and others (**1988**), Ehlers and de Guzman (**2002**) and the National Research Council as discussed on **pages 25 and 26** of this Plan Update. This 2004 Management Plan Update does not change the definition of the "Soquel Creek Riparian Corridor" as it is used in the city's Environmentally Sensitive Habitats ordinance (Chapter 17.95), and does not determine the way the City applies those zoning ordinance regulations. Overall, the City's Environmentally Sensitive Habitats ordinance and the 2004 Lagoon Management Plan Update are consistent in their intentions, in terms of emphasis on protecting habitat values through conditions/mitigation measures, which could even include greater-than-minimum setback requirements.

CREEK GEOMORPHOLOGY IN THE NOB HILL REACH IN 2002

Watershed History

Soquel Creek may be aggrading because sediment yields are likely elevated as a result of disturbance in its watershed. The timeline illustrated in **Figure 8** (page 165) presents human-induced disturbances along the top of the axis and natural disturbances along the bottom of the axis. The timeline covers the period between 1860 and 2001. Human-induced disturbances presented include timber harvests and large-scale fires. Natural disturbances presented include earthquakes and floods. For purposes of evaluating the Nob Hill reach, it is sufficient to recognize that many disturbances introducing boulders or large rock to the stream have occurred during the past century and a half. The Nob Hill reach extends from the protruding bedrock outcrop near the sewage lift station (just upstream of Peery Park) to Highway 1.

The watershed has experienced five magnitude 6.0 or greater earthquakes since 1860 along the San Andreas Fault zone with most the most recent of these, the Loma Prieta earthquake of 1989, having been centered on Loma Prieta just east of the upper watershed. Numerous landslides and debris flows were generated from these earthquakes resulting in massive inputs of sediment to the channel and a short lived damming of the east branch of Soquel Creek (**Manson and Sowma-Bawcom, 1992**). During the period of 1982 to 1986, five peak flows of 6500 cfs or greater were generated. These five flood peaks represent five of the eight largest flows recorded in Soquel Creek since 1951. Over the last seven years, four years have brought flows of at least 3300 cfs; the 2[1]-year recurrence interval streamflow for Soquel Creek has been estimated to be 2000 cfs (**Northwest Hydraulic Consultants, 1999**).

These numbers illustrate the fact that the watershed has experienced an unusual number of peak flows over the last twenty years, and that these peak flows have moved a larger-than-usual load of cobbles into a reach where sand and gravel beds have been the norm. This is evident today by observing the coarse sediment that mantles the bar along the eastern side of the channel through the Nob Hill reach. Throughout the watershed we have measured very coarse material on the bars and bed of Soquel Creek (**Figure 9**; page 166) and we have observed reaches where the channel has aggraded by several feet, bringing the bed of the channel to the elevation of streamside alders (**Balance Hydrologics, in prep**). Bed conditions in Soquel Creek today appear to be episodically coarsened and aggraded, which directly contributes to bank erosion.

[1] A 2-year recurrence interval event is widely used as the bankfull streamflow. The specifics of applying the 2-year event as a bankfull streamflow should be considered on a stream-by-stream basis and verified by geomorphic indicators and a long record of flow at a station. For the purpose of discussion in this report, we have assumed that the 2-year recurrence interval event approximates the bankfull flow on Soquel Creek.

The approximate elevation for the western bank through the project reach at the point of flooding is 20 feet above mean sea level[2].

Reach Analysis Using Aerial Photographs

Aerial photography coverage for lower Soquel Creek from 1952, 1956, 1963 and 1985 were reviewed to ascertain probable causes for the current degraded bank conditions through the Nob Hill Reach on Soquel Creek. Aerial photographs from 1956, 1963 and 1985 were scanned and are included in this report as **Figures 8, 9 and 10** (pages 165-167). **Figure 11** (page 168) denotes the cluster of redwoods used as a reference point in all aerial photographs. Channel and riparian corridor characteristics for each aerial photograph are briefly discussed below.

1952 Aerial Photograph

We worked from a photocopied July 1952 aerial photograph for this analysis. For the Nob Hill reach, the degree of development illustrated in photocopied 1952 aerial photograph represents roughly a third[3] of present day conditions. Notable land uses through the reach in 1956 included orchards and open space along the eastern bank and low-density rural homes (within several acres of agricultural parcels) along the western bank. The homes were built to the west of Wharf Road above, in terms of elevation, the riparian corridor[4] along this bank.

From the photocopy, it is clear that the western and eastern banks were densely vegetated with riparian tree species[5] with very little to no break in this growth along either bank through the project reach. Uphill of this buffer of trees along the western bank, the slope leading up to Wharf Road was covered with scrub vegetation, and pockets of vigorous trees possibly associated with perennial seeps along this slope. Outside of this buffer along the eastern bank, two types of land-uses were observed. For a distance of 700 feet downstream of the Highway 1 Bridge crossing, an orchard was in operation over an area of roughly 6.5 acres. South of this orchard, the land left

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[2] The elevation should be confirmed by means of a level survey and, for this project, was approximated from available topographic maps. It is interesting to not that elevations of the 100-year flood along the eastern bank through the project reach have been determined to range from 26.8 to 28.2 feet (Philip Williams & Associates, 1997).

[3] This is a visual estimate based on the area of riparian corridor in the Nob Hill reach between Bay Avenue and Wharf Road, which was being used for some purpose in 1963 verses 1985. No development was defined as that part of the corridor, which was open space at the time the aerial photographs were shot.

[4] Through the Nob Hill reach, the riparian corridor along the western bank was defined in 1952 as the area in between Wharf Road and Soquel Creek. Along the eastern bank, the riparian corridor in 1952 was a strip of woody vegetation roughly 10 to 30 feet in width

[5] In addition to the three redwoods, the dominant riparian species include alders (*Alnus spp.*) and willows (*Salix spp.*) within the bankfull channel and cottonwoods (*Populus spp.*) above the bankfull channel.

in open space roughly coincides with the present day location of the Nob Hill grocery complex and adjoining parking lot. South of this open space, residential housing lined the east bank.

Morphologic characteristics of the channel in the photocopied 1952 aerial photograph were not discernible due to the dense coverage of vegetation over the channel and, to a lesser degree the poor quality of the photocopy.

1956 Aerial Photograph

The degree of development and land uses that can be observed in the 1956 aerial photograph appears to be similar to that discussed for the 1952 aerial photograph. However, the condition of the riparian corridor along both banks differed from those discussed for 1952.

Figure 10 (page 167) illustrates an area along the western bank (which was within the 1952 riparian corridor) that was scoured of woody vegetation and subsequently mantled with flood deposits during the December 1955 flood. This is evident by the lack of visible vegetation over the bar in the highlighted region of **Figure 10** and by the sediment deposits that are visible on the downstream side of vegetation within and near to the highlighted region. The photo-interpreted lateral extent of flooding and deposition along this bank is also highlighted in **Figure 10** by a dashed, dark line. The lateral extent of flooding on the east side is also delineated. This line basically coincides with the furthest lateral extent of flooding that is visible in the photograph. It is important to note that a grove of redwoods is highlighted at the downstream end of the lateral extent flooding line in **Figure 8** (page 165). This grove serves as a useful reference point for tracking the loss of riparian corridor along the western bank over the last 50 years. This grove of redwoods is still present today and is illustrated in **Figure 11** (page 168). Review of **Figure 9** (page 166) and a visit to the reach will reveal that this grove of redwoods currently stands at the top of a 12 to 15 foot bank that is near vertical and composed of bedrock. The eastern most redwood within the grove is currently on the verge of falling into Soquel Creek.

Along the eastern bank, the riparian corridor was substantially wiped out just downstream of the Highway 1 bridge crossing. The length of woody vegetation removed by the 1955 flood was roughly 300 feet. It is also apparent in **Figure 10** (page 167) that the flood covered a substantial portion of the orchard and downstream open-space land.

Morphologic characteristics of the channel after the 1955 flood include three alternating bars starting from the Highway 1 Bridge crossing and re-working and deposition of flood deposits through the riparian corridor along both banks of the channel. The three alternating bars below Highway 1 through the project reach are very clearly illustrated in **Figure 10**. There are several

important observations that can be made regarding two of the three bars. The downstream end of the second bar roughly lines-up with the upstream end of the bar that is present today along the eastern bank (**Figures 6 and 7** (pages 163-164). This points towards the likely possibility that this bar has migrated downstream along the eastern bank to its present day location over the last 17 years (see below). Secondly, the third bar downstream of Highway 1 present in the 1956 photograph corresponds to the current location of bank retreat and failure through the project reach. The area over the bar that was stripped of overhanging vegetation during the December 1955 flood has approximate dimensions of 250 feet by 50 feet (0.30 acres).

Aerial photographs from 1963 and 1985 document the gradual change in channel characteristics during those 22 years. The observed changes that occurred over those 22 years help to relate present day conditions illustrated in **Figures 6 and 7** (pages 163-164) to those that characterized the reach in the 1950's. Therefore, the following discussion of aerial photographs from 1963 and 1985 will be briefer and only highlight major changes in reach characteristics apparent in the photographs.

1963 Aerial Photograph

See the discussion of development and land use for the 1952 aerial photograph as those conditions parallel the 1963 conditions. The 1963 aerial photograph for the project reach is highlighted and illustrated in **Figure 12** (page 169). Important observations from the 1963 aerial photograph are as follows:

- The region along the western bank highlighted in the 1956 aerial photograph as having lost vegetation was re-established with woody vegetation by 1963. A few of the individual trees appear to be on the order of 5 to 7 years in age. The area where woody vegetation had re-established by 1963 roughly equals 0.3 acres.

- The lateral extent of flooding from the December 1955 event is clearly discernible in the 1963 photograph.

- The riparian corridor along the eastern bank in 1963 was similar to that of the 1956 aerial photograph.

- The locations of the bars discussed in the 1956 review appear to be stable over the 8 years to 1963. Additional characteristics concerning channel organization are difficult to discern due to differences in flow on the day the photographs were shot. However, if we set that difficulty aside, it appears that the cross sectional width of the second bar was

reduced by several feet from 1956 to 1963. Characteristics of the first and third bar appear unchanged.

1985 Aerial Photograph

Development through the Nob Hill reach since 1963 has increased substantially by 1985 along both banks (**Figure 13**; page 170). Important observations from the 1985 aerial photograph include:

- Along the western bank, an apartment complex was constructed within the 1952 riparian corridor, as defined earlier in this section. Site drainage configuration for the apartment complex was not determined as a part of this study. The apartment complex does consist of impervious surfaces and has undoubtedly changed the local hydrology along the western bank. However, a brief visit to the apartment dwelling in February of 2002 did not reveal any obvious site drainage configurations that could be contributing to the current problem along this reach.

- The buffer strip of riparian vegetation along the eastern bank has begun to fill in along the stretch that was wiped out in December 1955 (see discussion of 1956 aerial photograph). Additionally, the density of riparian vegetation along this bank is similar to those levels observed in the 1956 and 1963 aerial photographs. Riparian density observed in the 1952 photograph was higher than in 1956, 1963 and 1985.

- The orchard and adjacent open space land has been developed since 1963. The Nob Hill grocery complex, adjoining parking lot and additional commercial structures were built on these properties.

- Channel organization is similar in 1985 to those observed in the 1963 photograph. Depositional bars appear to be in the same relative location as observed in 1963. Bar 2 (as discussed in review of the 1956 photograph) along the eastern bank does not appear to have migrated downstream by April of 1985. However, view of the channel bed in the 1985 photograph is somewhat compromised due to the higher streamflow on the day the photograph was shot (in comparison to 1963).

- Bar 3 along the western bank is present in 1985 photograph. The western bank paralleling bar 3 appears to be in good shape and does not appear to be failing, as is presently the case. Vegetation along the bank is prevalent and no signs of bank failure can be observed.

Processes and Factors Leading to Current Conditions through the Nob Hill Reach

The primary reason for present day erosion of the western bank through Nob Hill is due to the current location of the bar along the eastern bank, as illustrated in **Figures 6 and 7** (pages 163-164). At high flows, this bar diverts flow towards the western bank thereby providing the means to erode the bank. This bar is theorized to have migrated downstream from the position of bar 2 as discussed in review of the 1956, 1963 and 1985 aerial photographs. Over the past 17 years the bar has migrated roughly 150 feet to its present day location. Bar and channel form migration are a natural process of river systems (**Leopold, and others, 1964**). Northwest Hydraulic Consultants (**1999**) briefly discussed the apparent lateral migration of the channel to the east through the Nob Hill reach from 1912 to 1954. They do state that the apparent migration over those years may be due to erroneous mapping illustrated in the 1912 topographic map from which they worked. It is interesting to note that they did not discuss any migration of the channel to the west from 1954 to 1999, as is presently the case. It is unlikely that the channel has migrated to the west solely in the last 3 years given the history of annual peak flows for Soquel Creek since 1985.

The stability of the present day bar along the eastern bank has apparently been enhanced in the last several years due to an armoring and stabilization of the bar with very coarse sediment particles (**Figure 9**; page 166). The Nob Hill bar surface particles were counted and measured by the Coastal Watershed Council in 2000 as a part of the Soquel Creek Watershed Assessment. From their measurements, the D_{84} particle size[6] was 88 millimeters (small cobbles) in 2000. Particles of this size on the surface of the bar will effectively stabilize the bar until sufficient flow is generated to begin to move these particle sizes and re-work the bar. It is interesting to note that a coarsening of the channel bed is believed to have occurred elsewhere in the watershed. This statement is based solely on the observations of consultants who have worked in the watershed over the last 10 to 15 years.

The flood terrace that currently is failing along the western bank through the project reach appears to be composed of unconsolidated flood deposits likely to be primarily sand in size. This observation is based on examination of the now exposed stream bank along the reach. The lateral extent of the sand deposits (towards Wharf Road) within the terrace are unknown. These unconsolidated flood deposits are easily erodible, in a relative sense, and rely on vegetation for

[6] The D_{84} particle size represents the 84th percentile grain size for the particles sampled on the channel bed. Therefore, 83 percent of the particles sampled were finer than the D_{84} particle size.

structural support. Under current conditions, vegetation does not appear to be a sufficient stabilizing element, given that the bank has retreated by roughly 4 to 5 feet[7] over the last 17 years.

Geomorphic Conclusions

1. The erosion site on the west bank in the Nob Hill reach is a terrace upon which the 1955 flood likely deposited sediment but which was formed in earlier event(s). The large alders and cottonwoods on the terrace are older than the 1955 flood, and are likely coming to the end of their expected lifetimes.

2. The primary cause of this eroding bank is likely that the channel is widening to accommodate coarser sediment being introduced from further upstream. Widening is an expected response for an alluvial channel when its bed becomes coarser or rougher. The coarsening of bed sediment is a result of several events that triggered large slope failures in the middle and headwater reaches of both forks of Soquel Creek, including the floods of 1982, 1983, and 1986, plus (especially) slopes loosened or failed during the Loma Prieta earthquake. Other events and processes may also be responsible.

3. Other causes likely include the migration of a cobble riffle into a position where it occupies much of the channel cross-section at this position, deflecting flow into the western bank. It may also be that as the older large trees mature that root strength or extent is being lost.

4. Several similar banks along Soquel Creek are also retreating, most notably the west-bank terrace across the creek from the Bargetto's tasting room on Main Street, where retreat of 50 to 80 feet has occurred during the past several years. Other retreating banks of similar vintage are apparent along Soquel Creek for 1.5 miles north of Bargetto's, as well.

[7] Estimate based on aerial photograph interpretation and given that if one, 10 to 15 year old tree has fallen into the channel (Figures 6 and 7) that it would likely have taken four to five feet of the bank with it into the channel.

DEVELOPMENT OF THE MANAGEMENT PLAN UPDATE

Preliminary to development of the Plan Update, a Soquel Creek Task Force was convened to discuss challenges to protecting natural resources in Soquel Creek. The limited scope of the Soquel Creek Task Force, organized by Capitola City Council Member Dennis Norton and endorsed by the Capitola City Council in the spring of 1999, was to identify major problem areas facing Soquel Creek, suggest possible solutions to those problems, and spearhead vehicles for the implementation of solutions.

Task Force Participants:

Donald Alley, Aquatic and Fisheries Biologist
Patricia Anderson, Fisheries Biologist, Department of Fish and Game
Bruce Arthur, Capitola City Council
Dan Carl, California Coastal Commission
Bill Davilla, Biologist, Eco-Systems West
Robert Dixon, Surfrider Foundation
Gary Kittleson, Biologist
Mitch Swanson, Hydrologist
Steve Leinau, Friends of Soquel Creek
Tom Mader, Save the Habitat
Donna Meyers, Coastal Watershed Council
Ed Morrison, Capitola Public Works
Vicki Nichols, Save Our Shores
Dennis Norton, Capitola City Council
John Ricker, County Environmental Health
Dave Streig, Fisheries Biologist/Hatchery Manager, Monterey Bay Salmon and Trout Project

Other Participants:

Richard Casale, USDA Natural Resources Conservation Service
Karen Christensen, Santa Cruz County Resource Conservation District
Bruce Daniels, Capitola resident and currently Soquel Creek Water District Board Member
Marty Gingras, CDFG grants program
Barbara Graves, Capitola resident
Rick Jones, Capitola Planning Commission
Brook Kraeger, Hydrologist, Soquel Creek Water District
Dan Kriege, Soquel Creek Water District Board Chair and Capitola resident
Dan Pincetich, Capitola City Manager
Eric Remington, Soquel watershed property owner
Mick Routh, Redtree Properties

David Suddjian, Santa Cruz Bird Club, Biological Consulting Services

The Soquel Creek Task Force, Donald Alley who was the project manager/ fishery biologist for the original 1990 Plan, Kathy Lyons who was the senior botanist on the original Plan and Shawn Chartrand of Balance Hydrologics, Inc. (the geomorphology firm that worked on the Soquel Creek Watershed Assessment and Enhancement Plan (**2003**)) developed suggested policies and actions for the 2004 Plan Update. D.W. ALLEY & Associates implemented the original Plan, supervised and carried out enhancement projects, and has annually monitored the lagoon since 1990. Recommendations made in annual monitoring reports since the original 1990 Plan are included in this Plan Update.

IMPLEMENTATION POLICIES AND ACTIONS

Matrices of prioritized policies (**Appendix F**; page 131) and the projects (**Appendix G**; page 138) stemming from them are provided in the appendices. Policies and actions are prioritized as high, medium and low and arranged by environmental topic, educational opportunity and staffing requirements. Projects are prioritized numerically from 1 (highest priority) to 5 (lowest priority). They are grouped by similarity.

1) FISHERY ISSUES

Situation: The management/protection of federally protected steelhead and tidewater goby is mandated by law. Steelhead populations in the Soquel Creek Lagoon are threatened by inadequate stream inflow in summer during drought years. They are potentially stressed by high summer water temperatures when several consecutive days occur without morning fog or when tidal overwash brings salt water into the lagoon. Oxygen depletion threatens juvenile steelhead in the lagoon when the sandbar breaches prematurely in fall after a small stormflow. Kelp, seagrass, and saltwater enter, get trapped after the sandbar reforms, and begin to decompose. Juvenile steelhead are threatened by oxygen depletion in the lagoon when the first storm of the season washes pollutants into the lagoon, causing water turbidity, aquatic plant mortality, and decomposition. Migrating adult steelhead are vulnerable to angling pressure and illegal snagging if they become delayed in deeper pools at Nob Hill and Highway 1 due to inadequate passage flows. Water temperature is currently too warm in summer in the lower gradient mainstem of Soquel Creek to support coho salmon and allow their recovery. The quality of shelter (escape cover) has been further degraded by loss of riparian trees that overhang the lagoon in residential areas, as detected by the botanist between 1990 and the present. Riparian tree canopy, which provides shade to the lagoon and creek channel upstream, may be threatened by proposed development. Shallowing of the lagoon from excessive sediment inputs threatens steelhead

habitat by increasing bird predation and increasing daily water temperature fluctuations. Stream sedimentation reduces spawning habitat quality and spawning success in the lower creek, where young-of-the-year steelhead that seed the lagoon are produced.

Major goals are to increase steelhead numbers in lower Soquel Creek and the lagoon and to restore coho salmon to the watershed. This may be done by restoring, maintaining, and enhancing the Creek habitat. Key aspects of this include the following: (1) actively increasing streamside vegetation and shading to reduce water temperature; (2) leaving large woody material in the stream channel to create habitat complexity and cover; (3) reducing sediment input to improve spawning habitat and insect production; (4) improving lagoon water quality by preventing point source and reducing non-point source pollution, particularly from commercial businesses; (5) maximizing water percolation during winter storms by reducing surface runoff from impermeable surfaces into the creek; and (6) protecting lower Creek baseflow in the spring and summer from water diversion and extraction to prevent channel dewatering and provide fast-water feeding habitat for steelhead. Agency planning must reflect these major goals.

1.1. Policies and Actions for General Habitat Restoration and Protection

1.1.1. The City will work with the City's fisheries biologist to identify and map (within the City limits) immediately critical microhabitats for steelhead and tidewater goby (such as potential fish habitat or pollutant gateways) requiring protection, habitat restoration, or other action. Aerial photos can be utilized.

1.1.2. The City will define immediate and long-range projects to enhance fish habitat.

1.1.3. The City will create "experimental habitats" that will provide escape cover for juvenile steelhead to avoid bird predation (refer to **Appendix H** (page 141)). This effort will be coordinated with streambank stabilization projects.

1.1.4. The City will restore critical fish habitat in the lagoon and support restoration efforts in the upper creek. Recommended efforts above the lagoon are outlined in the Soquel Creek Watershed Assessment and Enhancement Plan (**2003**).

1.1.5. The City will propagate native trees in critical areas to insure a continuous riparian canopy.

1.1.6. The City shall request Begonia Festival participants to propel floats from shore or with a limited number of people on surfboards rather than by people walking in the creek. If wading is deemed necessary, The City shall perform 3 years of pre- and

post-festival water quality monitoring for biological oxygen demand and hydrogen sulfide concentration, along with the current monitoring of turbidity and dissolved oxygen. Important statistics will be recorded, such as number of floats, number of waders and number of surfboard paddlers each year. This monitoring will help determine if wading has significant impacts on lagoon water quality. Barring such monitoring, the Department of Fish and Game (CDFG) believes that festival participants should be discouraged or prohibited from wading (**Urquhart 2002**). As conditions of the permit, the City will allow passage of floats in one direction only, presumably downstream and then to the dismantling location near the Stockton Avenue Bridge. In the past, floats were walked down the lagoon and then back upstream through the lagoon before dismantling at the lower end near the bridge.

1.1.7. The City will request that the CDFG include in the fishing regulations that no fishing may occur at streamflows when adult steelhead have difficulty passing upstream. Request that the CDFG arrive at this minimum streamflow determination that will allow adult fish movement. The City will request a regulation similar to that on the Carmel River where anglers may call and find out the streamflow at the USGS gage on Soquel Creek to determine if sufficient flows exist to allow fishing. This will prevent anglers from snagging adult steelhead that are congregating in deeper pools until sufficient passage flows develop. The Soquel Creek Water District funded an adult steelhead passage study, although the results have not been finalized.

1.1.8. The City shall leave all large woody material in the stream channel as valuable escape cover for steelhead. Cutting it into smaller pieces destroys its value. Rearrangement and cutting of woody material may be required if it poses a flood hazard. Cutting will require a CDFG Streambed Alteration Agreement. Wood rearrangement/ cutting will be supervised by a qualified fishery biologist.

1.1.9. The City will pursue long-range efforts to improve the quality of stormwater runoff with installation and maintenance of silt and grease traps on City storm drains, with the incorporation of a twice-yearly maintenance program for silt and grease traps for commercial properties. All new commercial projects will be conditioned so that the applicant provides to the Community Development Director evidence that a contract is in place for twice-yearly cleaning of all silt and grease traps in the stormwater system.

1.1.10. The City will advocate for the priority inclusion of Soquel Creek in the demonstration Recovery Program for coho salmon with the CDFG and the National Marine Fisheries Service.

1.1.11. The City will work with the six-county effort to analyze policies regarding fishery issues.

1.1.12. The City will consider either replacing the Stockton Avenue Bridge with a free-span design or retrofitting the existing bridge to alleviate the danger of wood jamming on it during high stormflows.

1.2. Policies and Actions for Management and Enhancement of Riparian Vegetation Resources

Situation: There are significant opportunities for improving and managing the native riparian vegetation resources along Soquel Creek. Improvements to native riparian vegetation resources will provide benefit to the overall botanical diversity of the creek, conserve native plant communities, and contribute to improved water quality (reduced water temperatures) in the creek. These opportunities are present throughout the creek; specific actions will vary depending upon the vegetation type and its location along the creek. All actions will require the participation of willing landowners. **Table 3** (page 54) displays the key botanical problems along the creek and remedial opportunities. Removal of vegetation must be consistent with the Environmentally Sensitive Habitats Ordinance.

1.2.1. Landowners will be encouraged by the City to preserve and manage the native riparian habitats on their properties. The City will re-publish and re-distribute the Stream Care Guide prepared as an enhancement project in the original Management Plan.

1.2.2. The City will solicit participation from landowners and City residents in implementing management and enhancement activities along the creek.

There are currently few incentives given to landowners to encourage voluntarily improvements to native habitats on their property, despite that these habitats are protected by both City policy and State regulations. There need to be more incentives for these activities. Examples include streamlining permits for the removal of invasive, non-native trees, waiving permit fees, and the City (and County assessor's office) providing property tax credits to property owners who implement habitat restoration and commit to maintaining a continuous native riparian corridor on their property; City-sponsored creek clean-up days; City-sponsored training days; and City-sponsored dumpster service (for removal of invasive, non-native plant species).

1.2.3. The City will encourage restoration of degraded portions of the riparian corridor through riparian revegetation of residential areas. The City will provide incentives for property owners living adjacent to Soquel Creek to encourage enhancement of riparian and wildlife habitat. In addition, the City shall require planting of riparian vegetation during the development review process. The desire is to improve riparian cover and increase lagoon shading in order to reduce summer lagoon temperatures.

City Property Adjacent to the Stockton Avenue Bridge: Restore riparian habitat with appropriate plants resistant to saltwater spray and the saline estuary. The restoration plan may include removal of the pump station adjacent to the bridge. The purpose of the riparian vegetation would be to provide lagoon shading and/or overhanging cover for juvenile steelhead. The riparian restoration would serve as a model for other properties along Soquel Creek.

Yards Fronting the Creek along the Downstream Portion of Soquel Creek (Riverview Avenue Area): Encourage the establishment of woody riparian cover by having landowners plant a minimum of 1 native riparian tree per parcel (approximately 30 feet on-center) to provide some riparian cover along the creek. Encourage landowners to plant native understory plants and incorporate bio-technical bank protection techniques during the replacement of existing retaining walls. Require riparian habitat enhancement and management as a condition of permit approvals for site improvements.

All Landowners with Yards Fronting Soquel Creek: Encourage landowners to maintain and enhance native riparian vegetation along the creek bank. Encourage landowners to remove invasive plant species, to re-plant with native trees, shrubs, and groundcovers, and to incorporate bio-technical streambank protection techniques during any bank stabilization or erosion repair work. Require riparian habitat enhancement and management as a condition of permit approvals for site improvements.

1.2.4. The City will strive to increase native plant species diversity through revegetation and control/removal of occurrences of invasive, non-native plant species. Removal of non-native vegetation along with revegetation with native riparian vegetation can better stabilize streambanks and provide better stream shading than current invasives. Non-native invasives also discourage or prevent re-establishment of native vegetation. Work must be consistent with the Environmentally Sensitive Habitat ordinance.

Remove ivy (English and Cape ivy) from native trees. Ivy stems should be cut and plant materials pulled from the trees (as much as feasible).

Remove pampas grass from the riparian corridor. Plumes should be cut and removed; root crowns should also be removed

Remove French broom, giant reed, and acacia. Plants should be hand-removed, with cut materials removed from the site.

Areas for Restoration:

Rispin Mansion Open Space: Remove ivy (English and Cape ivy) from native trees; remove and control French broom, pampas grass, and acacia.

Riparian Corridor between Highway 1 and Peery Park: Remove ivies (English and Cape) from native trees.

West Bank of the Creek Upstream of the Railroad Trestle: Remove ivies (English and Cape) from native trees.

Creek Banks between the Shadowbrook Restaurant and the Stockton Street Bridge: Remove pampas grass.

Redtree Property Downstream of Highway 1: Remove pampas grass, giant reed, acacia, and French broom.

CalTrans Highway 1 Right-of-Way: Remove French broom, pampas grass, and acacia.

1.2.5. The City will utilize vegetation as part of stream bank erosion control and streambank stabilization projects (i.e., the use of bio-technical streambank stabilization techniques where feasible). Refer to **Appendix C** (page 110) for revegetation guidelines. Refer to **Figure 14** (page 171) in this Plan Update and the California Salmonid Stream Habitat Restoration Manual (**Flosi and others 1998**) in the Project Implementation Part VII for bio-technical approaches to streambank stabilization.

Table 3. **Summary of Opportunities and Constraints for Riparian Vegetation Enhancement and Management along Soquel Creek.**

OPPORTUNITIES	CONSTRAINTS
Maintain existing riparian forest to benefit native species richness and diversity.	Need participation from landowners. Need to educate landowners of the benefits of maintaining intact riparian forest habitat. Need to educate landowners of City and State regulations relating to removal of riparian vegetation.
Restore degraded riparian areas to benefit native riparian biodiversity (e.g., control erosion from stream banks, remove invasive, non-native plants, install native plants). Opportunity to obtain grants, which may help pay for cost of restoration	Need participation from landowners. Need to educate landowners of the benefits of maintaining intact riparian forest habitat and the value of removing invasive, non-native plant species. Potential cost of enhancement and management, such as special labor needs (tree removal for invasive trees), tools, revegetation materials, dumpster services. Need to train landowners in techniques for the removal of invasive plants. Need to train landowners in techniques of planting and maintaining riparian revegetation areas. Need to require use of bio-technical bank slope protection and riparian enhancement and management as part of City permitting action for site improvements.
Encourage use of bio-technical bank slope protection	Need to train landowners in techniques of bio-technical bank slope protection. Need to require use of bio-technical bank slope protection as part of City permitting action.
Develop and outreach programs to local volunteer groups (e.g., Santa Cruz Bird Club, Friends of Soquel Creek, Mid-County Senior Center, etc.) and partnerships with educational institutions to encourage them to conduct and monitor enhancement and management actions.	Need participation from landowners. Need to educate participants on techniques to monitor riparian resources. Potential cost of enhancement and management actions and monitoring.

1.3. Policies and Actions for Lagoon Preparation and Sandbar Construction

Situation: Currently, the City may install an artificial sandbar at the mouth of Soquel Creek in the week prior to the Memorial Day weekend or afterwards. The City notifies CDFG of the date of closure and obtains the necessary CDFG 1601 agreement to close the estuary. After the 1601 agreement is made, the City notifies the Coastal Commission, Army Corps of Engineers, the monitoring group, and streamside businesses/residents of the date of closure. In order to prevent adverse impacts of artificial sandbar installation, the City will carry out the policies and actions outlined below:

1.3.1. The City shall perform all grading from the beach only. No grading of the channel bottom in the area of the summer lagoon embayment shall be undertaken except to eliminate sharp drop-offs within 25 feet of the culvert (flume) entrance and immediately along the sandy shore of the first 10 linear feet of the lagoon bottom (below the elevation of the top of the culvert, from Venetian Courts on the west to the pilings adjacent to the restaurants on the east side). Kelp shall not be buried in the lagoon. Heavy tracked equipment shall not be used in the lagoon area for kelp removal. Only hand rakes and shovels shall be used for kelp removal.

1.3.2. The City shall screen the intake pipe to the pump used to pump water from the channel adjacent to the flume into the flume to clear it of sand. This will prevent intake of fish.

1.3.3. The sandbar shall be installed during the lowest tide occurring within the week prior to the Memorial Day weekend or after, when the estuary is at its minimum depth, in order to reduce salt water present after sandbar installation.

1.3.4. The City shall minimize the number of days required to stockpile sand, prepare the flume inlet for fish passage, construct the sandbar, and rake out the decomposing organic material in order to minimize the artificial fluctuation of the lagoon water level. The City shall provide a maximum number of personnel to rake decomposing organic material into the bay and to clear the flume of sand in order to minimize the days needed to prepare the lagoon for the summer.

1.3.5. To minimize the time required for sandbar construction, the City shall also remain flexible on the timing of the work. If rain is in the forecast within 2 days after the intended starting date for sandbar construction, Public Works shall postpone construction until clear weather is forecasted. If 4–5 working days are set aside to construct the sandbar, the sandbar construction may be delayed as late as 4–5 days

before the Memorial Day weekend yet may still satisfy the tradition of lagoon formation before that weekend.

1.3.6. As stipulated in past Streambed Alteration Agreements with the Department of Fish and Game, the City shall 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. The specific mechanisms/procedures shall be developed during the permitting process. Sufficient City staff shall be assigned to quickly rake out decomposing kelp and clear the sand-filled flume.

1.3.7. The City shall dispose of kelp in the Bay rather than bury it in the sandbar. It will be disperse up and down the beach. County Environmental Health approved this method as long as kelp is spread over a wide area (**J. Ricker, pers. comm.**).

1.3.8. During sandbar construction, the City shall continue to close the lagoon each day before the incoming tide can wash salt water and kelp into the lagoon. The City shall re-open the sandbar and unplug the flume each morning, if necessary, at low tide to drain out more kelp.

1.3.9. The City shall construct the sandbar sufficiently high to reduce the likelihood of tidal overwash during the summer. Creation of a temporary ponding area on the beach may be required.

1.3.10. The City shall retain large woody material in the lagoon for fish cover. Rearrangement of wood may be required for flood control purposes. A qualified fishery biologist shall supervise any rearrangement activities.

1.3.11. Before the sandbar is closed the first night of sandbar construction activities, the City shall remove sand from the culvert (flume) to allow passage of water and salmonid smolts through the flume and to prevent flooding.

1.3.12. To speed the conversion of the lagoon to freshwater, the City shall use the fishgate/shroud that was designed by the CDFG on the flume entrance to draw salt water off the lagoon bottom, if necessary, for one to two continuous weeks after sandbar closure. The top flashboard on each side shall be notched 3-4 inches deep and 6 inches wide to focus water and facilitate juvenile salmonid smolt out-migration. If adult steelhead are seen in the lagoon at this time, the shroud may be removed from one side of the flume for a week with an underwater portal 8 inches square shall

be cut in the in the existing flashboards on that side to allow adult out-migration. The improved flume inlet will also provide this portal. Fish and Game and the National Marine Fisheries Service shall review the exact dimensions of this configuration. After this week period, City Public Works shall reinstall the shroud with the original flashboard. The shroud shall be left on the flume entrance for longer periods to pull poor-quality water off the bottom, provided there is sufficient flow to keep the culvert open to the bay.

1.3.13. In the event that a storm is forecasted after sandbar closure or high spring streamflow requires high-flow capacity through the flume, the City shall remove the shroud on one side of the culvert along with 2 or more flashboards in order to increase the flow capacity of the culvert. For public safety, the culvert opening is to be covered with 4-inch by 6-inch meshed screening, with the longest dimension in the vertical direction. Further, the manhole cover situated on the top of the culvert, closest to the flashboards, will be removed, if necessary. It, too, is to be screened for public safety. If the storm does not materialize or once streamflow has subsided after the storm, the flashboards and shroud shall be reinstalled as soon as possible.

1.3.14. The City shall annually evaluate the structural integrity of the flume and its supports. Repair cracks and supports as necessary.

1.3.15. The City shall hire a qualified fishery biologist to monitor sandbar closure, sandbar breaching, and lagoon water quality throughout the summer lagoon period and to provide annual reports to the City. The City shall include the recommendations provided in these reports in future management policies related to the summer lagoon.

1.3.16. The City shall submit necessary monitoring reports on sandbar closure and lagoon monitoring to the U.S. Army Corps of Engineers and other regulatory agencies.

1.3.17. The City will request from Cal-Trans that they shield Soquel Creek from lights on Highway 1.

1.4. Policies and Actions for Management of the Lagoon for Fishes and Maintaining Fish Passage through the Flume

Situation: To maximize water quality and fishery habitat in the summer lagoon, the City must maximize lagoon depth, insure sufficient stream inflow to the lagoon and maintain smolt passage. Fluctuation in lagoon level must be minimized until the sandbar actually breaches. Sustaining

lagoon habitat until later in the fall when storm frequency and streamflows increase will maximize the lagoon's benefit to juvenile steelhead. Out-migration to the ocean shall be insured through the culvert for adult steelhead through June 15th and for steelhead smolts until June 30th. This requires a notch in the top flashboard, 3-4 inches deep and 6 inches wide under existing conditions and a 4–5 inch wide opening at the entrance in the improved flume inlet to allow smolts to easily pass from the lagoon into the culvert. Fish and Game and the National Marine Fisheries Service shall review the exact dimensions of this opening. Notching the top flashboards focuses water and makes the shrouded flume entrance passable to smolts. Sufficient water depth in the culvert must also be maintained.

1.4.1. The City shall immediately ameliorate sewage spills into the lagoon. As was done in 1996, an effort will be made to dilute the sewage and flush it out of the lagoon by removing flume flashboards. The lagoon may be lowered approximately one foot without a significant increase in fish predation when refilling may occur overnight. The California Department of Fish and Game shall be notified immediately after the spill, and the lagoon shall be partially drained immediately after the sewage spill with their approval. In the future, the City will require that maps and cautious excavation be employed to avoid future accidents that could contaminate the lagoon.

1.4.2. If early storms create turbidity that prevents light penetration to the lagoon bottom, the City shall lower the lagoon level until the bottom becomes visible. This will allow algal growth despite the high turbidity. Plant photosynthesis will produce oxygen and prevent anoxic conditions. The shroud shall be used to pull anaerobic layers off the bottom to exit the lagoon. The City shall re-establish maximum lagoon depth after turbidity has subsided. The City shall not breach the sandbar artificially to release organic material from the lagoon in early fall.

1.4.3. Road repaving and application of petrochemicals shall be done early in the summer. This will allow penetration and drying before fall rains.

1.4.4. Although no adverse impacts have been detected from the Begonia Festival, the City will ask Begonia Festival participants to propel floats with paddlers on surfboards or in boats instead of wading through the lagoon.

1.4.5. To prevent water quality problems in the lagoon, the City shall issue a permit to the organizers of the Begonia Festival stipulating the following: (1) discourage wading in the lagoon to propel floats until 3 years of more extensive water quality monitoring is done before and after festival activities to show that impacts are insignificant, (2) only partially dismantle floats in the lagoon, to the extent needed to carefully remove floats

from the water; (3) the remainder of the dismantling to be done away from the lagoon; (4) begonias at the dismantling site to be disposed of off-site; and (5) remaining begonias to be removed from the lagoon within 48 hours of the end of the Begonia Festival and disposed of off-site. The City Public Works Department shall insure that these steps are taken.

1.4.6. If the lagoon water level begins to drop despite efforts to minimize outlet flow through the flume, the City will begin to daily monitor streamflow at Nob Hill and the Walnut Street walk bridge to determine if the stream becomes intermittent. The City will alert CDFG when the lagoon water level cannot be maintained and when stream intermittency is observed, recording the date at which intermittency is first observed.

1.4.7. If the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, the City will notify nurseries with surface diversions upstream and the California Department of Fish and Game of the streamflow conditions so that water extraction may be reduced or discontinued until flow returns. The goal will be to avoid complete loss of surface flow.

1.4.8. The City shall secure the flume boards so that vandals cannot pry them up and drain the lagoon. This will prevent tidal surges through the flume from doing the same thing.

1.4.9. It is harmful to steelhead to drop the lagoon level in anticipation of a storm that fails to develop and then fail to re-install the flume boards afterwards. Many forecasts for rain and storm intensities are incorrect in the early fall. The City will remove flume boards as the first small storms begin in fall and replace the boards after the stormflow has subsided. Boards will not be removed until rain appears imminent. Upon completion of the flume inlet improvement, the capacity of the flume to pass water without removing boards will be increased significantly. This will reduce the need to lower the lagoon level in preparation for a storm.

1.4.10. The City will attempt to maintain the lagoon in fall until streamflow has increased enough (20–25 cfs) to prevent stranding of spawning adult steelhead or coho salmon and to prevent osmotic stress to lagoon- inhabiting steelhead. If necessary, the City will install a perimeter fence with 2"x 4" 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. The goal will be to maintain the lagoon until approximately Thanksgiving, in late November, before allowing stormflow to breach the sandbar.

1.4.11. In drought years, if surface streamflow becomes intermittent upstream of the lagoon, thus stranding juvenile steelhead, the City will make emergency inquires to the Department of Fish and Game as to the cause of dewatering and measures to be taken to prevent fish mortality. Twelve years of lagoon censusing indicates that in most years, the number of juvenile steelhead inhabiting the lagoon is less than 1,000, although it supported an estimated 2,700 juveniles in 1993 with water quality similar to other years. This implies that the lagoon can support many more juveniles in most years than typically utilize the lagoon, making it an appropriate location to place rescued fish.

1.4.12. The City will obtain "No Fishing" signs from CDFG and post them at the lagoon and downstream of Highway 1 during the off-fishing season.

1.4.13. If algal mats are determined to be causing water quality problems related to oxygen supply, or are deemed aesthetically detrimental, the City shall remove them manually downstream of Stockton Avenue Bridge. This can be done with two maintenance personnel, skimming algae off the surface with a wooden beam and collecting it on a floating barge. Use no chemicals to kill algae.

1.4.14. The City shall maintain the underwater portal in the flume intake for out-migration of adult steelhead until June 15.

1.4.15. The City shall maintain a notched top plank at the top of the flashboards in the flume inlet for out-migration of smolts until 1 July.

1.4.16. The City shall annually re-install the 1-foot-high baffle inside the flume as needed for safe entrance of out-migrating smolts into the flume inlet.

1.4.17. The City shall continue to maintain a 6- to 8-inch depth at the outlet of the flume until July 1. The City shall install 4" x 4" planks in the outlet, if necessary, as George Heise (CDFG passage expert) originally recommended.

1.4.18. The City shall remove sand at the ocean end of the culvert (daily, if necessary) through July 1st in order to assure fish passage.

1.4.19. In the fall, during the first early storms that do not completely breach the sandbar, fish passage for spawning adults need not be maintained through the flume, and in fact will 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 be

unable to migrate upstream because of insufficient streamflow.

1.4.20. Trees that have naturally fallen into Soquel Creek shall remain undisturbed to provide fish habitat. Rearrangement of fallen timber may be required for flood control purposes. A qualified fishery biologist shall oversee any rearrangement.

1.4.21. Trees, 6 inches or greater diameter at breast height (dbh) that are to be cut on property adjacent to Soquel Creek after obtaining the necessary City permit for tree removal, shall be felled into the creek (branches intact), to provide fish habitat. Length of the pieces shall be maximized to the extent that safety will dictate during the felling. Cut trees and shrubs trimmings less than 6 inches dbh shall not be dumped into the lagoon or creek.

1.4.22. The City shall continue to annually monitor numbers of juvenile steelhead in the lagoon as required in their Army Corps permit to construct the sandbar and will pursue funding to continue censusing the steelhead population throughout the watershed.

1.5. Policies and Actions for Emergency Sandbar Breaching

Situation: Lagoon water quality and steelhead survival are maximized if the sandbar is maintained until approximately Thanksgiving, while passing early stormflows through the flume by removing flashboards (or operating an upgraded inlet structure). If the sandbar breaches prematurely, it allows kelp and saltwater to enter and become trapped after the sandbar re-closes. Decomposing kelp and saltwater cause water quality deterioration for steelhead and aesthetic problems for streamside residents and businesses. Fish passage need not be maintained through the flume and shall be discouraged in fall until sufficient stormflow develops to provide passage upstream. If adult salmonids enter too early, they may become stranded with insufficient streamflow to migrate.

1.5.1. City of Capitola Public Works shall notch the sandbar in fall at an elevation slightly lower than that of 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, notch the sandbar to prevent flooding. By notching the sandbar, runoff from a larger, late fall storm will breach the sandbar prior to flooding. Make the notch 20-30 feet wide so as to minimize the downcutting during sandbar breaching and maintain estuary depth after breaching.

1.5.2. The City shall post warning signs to instruct the public to avoid the sandbar notch

and surrounding beach when sandbar breaching appears imminent.

1.5.3. The City shall notify their lagoon biologist prior to any anticipated emergency breaching and/or facilitated natural breaching to allow monitoring.

1.5.4. The City shall remove flashboards as needed immediately prior to the forecasted approach of the first storms in fall to lower the lagoon water level and to increase the outflow capacity of the culvert. The specific procedure for removing boards (how many to remove and how much the lagoon level shall be reduced in expectation of impeding flood flows) needs to be specified in the Fish and Game 1601 agreement. This will delay the need for sandbar breaching until the arrival of larger winter storms and runoff capable of keeping the lagoon open. This will mimic or even enhance natural conditions and reduce maintenance. However, large, repetitive reductions in lagoon volume in expectation of storm flows may be detrimental to aquatic species inhabiting the lagoon.

1.5.5. If necessary, the City will clear the sand away from the top of the flume back to the first porthole cover beyond the flume inlet to delay sandbar breaching. As stated in the 1993 monitoring report, management options to delay sandbar breaching include installation of a perimeter fence around the flume inlet to collect algae and the opening of the first flume portal behind the flume inlet. The portal must be screened and isolated from human access to prevent a hazard to public safety. The City shall replace the boards after the stormflow subsides, removing them for each succeeding storm until the sandbar is eventually breached during later, larger storms, usually occurring after Thanksgiving. The City shall remove the first flume portal cover and screen it if the entrance of the flume and the grated opening in the flume ceiling cannot handle the volume of the stormflow in October and early November. After the stormflow subsides, the City shall replace the cover until the next storm.

1.5.6. 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, the City will attempt to pull the decomposing kelp out of the stagnating lagoon. This will be done by opening the flume and encouraging streamflow out with the shroud installed and lagoon depth maximized. Specifics for how this is done shall be clearly stated in the CDFG 1601 agreement.

1.5.7. The City shall not breach the sandbar artificially to release organic material from the lagoon in early fall. Breaching of the lagoon will increase the opportunity for more kelp to enter and probably will not empty the entire lagoon anyway. If a stagnant,

kelp-filled lagoon forms in fall after an early breach and a dry period, the flume shall be used to pull salt water out.

1.5.8. The City shall upgrade the flume inlet (see recommendation 1.4.1.) to more easily open the flume inlet and prevent flooding before the sandbar breaches.

1.6. Policies and Actions for Sediment Reduction

Situation: Stream sedimentation reduces steelhead spawning success, insect productivity and juvenile rearing habitat. It shallows the summer lagoon, leading to poor water quality. Efforts to remove sediment from the creek or lagoon (except behind sediment catchment basins) would be damaging to water quality in the vicinity of dredging, would not likely be allowed by regulatory agencies and would not address the root causes of sedimentation. Refer to **Table 4** (page 65) for opportunities for fishery enhancement in Soquel Creek and Lagoon.

1.6.1. The City will support watershed efforts to treat sediment sources, such as landslides, eroding streambanks, and gullies, with appropriate erosion control/land-stability measures. The City will seek funding for proposal writing to seek funding of feasibility studies and corrective measures of significant sediment sources, such as the eroding streambank between the lagoon and Highway 1 in Capitola, the eroding streambank at the Whitehead bend upstream of the Bargetto Winery, as well as landslides and associated streambank erosion detected in Bates, Amaya and Hester creeks, Grover Gulch and the upper West Branch during field surveys in preparation of the Soquel Creek Fisheries Assessment and Enhancement Plan (**2003**).

1.6.2. The City will, with staff resources permitting, review timber harvest plans submitted to the California Department of Forestry (CDF) for the Soquel Creek watershed and make recommendations for reducing erosion and sediment flow into the watershed.

1.6.3. The City will submit a letter to the State Board of Forestry to add regulations that provide no cut/no entry buffers along all stream courses (perennial and ephemeral). The City will submit an additional letter to NOAA Fisheries requesting that they review timber harvest plans and protect riparian corridors from logging.

1.6.4. The City will support erosion control measures to reduce sedimentation during late season stormflows.

1.6.5. The City will submit a letter to the County of Santa Cruz to monitor progress on one currently known source of Creek sediment, the slide on Highland Way. Contact

NRCS and the Santa Cruz County Resource Conservation District concerning a volunteer effort to stabilize the area after the slide is removed.

1.6.6. Where feasible, the City will retrofit City storm drains leading into Soquel Creek with detention basins that will collect surface runoff and meter it out at a slower rate and reduce streamflow flashiness. Refer to the policies and actions regarding the Rispin Mansion.

1.6.7. The City will pursue funding for proposal writing to obtain funding to study the feasibility of using the Bates Creek Dam as a sediment catchment basin. Reduction in sediment input to Bates Creek and lower Soquel Creek offer significant opportunity to reduce sediment impairment of the lower creek and lagoon and to create better spawning conditions in Bates Creek.

1.6.8. The City will support efforts to locate and develop long-term sediment spoil sites in the watershed. Substantial sediment is removed from inside ditches and road surfaces during the winter months due to general erosion and removal of landslide debris. Rather than depositing this sediment at road turnouts or on the outside edge of road surfaces adjacent to streams, established sites are needed for effective disposal of sediment.

1.6.9. The City will support watershed management efforts to retain wood clusters in Soquel Creek to increase channel complexity (scouring of deeper pools and provision of fish cover) and to create steep, constricting riffles adjacent to the wood clusters that cause bar formation. This will increase spawning habitat in this sediment-laden stream.

1.6.10. The City will support efforts of Fish and Game to obtain a conservation easement or purchase of open space land in the Soquel Village and Capitola area where urban surface runoff may be piped and infiltrated more slowly into the groundwater.

1.6.11. The City will support County and private efforts to reduce erosion from unpaved rural roads, such as timber harvest roads. Ways to reduce such erosion were included the Zayante Area Sediment Study in the San Lorenzo River drainage (**Swanson and Dvorsky 2001**). Items included surfacing of year-round access roads, 5-year monitoring and maintenance periods of unsurfaced roads after land-use activities, such as logging, are completed, fixing of erosion problems on legacy roads prior to re-occurring rural and use, and certification of all grading on inner gorge slopes by a Registered Engineering Geologist.

Table 4. Opportunities for Fishery Enhancement in Soquel Lagoon & Creek

OPPORTUNITIES	CONSTRAINTS
Reduce fecal coliform bacteria in the lagoon Improve lagoon water quality	Need to enact gull and pigeon management measures Must reduce water pollution in summer/fall lagoon Must re-stencil storm drains Must protect permeable surfaces during development Imperative to reduce water temperatures in lagoon Must install and maintain silt and grease traps on storm drains (in progress) Commercial businesses need to install and maintain silt and grease traps entering the stormdrain system Need to clean parking lots prior to fall storms Must continue to rake kelp out of lagoon at sandbar closure Must insure light penetration to the bottom after first fall storm by lowering the lagoon level
Restore coho salmon and increase juvenile steelhead in the lower watershed	Imperative to reduce weekly average summer water temperature to 16–17ºC to satisfy coho salmon requirements Must leave large woody material in the stream channel Necessary to restore riparian corridor with tall trees Need to protect instream flow through conscientious water extraction and water conservation during water shortage Will have to stock Soquel Creek with juvenile coho to re-establish the run
Maximize lagoon water depth	Water conservation measures needed Requires reduction of sedimentation to the lagoon/creek Necessitates maintaining adequate summer stream inflow Need to improve regulation of lagoon water level; must mandate that peddle boat concession not dictate lagoon water level Must increase diligence in manipulating flashboards/ new system (in progress) Must prevent breach sandbar too early in the fall Must prevent vandalism to flume inlet
Provide environmental education	Funding needed Need to provide a permanent venue (Capitola Library and Park) Qualified staff must be hired
Reduce potential for flood damage to lagoon residents Reduce streambank erosion and sedimentation basin-wide Reduce streambank erosion between Nob Hill and Hwy 1 and basin-wide	Must prevent woody debris jam at Stockton Avenue bridge Must build a free-span bridge or retrofit the existing bridge to alleviate the problem Must resolve the conflict between leaving woody material in the creek to provide fish and wildlife habitat versus cutting it up to reduce potential jams on bridges and flooding Removal of wood for flood control/prevention as part of any ongoing stream channel maintenance program requires a Fish and Game 1601 Agreement. Must address watershed issues—such as establishing no cut buffer strips along streams during logging and the threat of increased surface runoff from development and more impermeable surfaces Must preserve permeable surfaces and open space Must detain surface runoff from impermeable surfaces Must increase diligence in manipulating flashboards/louvers (in progress) Revegetation of riparian corridor imperative Streambank stabilization projects needed; must revegetate

OPPORTUNITIES	CONSTRAINTS
	streambanks
Restore riparian corridor	Need to educate streamside residents to protect riparian habitat Must revegetate riparian border of lagoon, including City property adjacent to the Stockton Avenue Bridge as a model Must remove non-native trees and plants Must discourage streamside development that threatens to reduce riparian vegetation

1.7. Policies and Actions for Reducing Summer Water Temperature

Situation: In the Mattole River system (northern California) coho were found only in tributaries where the maximum weekly average water temperatures were 16.7ºC (62ºF) or less and the maximum weekly maximum temperatures were 18.0ºC (64ºF) or less (**Welsh et al. 2001**). For further details, refer to **Appendix E** (page 121). Because of the generally sandy substrate in the Soquel Creek system, and the presence of steelhead, the temperature limits found in the Mattole River are the appropriate goal for re-establishing coho in the low gradient portions of the middle Soquel Creek watershed from the Moores Gulch confluence to the beginning of the canyon, upstream of the Olive Springs quarry (Reaches 7-10; **Alley 2002**). Soquel Creek. In Scott and Waddell creeks in Santa Cruz County, coho were found at warmer sites, but only where the pools were very productive (small pools, abundant algae, extensive and productive riffles upstream of the pools) (**Smith pers. observation**).

Because of the existing spawning challenges for coho and typical summer water temperatures found in the mainstem below the Moores Gulch confluence, no acceptable water temperature goal can realistically be attained for coho downstream of Moores Gulch. It is highly unlikely that coho salmon can successfully spawn in the mainstem Creek below the Moores Gulch confluence in most years (**Appendix J**; page 144).

Steelhead are tolerant of higher water temperatures than coho salmon. In Soquel Creek, water temperature is primarily a food issue. In lower Soquel Creek and the lagoon, water temperature is probably not directly lethal. But higher temperatures increase food demands and restrict the steelhead to faster habitats for feeding, especially above 21ºC (70ºC) (**Smith and Li 1983**). For more details, refer to **Appendix E** (page 121). The lethal level for steelhead would probably be above 26-28ºC (79-82ºF) for several hours during the day. But this is rarely, if ever reached, unless significant tidal overwash has occurred in the lagoon. Even so, warmer temperatures could result in slow growth or starvation in steelhead if food supply becomes very limited. As part of annual steelhead monitoring on the San Lorenzo River in 1997-2001, Alley (**2001**) regularly measured water temperatures of 21ºC+ (69.8ºF+) in August and September in the lower and middle River in a number of reaches from Paradise Park to Brookdale, except during the cool

and high-flow summer of 1998.

Regarding Soquel Creek Lagoon in summer, where food is more abundant than upstream, a management goal for steelhead shall be to maintain water temperature at or below 20ºC (68ºF) at dawn within 0.25 m of the bottom and an afternoon maximum below 22ºC (71.6ºF) near the bottom. Maximum daily water temperature should not reach 26.5ºC (79.5ºF). Water temperatures above 20ºC (68ºF) are considered limiting to juvenile coho salmon in the presence of steelhead (depending on food abundance), and temperatures below 16ºC (60.8ºF) are preferred (**J. Smith, personal communication**). Therefore, the management target for making Soquel Creek Lagoon habitable for coho shall be to maintain summer water temperature below 20ºC (68ºF). However, we do not believe that Soquel Creek Lagoon may be cooled sufficiently for juvenile coho salmon.

The management goal for steelhead regarding water temperature in stream habitat upstream of the lagoon shall be maintenance below 20ºC (68ºF) in April and May. This is when baseflow still remains above summer low-flow conditions and juvenile salmonids are feeding and growing rapidly. From June 1 to September 1, the water temperature shall not rise above 20ºC (68ºF) more than 4 hours a day (15% of the month) and preferably the maximum daily temperature, averaged weekly, shall not rise above 21ºC (70ºF). Refer to Table 4 for opportunities for fishery enhancement in Soquel Creek and Lagoon.

1.7.1. The City will determine locations where riparian vegetation is lacking from the Soquel Creek Assessment and Enhancement Plan and offer support in the design and implementation of specific revegetation projects to achieve a reduction in water temperature in Reaches 7–9 of the middle watershed (**Figure 4**; page 161). The goal will be to bring maximum weekly average water temperatures in summer/fall down to 16.7ºC (62ºF) or less and the maximum weekly maximum temperature down to 18.0ºC (64ºF) or less (see **Appendix E** (page 121) for temperature considerations for coho salmon habitat). The Department of Fish and Game concurs with these temperature targets (**Urquhart 2002**).

1.7.2 The City will follow policies and actions in Section 1.2 to protect and restore the riparian corridor within the City limits.

1.7.3 The City will endeavor to protect stream inflow to the lagoon, maximizing it in drier years.

1.7.4 The City will reduce chance of tidal overwash by constructing a high sandbar.

2) HIGH BACTERIAL COUNTS IN THE LAGOON AND ALONG THE BEACH

Situation: Fecal coliform counts need to be reduced sufficiently to allow human contact in the lagoon and prevent beach closings by reducing inputs of fecal coliform bacteria. Past work has identified bird excrement as the primary source of fecal coliform to the lagoon. Reduction of bird excrement will also reduce nutrient inputs, algal blooms, and oxygen depletion.

Policies and Actions for the Reduction of Gull and Rock Dove Populations in an Effort to Reduce Bacteria in the Lagoon

2.1. The City will enact policies and actions for the reduction of non-point-source pollution (Section 7).

2.2. The City shall enact policies and actions for lagoon preparation and sandbar construction (specifically, those regarding the raking and disposing of kelp from the lagoon) (Section 1.3.).

2.3. The City will install gull-proof trashcans on the beach. Use enough gull-proof refuse cans on the beach to satisfy the demand for refuse disposal.

2.4. The City will pursue plans to control Esplanade restaurant runoff (which includes avian fecal matter) by hooking up roof and deck runoff to the sewer system. Commence this effort by initiating discussions with the appropriate agencies. Seal off storm drains on the west side of the street in front of the Esplanade. This will occur from May 15 to the time of sandbar breaching in the fall. Remind restaurant owners that sidewalk cleaning during the summer is to be done by steam cleaning rather than by water hose. Seal sidewalk grates along the Esplanade during the same period. This will reduce pollution from restaurant clean up. (Many smokers leave cigarette filters on sidewalks, which are then swept or washed into storm drains. These filters are mistaken as food by fish and ingested if they reach the water. This may cause serious digestive problems and potential fish mortality.)

2.5. The City will encourage and facilitate installation of "gull sweeps" on Esplanade roofs. These are available from West Marine Products [$32.00 each (in 2000) and 6 feet across]. According to the catalogue, "Powered by the slightest breeze, the Gull Sweep's motion will deter the most determined bird." Effectiveness may be tested first on the roof of one establishment.

2.6. The City will pursue permission and a plan to screen and add prongs to the railroad trestle to discourage roosting of rock doves.

3) WATERSHED PERSPECTIVE/CUMULATIVE IMPACTS ANALYSIS

Situation: Soquel Creek is affected by development, logging, water extraction, flood control measures, etc., outside the City's jurisdiction. Overall management coordination is needed to bring all of the public and private entities throughout the watershed together in a meaningful way. Furthermore, solid information on the extent of all upper watershed influences is needed. More research, comprehensive monitoring, and riparian system models are necessary foundations for appropriate watershed management. Watershed photographs and a map are provided in **Appendix J** (page 144)**.** The City will develop public policies that support watershed awareness, such as developing a watershed component of the Capitola General Plan, including issues raised in the Soquel Creek Task Force document, staff recommendations, and through citizen participation.

Policies and Actions to Increase Capitola's Watershed Perspective and Awareness of Cumulative Watershed Impacts

3.1. The City will incorporate watershed factors into the conservation element of the Capitola General Plan.

3.2. The City will continue discussions with various agencies in the watershed. Support existing watershed restoration efforts and participate in revitalizing a CRMP (Coordinated Resources Management and Planning) group. Join the Blue Circle and other technical advisory committees to establish a format for interagency communication.

3.3. The City will endeavor to support increased commitment to watershed husbandry with programs, funding, and internships.

3.4. The City will work to establish an awards and incentives program for City staff that does environmental work, such as a yearly "Friend of the Creek" award and recognition for a staff-initiated "Creek Public Awareness Project."

3.5. Due to concerns regarding genetic diversity, overstocking, and competition, the City will formulate a letter of concern to NOAA Fisheries and to the California Department of Fish and Game regarding any further introduction of steelhead stock from other watersheds into Soquel Creek.

3.6. The City will develop a resources guide that explains who to call for specific environment-related problems.

4) ENHANCEMENT OF THE RISPIN MANSION PARCEL

Situation: The City has been involved in plans to develop the Rispin parcel into a hotel with the capacity to provide services for weddings. Any new plan needs to consider potential impacts to steelhead habitat in the lagoon. Riparian vegetation needs to be protected in a comprehensive manner that considers vegetation that provides shading to the stream and lagoon. Riparian indicator species and past mapping of vegetation should be considered with input from regulatory agencies. Loss of shade canopy and increased landsliding are potential adverse impacts of site development that need to be adequately mitigated. The lagoon beside the Rispin parcel provides very productive nursery habitat for steelhead. However, water temperatures are usually quite warm. Any loss of lagoon shading may elevate temperatures further and add physiological stress to steelhead. The present storm drain runoff adjacent to the Mansion contributes to high flashiness of stormflow to lower Soquel Creek. Any future development will add to this flashiness unless properly mitigated. The existing Mansion lacks a proper drainage system and the retaining wall is in disrepair. The creek bordering the Rispin parcel is important as a migration corridor for adult salmonids and is an important rearing habitat for juvenile steelhead in the summer lagoon (**Photos 16-18**; pages 71-73).

The eucalyptus grove south of the Rispin Mansion has been used by roosting Monarch butterflies in the past. As part of their overwintering habitat, these areas of Monarch roosting may be considered Environmentally Sensitive Habitat Area (ESHA) by the California Coastal Commission and as such must be protected. Overwintering monarchs require vegetation that retains its leaves in the winter to provide thermal protection during roosting. They need filtered light from a somewhat open overstory where they roost. Monarchs respond to light where they choose to roost in that in the fall they avoid light while in the winter they seek it out to maintain warmth. Non-native eucalyptus and acacia retain their leaves and filter light. In overwintering areas, Monarchs also require flowering plants that provide nectar and a water source, such as morning dew.

According to some Monarch experts, the Rispin site has become degraded by loss of trees during windy winter storms, combined with trimming along Wharf Road. Openings have developed and windbreaks have been lost. As a result, formerly used roosting trees (eucalyptus) are no longer used. Some experts have recommended eventual substitution of alternative tree species to the acacia on the periphery of the roosting area to provide better windbreaks for roosting trees. Red

iron bark, Chinese elm, Flaxleaf paperbark and Cajeput tree have been suggested to provide effective windbreaks and dappled sunlight in the area. They may be preferable to acacia, which are so easily uprooted by wind. Regarding the eventual substitution of other tree species after natural attrition of eucalyptus trees, some Monarch experts recommend postponing plans to plant alternative trees among the eucalyptus until after a period of years have past without Monarch roosting and with approval of the California Coastal Commission and the Department of Fish and Game.

Photo 16. Steep Riparian Corridor with Rispin Parcel on the Right, Looking Downstream from Peery Park Bridge 8 March 2002

Photo 17. Short-cut Pathway Down to Peery Park Bridge 8 March 2002

Photo 18. Undermined Peery Park Bridge Abutment 8 March 2002

Policies and Actions for Enhancement of the Rispin Mansion Parcel

4.1. In any future development of the Rispin parcel, proposed removal of trees will be reviewed with respect to butterfly habitat and particularly if the trees provide shade to the creek and summer lagoon. The City will seek concurrence from the Coastal Commission and consult with NOAA Fisheries and the California Department of Fish and Game on tree removal.

4.2. The City shall protect the eucalyptus grove and patches of redwood trees as valuable sources of shade to the stream, erosion prevention on the steep slope, and as Monarch butterfly habitat (with respect to the eucalyptus trees). However, the City will work under guidance from a monarch butterfly expert and a fishery biologist to allow the eucalyptus grove to disappear by attrition while eventually planting replacement trees. Native trees of tall stature such as redwood may be planted on the canyon slope to provide shade for the lagoon, while other trees may be planted as windbreaks and Monarch butterfly habitat, such as Red iron bark, Chinese elm, Flaxleaf paperbark and Cajeput tree. These substitute trees will provide shade to the lagoon and overwintering and roosting habitat for Monarch butterflies. Plantings among the eucalyptus shall not occur until Monarchs have failed to roost on the Rispin parcel for a period of consecutive years and until approval is granted by the Coastal Commission and the Department of Fish and Game. When plantings are approved, trees will be planted within the eucalyptus grove in areas cleared of debris and fallen eucalyptus leaves on the canyon slope and plateau where at least morning sun is available. Watering of the seedlings will likely be necessary for the first 2-3 years of establishment.

4.3. The City will plant tree seedlings recommended by the monarch butterfly expert on the windward, western periphery of the acacia-dominated area on the plateau south of the Mansion. Encourage tree survival so that they will eventually add to and substitute as a windbreak for the non-native, easily uprooted acacia. Do not remove acacia because they may constitute wind protection for Monarch butterflies and the Coastal Commission (**2001**) may consider them within an Environmentally Sensitive Habitat Area. The City of Capitola LCP (**1981**) states that trees adjacent to the Monarch butterfly overwintering trees need protection because they provide a windbreak for potentially roosting butterflies that may use the larger eucalyptus in the future. **Appendix I** (page 143) provides cost estimates for revegetation efforts.

4.4. The City will revegetate at least a portion of the clearing to the north of the Mansion

with coast live oak and other native species.

4.5. To reduce the flashiness of storm runoff in the storm drain system passing through the Rispin parcel, the City will consult with a drainage engineer to explore the feasibility of detaining runoff from the library parking lot to reduce the peak discharge level to the pre-development rate. If detention appears feasible, the City will make long range plans to install a buried stormwater detention facility.

4.6. To further reduce flashiness of storm runoff, the storm drainpipe buried across the Rispin bench shall be redesigned so as to meter out water at a slower rate. The City will consult with an engineer to determine the appropriate size of any detention tank that might be used for this purpose. One design could be a detention tank that can meter out water at a slower rate, with an overflow that would function if the tank were overwhelmed.

4.7. The City will stabilize the drainage channel leading from the energy dissipater to the creek. One design could be to rock the channel with large cobbles that would not wash way. The cobbles could be grouted with concrete to insure stability.

4.8. The City will ensure repair or replacement of the retaining wall at the top of the slope along the eastern edge of the Mansion.

4.9. The City will replace the fence above the retaining wall to prevent trails down to the creek.

4.10. The City will prevent any increase in impermeable surfaces on the Rispin parcel that would lead to increased surface runoff toward the creek. Construction of any new parking areas or new structures will be accompanied with an effective drainage plan in which increased runoff created by additional impermeable surfaces will be captured as much as possible on the bench without additional overland flow of water down the steep slope toward the creek. Such a plan should include two water detention facilities: one for clean roof/patio runoff and one for parking lot runoff. One design might be to direct runoff from any new parking area on the Rispin site into an open detention and settling basin such that water will drain from the bottom at a metered rate into a culvert and oily pollutants may be removed from the basin and disposed.

4.11. If a road to the Mansion is deemed necessary in the future, the existing paved road will be replaced with porous pavement blocks.

4.12. The City will re-work the compacted, relatively impermeable driveway immediately south of the Mansion so that it becomes more permeable for better percolation of rain.

4.13. Whether new development is approved or not, a drainage plan will be devised such that the bench immediately surrounding the existing Mansion will capture and retain roof and patio runoff from the Mansion and prevent uncontrolled surface runoff toward the creek. If a gutter system is inappropriate for restoration, an alternative design could be a paved ditch constructed around the foundation facing the creek to collect all runoff and feed it into a storm drain system.

4.14. The desire of anglers and others to access the creek will continue to result in unofficial and erodible "way trails" if no formal access trail is provided. To combat this, the City will explore the feasibility of constructing a zigzag footpath to the creek that would be more stable, safer and less erosive than the existing trail that parallels the storm drain down to the energy dissipater. If the trail proves feasible, it will be constructed. Existing trees shall not be removed during construction. The trail shall be designed to avoid the concentration of storm runoff. Making one trail will discourage the network of unofficial trails that was observed. The City shall not make the trail obvious or encourage its use.

4.15. The City will not allow construction of footpaths on the Rispin Mansion parcel other than the one to the creek. Other new trails may necessitate cutting or pruning of existing trees and will prevent future re-vegetation in the footpath location. Reduction in tree canopy and ground cover will be discouraged in close vicinity to the steep slope leading to the creek.

4.16. Proper erosion control measures will accompany any revegetation measures after removal of the invasive non-native plants. Remove ivy and periwinkle from the understory in stages. Strips of exotics may be removed along the contour of the slope, separated by undisturbed strips that may prevent erosion. The cleared strips will be covered with erosion control matting**,** and natives may be planted into the ground through the matting.

4.17. The City will strive to remove Cape ivy from all trees trunks on the Rispin parcel.

4.18. The City will remove the acacia trees down on the floodplain and replant with native alder, big leaf maple, and willow, unless it is determined that they provide a windbreak for Monarch butterflies.

4.19. The City will remove pampas grass in the vicinity of the Peery Park Bridge.

4.20. The City will investigate the source of water flowing under the west footing of the Peery Park Bridge and direct it away from the footing to a stable release point.

4.21. The City will extend the drainpipe to the creek from the walkway grate leading to the Peery Park Bridge.

4.22. The City will plant thorny shrubs, such as blackberry, adjacent to the walkway on the west side to discourage use of a shortcut path. Revegetate the existing shortcut path.

5) EDUCATION OF THE PUBLIC AND CITY STAFF REGARDING PROTECTION OF NATURAL RESOURCES

Situation: The public is generally unaware of the elements of a healthy creek/lagoon ecosystem. Watershed photographs and a map are provided in **Appendix J** (page 144). Many are still uninformed about how their activities affect the quality of the water they wish to enjoy. Education regarding non-point-source pollution is needed. School children are not involved in restoration efforts. The annual return of steelhead goes largely unnoticed instead of being celebrated. Human intrusion into valuable riparian habitats can be limited with trails and viewpoints that educate while containing visitors. "Best management" practices for land use need to be implemented. There is a feeling among some citizens that public agencies are sometimes unresponsive to environmental concerns regarding impacts to the riparian corridor from development and public access. Some feel that riparian protection policies need strengthening, particularly protection from development. Future health of Soquel Creek and Lagoon will require an ecological approach to identifying and protecting vegetation that influences the aquatic environment with regard to shading, nutrient input, erosion control and fish cover.

Policies and Actions for Educational Opportunities

5.1. The City shall enforce the regulations within the Environmentally Sensitive Habitats Chapter 17.95 in order to protect and enhance marine and stream water quality, and environmentally sensitive and locally unique habitats, including riparian and monarch butterfly habitats.

5.2. The City will reproduce and re-circulate the existing Stream Care Guide to residents living along the lagoon.

5.3. The City will enhance public awareness of the elements of a healthy creek/lagoon ecosystem and participation in restoration through media exposure.

5.4. The City will develop and annually circulate the educational flier on non-point-source pollution. The flier may be delivered door-to-door, perhaps by the recycling company.

5.5. The City will identify and/or modify a video for restaurant and shopping center staff about wise water use and avoiding runoff (see existing examples from the Monterey Bay Sanctuary). Distribute the video to Esplanade establishments through the Chamber of Commerce for viewing by employees.

5.6. The City will identify and/or modify a hazardous chemicals flier and disseminate it with the landfill telephone number. See the example from the California Department of Fish and Game. Contact Ecology Action for this flier.

5.7. The City will produce educational placemats to teach children not to feed the birds and to respect the creek habitat. Encourage local restaurateurs to use them.

5.8. The City will create and display a watershed map (contact Ecology Action) at public events, such as the Begonia Festival and Art and Wine Festival.

5.9. The City will pursue long-range plans to establish non-intrusive public "viewing stations" with educational signage along the Creek's riparian corridor where access is available without new trails.

5.10. The City will create educational tools such as "Summer Baseflow Level Today Is HIGH/AVERAGE/LOW" and "Bacterial Count Is ____" signage and newspaper postings to educate water users about seasonal conditions for fish and suitability for human contact.

6) PROTECTION OF INSTREAM FLOW FOR SALMONIDS

Situation: Sufficient passage flows are required in winter and spring for adult salmonids to negotiate more shallow areas (riffles) to reach spawning habitat and for out-migrating smolts to reach the ocean. Proposed winter diversions may potentially reduce winter streamflow

sufficiently to prevent or slow spawning migration in some years. If the creek becomes intermittent in the spring of drought years, smolts will be unable to reach the ocean. Adequate baseflow in Soquel Creek is necessary to provide rearing habitat for juvenile salmonids. Sufficient creek depth also helps maintain water temperatures within levels tolerable to fish. Baseflow may be diminished by increasing development, groundwater pumping of the underflow of the creek, and direct surface water diversions. Paved surfaces and rooftops restrict/inhibit percolation of rainwater that would replenish the groundwater. Surface water runoff is increased, with a more rapid increase in winter streamflow and loss of the water to the ocean. A well-functioning watershed maximally retains rainwater as a catchment basin that releases the water more slowly to the stream during the dry season. Currently, there is a lack of means to declare summer baseflow emergencies, thus delaying the instigation of measures to increase baseflow at critical times when portions of the stream channel become dewatered (**Photo 19**; page 79). Vandalism to the flume has also drained the lagoon at inappropriate times, endangering fish populations.

The California State Water Resources Control Board (SWRCB) administrated an adjudication of Soquel Creek in response to a 1971 petition. The procedure was directed by the Santa Cruz County Superior Court. The final decree was issued in 1977. The adjudication is still supervised by the Superior Court, and there is no Water Master or active regulatory supervision of Soquel Creek water use.

Photo 19. Mainstem Soquel Creek Subject to Dewatering in Drought Near the Walnut Street Bridge and Grange in Soquel Village

In the adjudication, users of creek water were requested in 1972 to provide proof of their creek water use to the SWRCB. The procedure is described in more detail in the Soquel Creek Stream System Order of Determination published by the SWRCB in 1975.

To locate the adjudication document on the Internet, go to the following site:

http://www.waterrights.ca.gov/hearings/Judgements/SoquelCreekJudgement&Decree.pdf

Based on claimed or estimated use at that time, the SWRCB staff assigned 4 classes of water right. The right assignment describes the user's maximum daily use in each of the four classes. The water desired in each class of user must be fully satisfied before water may be apportioned to the next higher numbered class. Within the *riparian* use classes, Classes 1, 2 and 4, water is to be simultaneously shared among all the users of that class in proportion to the user's allotment in that class. This implies that if there is insufficient water to satisfy everyone's right, and someone with a water right complains of not getting enough, then a determination must be made of how much water is available. Then that amount is to be prorated among the users of that class who wish to divert stream flow. The amount of water available must be divided according to the proportion of the total that each water user within a class is entitled to. However, the Class 1 members are guaranteed 250 gallons per day per dwelling. A Water Master is often employed for this kind of regulatory administration and would require appointment by the County Superior Court.

Class 1. This class of water right included riparian users with small allotments of mostly 500-1,000 gallons/day for domestic use only.

Class 2. This class of riparian water right included existing users other than domestic, such as riparian irrigators and other large riparian users at the time of the adjudication, including the Olive Springs Quarry. These users were given assigned rates of daily diversion.

Class 3. This class of water right included appropriative rights that were applied for and granted. Examples of these at the time of the adjudication were the Villa Del Monte Mutual Water Company, the Soquel Union School District, Laurel Community League, Inc., Summit Mutual Water Company and the City of Capitola. These appropriative rights were prioritized sequentially, based on the time of appropriative application. The Soquel Creek Water District has an application submitted but not completed. There were 11 appropriative users with prior application to the City, which has an appropriative right of 3 cubic feet per second. Therefore, these 11 appropriative users

must be satisfied before the City can obtain its 3 cubic feet per second.

Class 4. These were riparian property owners who were not using water at the time of adjudication, but were assigned a water right by virtue of their owning land adjacent to the creek. This is the right with the least priority.

If the creek goes intermittent and a party to the adjudication with a water right downstream of the dry section, such as the City of Capitola, files a water rights protest with the Division of Water Rights that it is not receiving its share of the water, then upstream users within priority Classes 2 and 3 would be required to reduce their diversion rates to allow surface flow to resume. "Water may be diverted under second and third priority class rights for consumptive purposes in any schedule of allotments only during such times as there is a visible surface flow at the downstream end of the stream or reach of stream for any particular schedule." Those diverters without water rights could be prosecuted. The protesting party could petition the County Superior Court for appointment of a Water Master to determine the amount of water available and to meter out the water to those wanting it according to the original adjudication.

Riparian users that were assigned Class 2 water rights at the time of the adjudication could lease their water right portion to the City of Capitola for protection of the fish in the stream, who would be the receiver of instream flow. This procedure is described in State Water Code, Section 1707. The Internet path to this section is as follows:

http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=01001-02000&file=1700-1707

The Internet path to the entire Water Code is as follows:

http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=wat&codebody=&hits=20

This would better protect fish habitat by protecting streamflow leading to the lagoon and inflow to the lagoon. This would occur because Class 2 rights would take precedence over all appropriative rights, which are in the Class 3 priority. Then, if the stream went intermittent, the City could protest and demand that streamflow equal to the amount leased to it by Class 2 users should be allowed to flow in the stream to the lagoon in Capitola, or at least the prorated share.

Hydrologic analysis was performed during development of the original lagoon management plan (**Habitat Restoration Group 1990**). It was determined at that time that lagoon inflow of between 0.15 and 0.2 cubic feet per second was recommended to maintain a stable water surface in Soquel Lagoon. Less than this may result in loss of pool volume and shall be avoided.

Water quality in the lagoon was assumed to be adequate if lagoon level could be maintained. However, 11 years of monitoring lagoon water quality indicate that water quality, with respect to cooler water temperatures, does improve with higher inflow. Also, juvenile steelhead in the stream benefit from higher baseflow with higher growth rates and higher proportions of young-of-the-year fish reaching smolt size the first year in mainstem Soquel Creek (**Alley 2002**; **Soquel Creek Watershed Assessment and Enhancement Plan (2003)**) and the middle mainstem of the San Lorenzo River (**Alley and others 2003**).

Since the development of the original Lagoon Management Plan and more than a decade of lagoon monitoring, the relationship between lagoon inflow and water quality for fish is still imprecise because of the multiple factors that play into water quality. However, the lagoon was clearly warmest during the drought in 1991 and 1992 (a negative effect of less inflow) and was coolest in years of high summer inflow, such as 1996 and 1998 (a positive effect of more inflow) (**Alley 1992-2002a**). This indicated a general benefit from higher lagoon inflow. However, the years 1997 and 2001 had particularly hot periods of water temperature due to tidal overwash, partially independent of lagoon inflow. Other factors besides stream inflow determine water quality, such as the water temperature of stream inflow (dependent on the coolness of the summer climate and the degree of stream shading upstream of the lagoon, along with streamflow volume), the prominence of foggy versus sunny days at the lagoon (also dependent on climatic patterns), the degree of lagoon shading (dependent on the density and stature of riparian vegetation adjacent to the lagoon), the production level of aquatic plant-life each summer (dependent on coarseness of the substrate after winter flows, water temperature, nutrient inputs and proportion of sunny days), occurrence of tidal overwash (dependent on height of the sandbar and tidal patterns) and the lagoon depth (dependent on the degree of scour or sedimentation resulting from winter flows and the skill of City staff to maximize the board height at the flume inlet). If tidal overwash occurs, the more the lagoon inflow, the sooner the trapped saltwater may be flushed from the lagoon and the less lagoon heating that will occur before the saltwater is flushed. In conclusion, water temperature targets have been recommended for the lagoon, and higher lagoon inflow generally improves the likelihood of reaching those targets. However, the minimum summer inflow necessary for lagoon health may annually vary depending on the amount of tidal overwash, climatic conditions and the degree of stream shading upstream of the lagoon.

Policies and Actions to Insure Instream Flows for Steelhead

6.1 The City will review development plans and make recommendations to encourage and influence planners, architects, and property owners through the permit review process to maximize water percolation and to filter out and collect surface runoff pollutants from new and existing land development within the City limits and upstream.

6.2 The City will support water conservation measures throughout the City and watershed. Work with appropriate agencies and water users to increase summer baseflow. Work with responsible agencies, including the California Department of Fish and Game, NMFS, the County of Santa Cruz, and the State Water Resources Control Board, on management recommendations.

6.3 The City will encourage the California Department of Fish and Game to establish optimum/minimum baseflow levels to sustain steelhead and coho salmon populations and riparian viability.

6.4 To protect stream in-flow to the lagoon, the City will routinely monitor streamflow at Soquel Village when in-flow becomes minimal. If the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, the City will notify watershed nurseries and the California Department of Fish and Game of the streamflow conditions so that direct water pumping from the stream may be reduced or discontinued until flow returns.

6.5 The City will pursue funding to continue to annually monitor juvenile steelhead populations to better understand how the juvenile population size is influenced by baseflow, winter stormflow patterns and rearing habitat quality (escape cover from overhanging vegetation and wood and water temperature). The previous 6 consecutive years of monitoring did not include a drought period. We do not know the drought impacts on the juvenile population nor the recovery time of the population after a drought.

6.6 The City will support watershed efforts to maximize summer baseflow through proper watershed management and cooperation from landowners. Maximize streamflow into the summer lagoon. Important considerations include maximization of water percolation to supply underground aquifers by minimizing impermeable surfaces. Where new housing and commercial developments are planned, water catchment basins should be constructed to encourage percolation and to slow runoff into the creek. Surface water diversions and groundwater pumping should be minimized when they draw from the creek or underflow during salmonid out-migration, the critical spring growth period and during summer rearing of juvenile salmonids.

6.7 For instream flow concerns for salmonid rearing, the City will pursue funding to install additional continuous streamflow monitoring stations for the months of May through September to better understand the gaining and losing of streamflow. These low-flow

gages will be less expensive than the year round USGS gage. Gages will be placed in the Nob Hill reach above the lagoon, just downstream of the Walnut Street Park and other locations up the watershed.

6.8 In order to maximize the instream flow benefits to fish, the City will encourage water extraction from the stream channel or its underflow for domestic and commercial uses as low in the watershed as possible, where this action is feasible. The City will recommend that water diversions be consolidated where feasible. Removing water from the headwaters of the Soquel Creek watershed limits the conjunctive use of that water for stream habitat functions. By removing the water at the lowest point in the system, the water becomes available to aquatic resources for important rearing and growth. Water supply agencies will be encouraged to assess their operations and cooperate to develop an efficient system that sustains the aquatic and riparian ecosystem and preserves the water supply.

6.9 The City will encourage water supply pumping during nighttime hours in summer and fall. Streamflow is often the highest during the nighttime hours as evaporation and vegetative transpiration are reduced. This is also the period of time when fish are relatively inactive and not feeding. During the low-flow summer months, water that is being stored off-channel for use during peak demand periods will be diverted during the hours of 9 p.m. and 5 a.m. Municipal water suppliers will assess their operations during low-flow summer months based on this recommendation.

6.10 The City will encourage water diverters to be proactive in developing critical instream flow levels for juvenile salmonids in impacted stream reaches. Instream flow levels should be updated every few years because of the dynamic nature of streambed morphology in the mainstem of Soquel Creek. A stream monitoring system will be established to inform water diverters and the community when water conservation is of greatest importance. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. These flow requirements may vary before and after large flood flows that widen the channel and flatten it with sediment, necessitating periodic re-evaluation of fishery needs.

6.11 The City will support and pursue the appointment of a Water Master to carry out the adjudication of water rights on Soquel Creek.

6.12 The City will support efforts to protect existing and potential salmonid refugia from catastrophic events and to secure additional refugia where possible.

6.13 The City will support efforts to protect hydraulic continuity throughout the watershed. The goal will be to prevent loss of surface streamflow that has occurred in the past.

6.14 The City will support use of appropriate methods, such as exceedence probability curves or the rainfall-runoff curve developed from the Watsonville waterworks station, to predict late summer flow conditions. Exceedence probability curves would be based on historic flow data for wet, average, dry, and drought conditions. This information, specifically the data developed for the Main Street USGS gage in Soquel Village, can be used to determine the range of flows that could be expected in the low-flow summer/fall months. If predicted flows are below the critical level to maintain viable rearing habitat for salmonids, measures to reduce water consumption can be initiated by municipal water suppliers and other primary diverters through conservation programs.

6.15 The City will support watershed efforts to adequately screen water diversions to prevent juvenile salmonid mortalities.

7) NON-POINT-SOURCE POLLUTION

Situation: Several factors degrade the water quality for humans, fish, and other flora and fauna: high fecal coliform counts, pollution from Noble Gulch, the presence of pesticides and nitrates, and silt from erosion. Contaminants (toxic and oxygen-demanding substances) also drain into the lagoon from urban stormwater runoff and leaking sewer lines. Non-point source pollution may potentially flow into Soquel Creek from existing commercial facilities (i.e. the Auto Mall and Nob Hill shopping area). There is the feeling by some that there is inadequate testing and upgrades of storm drains and septic systems, and that there is also too little enforcement of pertinent regulations (fines, etc.). (Storm drain improvements have been funded and are underway.)

The City of Capitola will be required by the State Water Quality Control Board to implement a program that addresses polluted runoff and reduces the discharge of pollutants in storm water runoff. The City will be required to develop a formal urban runoff program (URP). To obtain the model urban runoff planning document on the Internet, go to the following website: http://www.swrcb.ca.gov/stormwtr/murp.html.

Best management practices (BMP's) must be developed for controlling, preventing, reducing or removing pollutants in urban runoff. Street sweeping is an effective BMP, for example. Installing functional silt and grease traps with adequate maintenance are BMP's. Problems specific to Capitola must be addressed.

Initially, the problem of polluted runoff must be assessed within Capitola and the watershed. This involves information gathering and research to identify resources, problems, opportunities, and priorities for implementing BMP's. After the problems are identified, the City will develop effective control policies and a funding program to enforce BMP's and reduce the polluted runoff. This will require education of the community about the problem and promoting public participation in reaching a solution. Next the BMP's must be carried out. The urban runoff program must provide the details of who implements the BMP's, when they are implemented, where they are implemented and how they are implemented. Finally, the success of the urban runoff program must be evaluated. The program must be held accountable to maintain and improve its effectiveness. The program must be allowed to adapt to new information, and evolve to address new problems and changing conditions with new BMP's.

Policies and Actions to Reduce Non-Point-Source Pollution

7.1. The City shall make a written request for an agreement with the Zone 5 Flood Control District to annually inspect and enforce maintenance of silt and grease traps in storm drains emptying into Soquel Creek and to retrofit them with detention tanks. This agreement will require the District to install silt and grease traps and detention tanks in all older storm drains and require maintenance. The City will condition any future storm drains to include detention tanks/basins and annual cleaning of silt and grease traps. Energy dissipaters will be installed at drain outlets as they enter the creek/lagoon. (The City has obtained funding to install silt and grease traps on certain storm drains entering Soquel Creek).

7.2. The City will negotiate with appropriate agencies to connect Esplanade runoff to the sewer system during the dry months (including the first road runoff of the season). Seal off storm drains on the west side of the street in front of the Esplanade. All sidewalk grates shall be covered to prevent refuse from accumulating in them. Inform restaurant owners that sidewalk cleaning during the summer is to be done by steam cleaning rather than by water hose. This shall occur from May 15 to the time of sandbar opening in the fall. This will reduce pollution from restaurant clean-up.

7.3. The City will check for and require repair of illegal and malfunctioning storm drain connections.

7.4. The City will identify an "environmental officer" for the City to monitor for compliance with appropriate regulations and ordinances. Duties regarding creek, riparian, and environmental concerns could be immediately assigned to this officer. The officer will give enforcement warnings with a copy of "Creek Protection Under California Law."

7.5. The City will comply with state law by developing a formal Urban Runoff Program to structure and direct non-point-source pollution management consistent with California's non-point-source pollution control program.

7.6. The City will comply with requirements for obtaining stormwater runoff permits. Stormwater runoff permits were required for cities with populations over 100,000 people in 1999.

7.7. The City will comply with requirements for implementation of the "Model Urban Runoff Plan for Small Cities."

7.8. The City will identify pollution sources (such as those in the Nob Hill Center, Noble Gulch and along the Esplanade) and pursue all available strategies to address them in Capitola, such as through conditions of permit approval, pursuing grants and working with the County Environmental Health Department.

7.9. The City will explore ways to minimize storm drain runoff into Noble Gulch during the dry season and pursue them if feasible. Usually when cloudy water enters the lagoon from Noble Gulch, the water is clear upstream in Noble Gulch at the park beyond Bay Street. This indicates that pollutants enter Noble Gulch from the lower village near Soquel Creek. If there are domestic ducks living at the mobile home park up that drainage, investigate their removal and relocation to reduce nutrient influxes and coliform bacterial inputs.

7.10. Another drain is situated under the railroad trestle, where slight oxygen depletion has been detected in recent years. The City will explore ways to cap this drain during the summer if it is feasible to redirect runoff into the sewer system.

7.11. The City will use vacuum-type street sweepers to thoroughly clean paved surfaces, including parking lots and streets draining into the lagoon, especially just before the rainy season. This will reduce the pollutants entering the lagoon during the first storm

of the season.

7.12. Roadwork such as repaving and application of fresh petrochemicals to pavement shall 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.

7.13. Existing commercial properties having parking areas shall provide evidence to the City that a contract is in place for street sweeping of paved areas at appropriate intervals. Being consistent with state law, new projects with large parking lots shall be conditioned with the requirement that the applicant provides evidence that a contract is in place for street sweeping of paved areas at appropriate intervals. Signage needs to be included for times of sweeping and associated fines for parking in these areas during scheduled sweeping.

8) STREAMBANK EROSION IN THE NOB HILL REACH

Situation: The west bank of Soquel Creek as it approaches the lagoon has experienced substantial erosion over the past 4-5 years (**Photo 20**; page 89; **Figure 5**; page 162). Several mature cottonwoods that existed on the terrace above the creek have fallen into the channel. Several others are in danger of being lost if the erosion continues. More tree canopy will be lost and water temperatures may be expected to increase, as more riparian shading is lost. Water temperatures in the lagoon are already warm in the summer lagoon, and further loss of riparian forest will exacerbate this water quality problem. Also, Soquel Creek Lagoon has been designated by the State Water Quality Control Board as a sediment-impaired reach. Further streambank erosion immediately upstream of the lagoon will result in further impairment.

Photo 20. Eroding Streambank on Soquel Creek in the Nob Hill Reach Above the Lagoon in 2002

The primary reason for present day erosion of the west bank through the Nob Hill reach (between the bedrock outcrop adjacent to the sewage lift station and Highway 1) is the current location of the bar along the eastern bank, as illustrated in **Figures 6 and 7** (pages 163-164). At high flows, this bar diverts flow towards the western bank, thereby providing the energy to erode the bank. This bar is theorized to have migrated downstream from the position of bar 2 as

discussed in review of the 1956, 1963 and 1985 aerial photographs. Over the past 17 years the bar has migrated roughly 150 feet to its present day location. Bar and channel form migration are a natural process of river systems (**Leopold, and others, 1964**). Because similar banks are retreating throughout the reach affected by coarsening bed material, there can be no guarantee that it will be feasible to stabilize this particular feature.

Any actions to stabilize the eroding streambank will require a Fish and Game 1601 Agreement, as well as other federal permits. According to Urquhart (**2002**), design approaches must be justified with the review and approval of a fluvial geomorphologist, Registered Engineering Geologist or Certified Hydrologist. Balance Hydrologics has the required technical staff to evaluate the benefits and method of streambank stabilization.

Due to the expense of detailed hydraulic modeling, existing FEMA flood elevations might be considered as adequate for a crib wall design process. However, this would need to be determined by the project design engineer. It is also possible that adjacent property owners may indicate concern towards the construction project with regards to altering flood paths and elevations. In this case, it would be likely that hydraulic modeling would be required to document the potential project effects through the reach.

Policies and Actions Regarding the Streambank Erosion

8.1. The City will explore alternatives for addressing bank instability, including (a) accepting the eventual loss of this bank and taking measures to slow the retreat rate, such as trimming and repositioning destabilized trees, (b) removing or re-location of coarse material present on the bar surface opposite the retreating bank[8], and (c) attempting to stabilize the bank, perhaps with a combination of fresh riparian woodland planting on the face[9] of the retreating bank and at the toe of the bank. Combinations of these alternatives may be applied. If the coarse bar material is to be re-located, it could simply be moved to the top edge of the bar along the east margin of the channel, out of the active channel.

[8] Removal of the coarse material could be accomplished with a conservation corps team working with their hands and wheelbarrows. The team should be directed by someone familiar with the project, in addition to the team leader.

[9] Revegetation of the streambank might require use of seed netting draped over the bank slope.

8.2. If the City decides that the west bank is to be stabilized, a design similar to the recommend a crib wall structure illustrated in **Figure 14** (page 171) will be considered. Logs will be placed in the channel to provide fish escape cover with this design. Implementation of the crib wall approach would need to occur simultaneously with lowering of the bar on the opposite side of the channel (as discussed above). If the crib wall were to make it past the first several winters of high flows, it could provide between 30 to 40 years of bank protection, although nothing can be guaranteed. Construction of the crib wall as illustrated in Figure 14 would require the use of heavy equipment and digging in the streambed, these factors may make it difficult for the project to be permitted. It should be noted that a not-dissimilar bank just upstream of the Highway 1 over-crossing has been hardened structurally rather than stabilized by revegetation. The project will require environmental permitting through the Department of Fish and Game and the Army Corps of Engineers.

8.3. The reach will be monitored on a bi-annual basis once enhancement plans are implemented along the western bank.

8.4. Native, riparian species will be planted along the eastern bank and remove nonnative ivy climbing the trunks of existing trees to increase future vegetative support along this bank.

8.7. The reach will be level-surveyed under current conditions to establish baseline conditions in 2004 and to track changes in subsequent years.

9) FUNDING TO ACT UPON POLICIES AND ACTIONS

Situation: Scientific research and data collection, public and staff education, restoration of habitat, watershed management, and enforcement all require funding for success. A committed, long-term effort is needed to insure that the policies and actions contained in this Plan Update are acted upon. A matrix that prioritizes policies and actions related to managing and enhancing the environment and providing education and funding is provided in **Appendix F** (page 131). A matrix of prioritized projects and staffing requirements is provided in **Appendix G** (page 138).

Policies and Actions for Obtaining Funding

9.1. The City will seek to make grant writing a priority task of a paid Soquel Creek

Education Coordinator, a joint venture between Capitola and a nonprofit group, such as the Friends of Soquel Creek.

9.2. The City will explore general funding possibilities for research and specific projects with CDFG, Coastal Conservancy and the Packard Foundation.

9.3. The City will encourage public participation in the budgeting process to earmark funds for creek-related programs, projects, and research.

9.4. The City will pursue alternative funding resources available for urban stream restoration.

9.5. The City will encourage local high schools to seek funding for projects on Soquel Creek.

9.6. The City will encourage universities to use Soquel Creek for research purposes by creating incentives, such as sharing of City facilities, providing City staff and related contractors as mentors and providing City planning documents and monitoring reports as background material for further research.

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APPENDIX A. IMPLEMENTATION OF THE ORIGINAL MANAGEMENT AND ENHANCEMENT PLAN BY D.W. ALLEY & ASSOCIATES, 1991–1996.

After adoption of the Soquel Creek Lagoon Management and Enhancement Plan, the City obtained a grant from the Coastal Conservancy for implementation and monitoring of its effectiveness over a five-year period. Annual reports were prepared and additional recommendations to maximize habitat value and human enjoyment of the lagoon were forthcoming. Several enhancement projects were completed:

- A shroud for the flume was designed by the California Department of Fish and Game. It fits over the flume inlet to pull saltwater off of the lagoon's bottom to hasten conversion to freshwater after sandbar construction.

- A baffle was placed in the flume to provide adequate water depth for juvenile steelhead smolts migrating through to the ocean.

- Domestic ducks and geese were collected and relocated. An ordinance was adopted to prohibit the sale of these birds in the City's pet stores.

- The Friends of Soquel Creek was organized by community members to discuss lagoon and watershed issues and environmental protection. It formed the nucleus of a citizen's caretaker group.

A series of educational projects was developed to familiarize the community with the ecological aspects of Soquel Creek and its lagoon. The intent was to instill a sense of appreciation and pride in the lagoon and its valuable fish and wildlife habitat:

- Eight interpretive signs were developed and placed around the lagoon and at the beach kiosk. They explained coastal birds and the lagoon's animals and riparian vegetation.

- Signs were placed around the lagoon to discourage bird feeding. An information sheet was created to explain the negative aspects of bird feeding. It was distributed to lagoon-side rentals and restaurants.

- In 1995 additional signs were placed along the lagoon path to encourage dog owners to clean up their dogs' excrement; plastic bags and garbage cans were also provided for this purpose.

- Thirty nest boxes were constructed by high school students and placed in the riparian forest between the lagoon and Highway 1.

- Fish and wildlife exhibits were designed and displayed in the City Museum.

- Storm drains within the City limits were stenciled to discourage dumping of pollutants.

- A stream-side care guide was created and distributed to stream-side residents. The guide described the native plant community and the invasive exotic plants that threatened it, the fish and wildlife habitats, and the general life history patterns of birds using the stream-side forest. It identified sources of pollution resulting from landscaping efforts and suggested methods of landscaping that would enhance property for native wildlife. There was a special section devoted to attracting butterflies and native birds with bird feeders and nest boxes.

- Four educational units were created for local schools. Concepts were described for the instructor in simplest terms and activities were included to reinforce them. The first unit explained major ecological concepts. The second unit described the life histories of important fish, wildlife, and riparian plants. General bird adaptations, special bat adaptations, and a comparison between fish and human sensory abilities and body functions was included. Suggested activities included field trips to the lagoon and riparian corridor, research projects for students to independently learn about the life history of other species, and a job fair for careers in natural resource management. The third educational unit taught watershed concepts involved with the water cycle, identified sources of aquatic pollution, and suggested lifestyle changes that could reduce them. Activities using maps and a trip to the local water department were developed to elucidate where our tap water comes from. The point was to show the connection between human behavior and the quantity and quality of aquatic habitat. An environmental ethic was developed through discussion of more than 60 common, every day activities that harm the environment, with relevant solutions to reduce pollution and waste. The fourth educational unit described the adverse impacts to the riparian corridor from poor logging practices and inadequate regulatory controls. It discussed sources of soil erosion, compaction, sedimentation, and habitat destruction.

APPENDIX B. VEGETATION INVENTORY IN THE RIPARIAN CORRIDOR OF SOQUEL LAGOON AND CREEK UP TO HIGHWAY 1, 2002.

Introduction

The diversity of riparian habitats is evident in the structural complexity of the vegetation (i.e., the presence of trees, shrubs, and groundcovers); the deciduous features of most riparian woodland creates a mosaic of sun and shade, an abundance of insects, and a rich duff layer that provides a variety of habitats for wildlife. Bird species diversity, for example, has been related to foliage height, diversity, and volume, percentage cover, and plant species diversity. Riparian trees provide important perches and nest sites for birds.

The native riparian vegetation along Soquel Creek also stabilizes and strengthens stream banks. Roots of woody vegetation can reduce erosion and thereby reduce the amount of sediments entering the creek. Vegetation helps prevent soil erosion, as plant roots hold the soil from below; from above, the tree canopy lessens the intensity with which rain strikes the ground, preventing excessive loosening of soil particles and thus reducing sheet erosion. Vegetation also moderates local climatic conditions. On hot summer days, temperatures within the riparian woodland are cooler than temperatures in open areas. Where native herbaceous plant species occur along the margins of the creek, these plants are capable of entrapping and filtering urban runoff through the uptake of materials in their plant matter.

Despite the importance of riparian habitats to native vegetation and wildlife, the extent of these areas has been significantly decreased within the local region, and the State as a whole, over the past 200 years. Locally, the amount of riparian and wetland habitat has decreased due to the encroachment of agriculture, urban development, roadway crossings, water diversions, and channelization for drainage control. As a result, riparian corridors in urban areas are often narrow, are constrained by residential and commercial development, and have significant gaps where riparian vegetation has been removed. Other factors that affect their value include traffic, bank stabilization projects, pollution, human activities, domestic pets, and the presence of invasive, non-native plants.

While Soquel Creek supports a mosaic of riparian habitats, the corridor also has been significantly modified by adjacent land uses and the encroachment of invasive, non-native plant species. In 2002, there is less vegetation along the yards fronting the creek (in the Riverview Avenue area) than observed in 1990. Woody vegetation that grew in yards and extended over the channel has been removed.

Methods

The focus of the riparian survey was to identify the principal plant communities along Soquel Creek. This was accomplished through a review of existing reports (e.g., the *Soquel Creek Lagoon Management and Enhancement Plan*, 1990), consultation with other knowledgeable individuals, aerial photo interpretation, and field reconnaissance.

Field surveys were conducted by the consulting plant ecologist in November 2001 and January and February 2002. Field surveys were conducted along public streets, public parks, and the stream channel. The principal habitats along the creek were identified based on the dominant plant species; the distribution of the habitats was depicted onto the project base maps (**Figures 1 and 2**; pages 158-59). A list of the dominant plant species within each habitat types was noted in a field notebook. The occurrence of invasive, non-native plant species was also recorded during the field surveys. The distribution of plant species observed along the creek were recorded on project base maps. The existing distribution of plant communities and invasive plant species was compared to the previous mapping conducted for the 1990 Management and Enhancement Plan.

Plant communities delineated in the base map (**Figure 1**; page 158) are general and preliminary and not intended for purposes of interpreting the City of Capitola Environmentally Sensitive Habitat Ordinance. Boundaries of the riparian corridor are sometimes difficult to delineate due to the presence of non-native vegetation and the remnant, isolated distribution of some native riparian species. The City ordinance calls for more precise delineation of riparian boundaries on an individual, case-by-case basis. The boundary of riparian vegetation is subject to interpretation. The term "riparian" on the map is intended to broadly define the extent of the "Soquel Creek Ecosystem," including vegetation that contributes functional value to the creek/lagoon in terms of shade, leaves, nutrients, woody material and erosion protection.

Existing Vegetation Resources

Five plant community types have been identified along the creek; each of these plant community types is described below. The occurrences of invasive non-native plant species along the creek are also described.

Riparian Forests

A riparian forest occurs along most of the length of Soquel Creek within the City. This streamside vegetation typically grows at the bank-full flow line and extends above this line due to our wet winter months, high soil moisture levels, and high groundwater levels. Three types of riparian habitat have been documented along Soquel Creek, as described below. During the 2002 field surveys, the creek exhibited evidence of both scour and deposition. The high water

regime of a stream is an important component in the species composition along a watercourse, as most riparian plant species are adapted to colonizing recently disturbed (i.e., flooded, scoured, or depositional) portions of a watercourse.

Figures 1 and 2 display the distribution of the riparian vegetation along Soquel Creek. Approximately 20 acres of riparian forest occur along Soquel Creek, as listed in **Table B.1**.

Table B.1. Acreage of Primary Community Types along Soquel Creek.

Primary Community Type	**Acres (%)**
Riparian Woodland	
• Cottonwood–Willow Riparian Forest	8.12 (28.7%)
• Coast Live Oak Riparian Forest	7.44 (26.2%)
• Non-Native Riparian Forest	
• Eucalyptus-dominated Woodland	3.22 (11.4%)
• Acacia-Dominated Woodland	0.10 (0.3%)
• Redwood Riparian Forest	0.99 (3.5%)
• Remnant Riparian Tree(s)	0.12 (0.4%)
Subtotal	19.99 (70.5%)
Non-Native Woodland Groves	0.90 (3.2%)
Horticultural Plantings	7.45 (26.3%)
Total Acres	**28.34 (100%)**

Cottonwood–Willow Riparian Forest

This riparian forest is distributed along the coast of California, from approximately San Luis Obispo County to Humboldt County (**Holland, 1986**). The community is characterized by the presence of a dense, winter deciduous thicket of trees, primarily arroyo willow (*Salix lasiolepis*) and black cottonwood (*Populus balsamifera* ssp. *tricocarpa*). Red alders (*Alnus rubra*) are also present along Soquel Creek. These three tree species respond well to seasonal flooding and easily colonize open sand and gravel deposits left from winter flows. In-stream gravels bars along the creek were also observed to support thickets of willow and young red alders (e.g., gravels bars between Highway 1 and Peery Park).

Other tree species that occur along Soquel Creek include shining willow (*Salix lucida* ssp. *lasiandra*), box elder (*Acer negundo*), big leaf maple (*Acer macrophyllum*), buckeye (*Aesculus californica*), and coast live oak (*Quercus agrifolia*). The densest cottonwood–willow riparian forest along the creek occurs downstream of the Highway 1 overpass and extends

to Peery Park. This forest supports mature cottonwoods and willows. Several cottonwoods grow adjacent to the Creekside condominium complex. However, bank erosion was observed in this area in February 2002, and mature trees had fallen into the creekbed.

Native understory plant species living along the creek include California blackberry (*Rubus ursinus*), coyote brush (*Baccharis pilularis*), California beeplant (*Scrophularia californica*), mugwort (*Artemisia douglasii*), miner's lettuce (*Montia* sp.), and stinging nettle (*Urtica doioca*).

Throughout Soquel Creek, the riparian forest supports significant infestations of invasive, non-native plant species. These non-native species thrive in previously disturbed areas, grow into dense stands, and exclude the growth of most native plant species, thereby reducing the plant diversity of the habitat. The dominant invasive tree species are green and black wattle acacias (*Acacia decurrens* and *A. dealbata*). These two acacias occur along the entire length of the creek within the City, typically inhabiting areas that have been previously disturbed. One grove, for example, grows along both sides of the creek just downstream of Highway 1. This area was disturbed during CalTrans freeway work (circa 1990), and acacia has since colonized the area. Invasive, non-native plant species are also prevalent in the understory and, in some areas, provide the dominant understory plant cover. The primary species along the creek are cape ivy (*Delaireia odorata*) (formerly known as German ivy), English ivy (*Hedera helix*), French broom (*Genista monspessulanus*), and pampas grass (*Cortederia jubata and C. selloana*). Other invasive, non-native species also occur but are not as widespread. These species include giant reed (*Arundo donax*), periwinkle (*Vinca major*), and cotoneaster (*Cotoneaster* sp.). These invasive plant species have significantly degraded the value of the riparian corridor for native plant species. This is especially evident by the growth of Cape and English ivy, which were observed to form dense carpets on the ground and over native understory plants as well as to grow into the tree canopy.

In addition to the invasive, non-native plant species, horticultural plantings (or "garden escapees") have also become established within the riparian forest along Soquel Creek. Non-native vines (*Lonicera* sp.) are present downstream of Highway 1; other plant species include privet (*Ligustrum* sp.), pittosporum (*Pittosporum* sp.), agapanthus (*Agapanthus* sp.), and Bermuda buttercup (*Oxalis pes-caprae*). Although not as widespread as the invasive, non-native plant species, these landscape plants generally provide less value to riparian wildlife and contribute to an overall loss of native plant diversity.

Soquel Creek offers significant opportunities for the management of the cottonwood–willow riparian forest through the removal of invasive, non-native plant species. The watercourses also offer opportunities for riparian revegetation and management, particularly where there has been

stream bank erosion or the removal of vegetation.

Coast Live Oak Riparian Forest

This riparian community occurs in canyon bottoms and floodplains along the coast range of California, from Sonoma County south to near Point Conception (**Holland, 1986**). The woodland occurs along both perennial and intermittent watercourses and can become an upland community on hillside edges and terraces. Oak riparian forest is prevalent along Soquel Creek. **Figures 1-2** (pages 161-162) indicate the largest areas of oak riparian forest occur near Peery Park, the Rispin Mansion, and along the southern extent of Wharf Road.

The oak riparian forest is characterized by the dominance of coast live oak; however, there are also occurrences of California buckeye, California bay (*Umbellularia californica*), sycamore (*Platanus racemosa*), and willow. The canopy cover is typically dense (>50% overstory plant cover). In some areas, such as near the Rispin Mansion, the oak riparian woodland intergrades with adjacent groves of coast redwood (*Sequoia sempervirens*) and non-native tree groves (primarily eucalyptus groves). The oak riparian woodland probably also occupied some of the upland slopes and terraces that abut the creek; the majority of this habitat, however, has been removed by historic agricultural land uses and, more recently, by urban development and the planting of non-native plant species.

The understory within the oak riparian woodland is diverse. Observed native shrub species include poison oak (*Toxicodendron diversilobum*), California blackberry, blue blossom ceanothus (*Ceanothus thyrsiflorus*), toyon (*Heteromeles arbutifolia)*, blue elderberry (*Sambucus mexicana*), and coffeeberry (*Rhamnus californica*). Hairy honeysuckle (*Lonicera hispidula*), a climbing vine, yerba buena (*Satureja douglasii*), a groundcover, bracken fern (*Pteridium aquilinum*), wood fern (*Dryopteris arguta*), California blackberry, and white-flowered nightshade (*Solanum nodiflorum*) also occur in the forest. Rock faces along the creek also support chain fern (*Woodwardia fimbriata*), California polypody fern (*Polypodium californicum*), and rushes (*Juncus* spp.).

The oak riparian forest along Soquel Creek also supports significant infestations of invasive, non-native plant species and urban landscape plants. Invasive, non-native plant species include French broom, pampas grass, periwinkle, English ivy, and Cape ivy. All have been documented within the oak riparian forest. Other invasive plant species included cotoneaster, acacia, and Himalayan berry (*Rubus procerus*).

These non-native species thrive in previously disturbed soils within the forest, grow into dense stands, and exclude the growth of most native plant species, thereby reducing the native plant diversity of the habitat. The oak riparian woodland along Soquel Creek offers opportunities for

removal or for control of the spread of these invasive understory plant species and for improvement of habitat conditions along the creek.

Redwood Riparian Forest

The Soquel Creek riparian corridor supports stands of coast redwood, such as the grove in the Rispin Mansion open space. The tree canopy is dominated by the redwood; however, individuals of hazel (*Corylus cornuta*) and California buckeye were also observed within these groves. The understory is similar to that of adjacent forests and is dominated by invasive, non-native plant species (primarily English and Cape ivy).

Non-Native Riparian Woodlands

Woodlands comprising non-native plant species occur along Soquel Creek. Non-native plants are species that have been introduced into an environment in which they did not naturally evolve. In general, many non-native plants have no natural enemies or controls to limit their spread and, as a result, can successfully compete with native species and dominate the landscape. The resultant lack of native plants generally reduces the diversity and number of native animals, birds, and insects.

Blue gum eucalyptus (*Eucalyptus globulus*), a non-native tree that occurs throughout coastal California, including Soquel Creek, is native to Australia. The species was intentionally brought to California as a lumber source and has since been used for windbreaks, firewood, and evergreen landscaping. Since the blue gum eucalyptus readily stump sprouts and can easily regenerate from seed, large groves of eucalyptus have been successful in inhabiting many types of environments. In addition to upland areas, the blue gum eucalyptus has become established along Soquel Creek, replacing the indigenous riparian vegetation, which was probably oak riparian woodland or, in some areas, cottonwood–willow riparian forest. Although the native riparian vegetation is absent (or substantially reduced in its extent) where the eucalyptus trees occur along the side slopes of Soquel Creek, the resulting tree groves are considered non-native riparian woodlands. This determination is supported by an analysis of the rooted location of the eucalyptus trees in the Rispin Mansion area and native oak riparian forest trees along the southern portion of Wharf Road. At the Rispin Mansion area, the eucalyptus trees are rooted along the lower and mid-bank areas of the creek channel. This rooting location corresponds to the location of sycamores and coast live oaks downslope of Wharf Road, suggesting that both the eucalyptus and sycamores are tapping into the groundwater of the creek and functioning as part of the riparian forest. In contrast, the eucalyptus trees located along the top of Wharf Road (near the intersection of Wharf Road and Clares Street) area rooted outside the creek canyon and are not considered part of the riparian forest (these tree groves are discussed below under Non-Native Tree Groves).

Plant species that are native to California are also considered non-native if they occur in areas that

they did not occupy historically (usually considered by most botanists to be before the arrival of Mexican land grantees). The Monterey pine (*Pinus radiata*) is native to distinct populations along California's central coast, yet has been planted as a landscape tree throughout the State (and elsewhere in the world). Where these trees occur outside native stands, they are considered non-native. The Monterey pine trees that occur along Soquel Creek are non-native and have been planted or have naturally established from planted individuals. Where the pines occur along watercourses, they have displaced the indigenous riparian vegetation. The trees retain some riparian functions, such as providing cover for riparian wildlife, and are therefore considered non-native riparian woodlands.

Another pair of non-native tree species prevalent along Soquel Creek is the green and black wattle acacias. Known by many residents by their characteristic winter-blooming yellow flowers, the acacias are aggressive colonizers of previously disturbed areas. In addition to colonizing human-disturbed areas, acacia can establish on creek-scoured or disturbed banks. The distribution of the acacias appears to have increased since 1990, based upon a review of the mapping conducted for the original Management and Enhancement Plan. Where the acacias occur as distinct groves within the riparian corridor, the groves are considered non-native riparian woodlands.

The understory beneath the non-native trees is commonly vegetated with non-native shrubs and vines, most notably French broom, pampas grass, and Himalayan berry. Other understory species in the non-native riparian woodland were cotoneaster, garden nasturtium (*Nasturtium officinalis*), English ivy, and periwinkle. The eucalyptus-dominated non-native riparian woodland at the Rispin Mansion includes native understory species, such as poison oak, miner's lettuce, California blackberry, young willow, and young coast live oak.

Non-native eucalyptus is adapted to natural fire because they are subject to natural fires in their native habitat (Australia). The tree's seed is released from its cap after fire and, like the native Monterey pine seed, has adapted to germinating in open, fire-scorched soil. The thick duff beneath the trees (composed of leaf and bark litter) as well as the numerous bark peels on the tree trunk provides favorable conditions for crown fires. In recognition of the fire danger these trees pose to nearby residential areas. Because these groves are non-native, there may be opportunities for replacement of eucalyptus by attrition and re-establishment of native woodlands (e.g., oak riparian woodland). Where the trees are supporting over-wintering habitat for Monarch butterflies, such as near the Rispin Mansion, the preservation of these tree groves may take precedent over re-establishment of a native riparian forest.

Non-Native Tree Groves and Horticultural Plantings

Many of the riparian areas adjacent to residential and commercial land uses along the creek have

been significantly altered by the removal of native riparian woodland, creation of hardscape walls, and planting of non-native horticultural plants. The most evident changes in the historic riparian corridor occurred in the early 1900's when residential areas were established along lower Riverview Avenue and the subsequent construction of retaining walls along the creek channel. Currently, this lower portion of the creek is significantly devoid of riparian vegetation; other than a few remnant riparian trees (willows and box elder), the area lacks riparian cover over the creek channel. The amount of riparian cover appears to have decreased in this area since last mapped in the 1990 Management and Enhancement Plan. Additionally, recent construction of hardscaping along the creek edges (i.e., patios, seating areas, walls) precludes re-establishment of vegetation in these areas.

Other areas of non-native trees and landscaping occur along the creek. The grove of eucalyptus and acacias along Wharf Road (Rispin Mansion area) also degrade the riparian resource values of the area in an ecological sense and contribute to low native biodiversity. However, they may provide windbreaks for Monarch butterfly overwintering and roosting habitat and shall not be removed without that consideration. The Coastal Commission may consider portions of this area to be Environmentally Sensitive Habitat Area (ESHA) (**2001**). Gradual replacement of non-natives through propagation of native trees in the vicinity may serve the same windbreak function. Residential plantings are evident along the creek-side properties along upper Riverside Avenue and along Wharf Road. Plantings (naturally occurring sprouts) of eucalyptus occur in these areas, as well as horticultural plantings of non-native trees and shrubs. English ivy is also prevalent in these areas, as are pockets of pampas grass (two invasive, non-native plant species). There are opportunities to enhance native riparian habitat values by encouraging planting of native riparian trees and shrubs and the removal of invasive, non-native plant species.

Special Status Plant Species

Several plant species are considered special status species due to their rarity or vulnerability to habitat loss or population decline. As listed in **Table B.2** (page 107), some species are listed by the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), or the California Native Plant Society (CNPS) as rare, threatened, or endangered.

Most special status plant species are restricted to specific habitats, such as grasslands or oak woodlands. No special status plant species are known or expected to occur along Soquel Creek within the City of Capitola.

Invasive, Non-Native Plant Species

The occurrence of invasive, non-native plant species along Soquel Creek is widespread. Almost all areas were observed to support at least one plant species (and usually more) that is considered invasive. The most widespread plant species are Cape ivy, English ivy, and acacia; however,

French broom and pampas grass are also abundant. Due to the aggressive growth of these species and their ability to out compete native plants; non-natives quickly dominate riparian areas. The value of the riparian corridor to native wildlife is significantly reduced due to the lack of food (e.g., reduction of native seeds, berries, and flowering plants) and a decrease in the structural diversity of the habitat, which is important to wildlife for their cover and foraging needs. Some non-native plants, such as acacia, can also present health problems (i.e., an irritating pollen source).

Several non-native plants are recognized as invasive by the California Exotic Pest Plant Council (CalEPPC) (a non-profit organization that monitors invasive plants within the State) and are on the State's Noxious Weeds List (a list of agricultural pest plants, as maintained by the U.S. Department of Agriculture). Many of the invasive, non-native plants that occur along Soquel Creek were introduced in the late 1800's as landscaping plants. Periwinkle, English ivy, and Cape ivy, aggressive, hardy plants adapted to shady conditions, are prevalent in such conditions. They provide no food or cover for native wildlife and easily out compete other plants that do. Other invasive, non-native plants, such as French broom and pampas grass, invade sunny, disturbed areas. These plant species are able to invade many habitat types and can quickly spread, creating dense thickets. As discussed earlier, eucalyptus, Monterey pine, and acacia are tree species non-native to Soquel Creek. With the exception of some wildlife species (e.g., raptors, the Monarch butterfly, and hummingbirds), these tree species do not supply valuable habitat to native riparian wildlife and reduce the native plant biodiversity of the area.

Table B-2. Special Status Plant Species with the Potential to Occur near Soquel Creek.

Species	CNPS Status	State Status	Federal Status	Habitat Affinity and Known Occurrences within County of Santa Cruz	Known or Potential Occurrence Along Soquel Creek within City of Capitola
Blasdale's bentgrass *(Agrostis blasdalei)*	List 1B	None	None	Upland grassland Known from Swanton Road and Highway 1	Unlikely
Robust spineflower *(Chorizanthe robusta var. robusta)*	List 1B	None	Endangered	Upland grassland Known from Pogonip	Unlikely
San Francisco popcorn flower *(Plagiobothrys diffusus)*	List 1B	Endangered	Species of special concern	Mesic grassland Known from City of Santa Cruz	Unlikely
Santa Cruz clover *(Trifolium buckwestiorum)*	List 1B	None	None	Margins of upland forest and grasslands Known from Swanton area and Soquel	Unlikely
Santa Cruz tarplant *(Holocarpha macradenia)*	List 1B	Endangered	Threatened	Upland grassland Known from Arana Gulch greenbelt, Schwan Lagoon area, and Soquel	Unlikely
Kellogg's horkelia *(Horkelia cuneata ssp. sericea)*	List 1B	None	Species of Special Concern	Coastal scrub and pine forests	Unlikely
Small-leaved lomatium *(Lomatium parviflorum)*	List 4	None	None	Oak woodland forest Known from Aptos area	Unlikely
Santa Cruz microseris *(Microseris decipiens)*	List 4	None	Species of special concern	Areas if loose soil in upland forest and grasslands Known from Swanton area, Scott Creek and Mill Creek	Unlikely
Gairdner's yampah *(Perideridia gairdneri* ssp. *gairdneri)*	List 4	None	Species of special concern	Margins of upland forest and grasslands Known from Soquel	Unlikely
Michael's piperia (*Piperia michaelii)*	List 1B	None	Species of special concern	Areas of loose soil in coastal scrub and bluff scrub Known from Scott Creek	Unlikely
Maple-leaved checkerbloom *(Sidalcea malachroides)*	List 1B	None	None	Oak woodland and mixed forests Last record in County from 1932	Unlikely
San Francisco campion *(Silene verecunda* ssp. *verecunda)*	List 1B	None	Species of special concern	Coastal scrub and grasslands Known from Swanton area	Unlikely

Source: CDFG Rarefind, 2001; Biotic Resources Group, 2002.

CNPS Status:

List 1B: These plants (predominately endemic) are rare through their range and are currently vulnerable or have a high potential for vulnerability due to limited or threatened habitat, few individuals per population, or a limited number of populations. List 1B plants meet the definitions of Section 1901, Chapter 10 of the CDFG Code.

List 3: This is a review list of plants that lack sufficient data to assign them to another list.

List 4: List 4 is a watch list of plants with limited distribution in the State that have low vulnerability and threat at this time. These plants are uncommon, often significant locally, and shall be monitored.

The following invasive, non-native plant species have been documented along Soquel Creek, based on field surveys in 2001 and 2002 and a review of previous reports:

Trees

- Acacia (*Acacia* spp.)
- Monterey pine (*Pinus radiata*)
- Blue gum eucalyptus (*Eucalyptus globulus*)

Shrubs and Vines

- French broom (*Genista monspessulanus*)
- Pampas grass (*Cortederia jubata*)
- Cape ivy (*Delaireia odorata*) (previously referred to as German ivy (*Senecio mikanoides*)
- English ivy (*Hedera helix*)
- Himalayan berry (*Rubus procerus*)
- Nasturtium (*Nasturtium officinalis*)
- Honeysuckle (*Lonicera* sp.)
- Morning Glory (unknown species)
- Giant Reed (*Arundo donax*)
- Cotoneaster (*Cotoneaster* sp.)
- Periwinkle (*Vinca major*)

Plant Pathogens

A fungus responsible for California Oak Mortality, formerly known as Sudden Oak Death, is a water mold fungus in the genus *Phytophthora*. This fungus has been reported within northern Santa Cruz County and may occur in the City. Although no oak trees along Soquel Creek were observed with obvious signs of California Oak Mortality during the 2001/2 field surveys, it may occur now (or in the future) in the oak riparian forest.

If California Oak Mortality becomes prevalent along Soquel Creek in the future, significant areas of oak riparian forest, as well as other species, may be susceptible to death. Current information on California Oak Mortality, including host plant information, symptoms, and preventative and treatment measures is available through the University of California Cooperative Extension, Sudden Oak Death website (http://cemarin.ucdavis.edu). Opportunities exist to inform property owners on measures to prevent/control the spread of this fungus.

APPENDIX B. LITERATURE CITED AND REFERENCES

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APPENDIX C. REVEGETATION GUIDELINES AND GUIDELINES FOR REMOVAL OF INVASIVE, NON-NATIVE SPECIES

Introduction

The major goal for the vegetation enhancement and restoration component of the Soquel Creek Lagoon Management and Enhancement Plan is to restore and manage the native riparian habitat along Soquel Creek to provide suitable and sustainable habitat for native plant and animal species. Another goal is the removal of invasive, non-native plant species.

Plant Materials

Plant materials used for revegetation of native habitats within the Soquel Creek riparian corridor shall utilize locally obtained native plants for the revegetation. Refer to **Table C.1** (page 112) for a list of suitable plant species for revegetation. There are several local sources that can provide contract-growing services, wherein plant materials are collected from the watershed and immediate vicinity and grown into stock suitable for installation. A landowner or agency will need to allow time for plant species to be collected and grown at a nursery prior to their installation. Some species, such as willow, cottonwood, and mulefat, can be obtained as live cuttings from the immediate area. These plants can be installed as dormant cuttings.

Sources of Container Stock Plants

Local nurseries and growers supply native riparian and wetland plant species. These sources are also available to collect and propagate plant material from a local area. Some available sources include:

CENTRAL COAST WILDS
Santa Cruz, CA
(831) 459-0656

NATIVE REVIVAL NURSERY
Aptos, CA
(831) 684-1811

ELKHORN NATIVE PLANT NURSERY
Moss Landing, CA
(831) 763-1207

Sources of Seed for Erosion Control and Revegetation

Regional and local nurseries and growers can supply native seed for erosion control and

revegetation. These sources are also available to collect native seed from a local area. Some available sources include:

PACIFIC COAST SEED
(925) 373-4417

CENTRAL COAST WILDS
(831) 459-0656

ELKHORN NATIVE PLANT NURSERY
(831) 763-1207

Revegetation Techniques and Guidelines

Planting Locations

Most riparian and wetland plant species are adapted to growing in distinct zones along a creek channel. Some species, such as willow, cottonwood, alder, and mulefat, typically grow along the toe of the channel and along the lower mid-bank. Plant species tolerant of drier conditions, such as buckeye, California sycamore, and coast live oak, are more appropriately planted along the upper slope and top-of-bank areas.

Refer to **Table C.1** (page 112) for a listing of the primary plant species suitable for revegetation along Soquel Creek. It shall be noted, however, that other plant species that occur in these habitats also may be suitable. The table also identifies typical periods for the collection of plant materials and the appropriate planting location for riparian species.

Techniques

Planting of container stock and live cuttings (i.e., willow and cottonwood pole stakes) shall occur in the fall months after rain has moistened the ground to a minimum depth of eight inches and more rain is in the forecast (typically November through January). Once the planting stock is delivered to the revegetation site, it can be installed, as described below.

Plants shall be installed by excavating a planting hole large enough to receive the rootball. All planting holes shall be backfilled with native soil and tamped. Plantings shall be watered such that the root crown is even with the surrounding grade. A 3-inch-high hand-packed soil berm shall be constructed around the plant (or just along the downslope edge for creek bank plantings) to create a watering basin. If soil is not moist to 14 inches from natural rainfall, the plant shall be hand-watered immediately following installation. After planting is complete, shredded mulch shall be spread in the planting basin.

Table C-1. Principal Plant Species Suitable for Riparian Revegetation

Common Name	Scientific Name	Propagule Collection Period	Typical Spacing (feet, on-center)	Recommended Application
Coast Live Oak Riparian Forest				
Coast live oak	*Quercus agrifolia*	Sept.–Oct.	15–20 feet	Tree pot or one gallon
California buckeye	*Aesculus californica*	July–Aug.	15–20 feet	Tree pot or one gallon
Sycamore	*Platanus racemosa*	July–Aug.	15–20 feet	Tree pot or one gallon
California rose	*Rosa californica*	Sept.–Oct.	6 feet	Dee Pot
Blue blossom	*Ceanothus thyrsiflorus*	June–July	6 feet	Dee Pot
Coffee berry	*Rhamnus californica*	July–Aug.	6 feet	Dee Pot
Flowering currant	*Ribes californicum*	July–Aug.	6 feet	Dee Pot
Sticky monkey flower	*Mimulus aurantiacus*	July–Aug.	6 feet	Dee Pot
California blackberry	*Rubus ursinus*	July–Aug.	6 feet	Rooted cutting or Dee Pot
Bracken fern	*Pteridium aquilinum*	Oct.	6 feet	Root division or Dee Pot
Wood fern	*Dryopteris arguta*	Oct.	6 feet	One gallon
Mugwort	*Artemisia californica*	Sept.–Oct.	6 feet	One gallon
Cottonwood–Willow Riparian Forest				
Willow	*Salix* spp.	Winter	10 feet	Dormant cutting
Black cottonwood	*Populus tricocharpa.*	Winter	10 feet	Dormant cutting
Mule fat	*Baccharis salcifolius*	Winter	10 feet	Dormant cutting
California rose	*Rosa californica*	Sept.–Oct.	6 feet	Dee Pot
Flowering currant	*Ribes californicum*	July–Aug.	6 feet	Dee Pot
California blackberry	*Rubus ursinus*	July–Aug.	6 feet	Rooted cutting or Dee Pot
Box elder	*Acer negundo*	Sept.–Oct.	15–20 feet	Tree pot or one gallon

Common Name	Scientific Name	Propagule Collection Period	Typical Spacing (feet, on-center)	Recommended Application
Erosion Control Seeding				
Blue wildrye	*Elymus glaucus*	Summer	3 feet	Plug
California brome	*Bromus carinatus*	Summer	3 feet	Plug
Common yarrow	*Achillea millefolium*	Summer	Not applicable	Seed
Meadow barley*	*Hordeum brachyantherum*	Summer	3 feet	Plug

For many areas, a root protector may be desirable if gopher activity is observed. Additionally, a foliage browse protector (metal cage) for deer and rabbit browsing may also be necessary. Willows and cottonwoods can be installed with live cuttings.

Irrigation of Installed Plants

Plants, when installed as container stock (i.e., one-gallon pots, or other sizes), will require supplemental irrigation for the first two–three years after installation. In some areas of the watershed, such as residences or other facilities, the revegetation areas can be served by a drip-type irrigation system. In less accessible areas, the plants may need a temporary water tank that provides gravity feeding, or the plants shall be hand-watered.

Supplemental watering shall be implemented for container stock plantings no less than three times a month during June, July, August, and September of the first two years after planting. Approximately five gallons of water shall be applied to each container stock planting during each watering event. Each watering shall be of such a quantity as to provide optimum growth conditions. If drought stress is noted on any of the plantings, the quantity and interval of watering shall be increased.

If an unusual drought occurs in other months (i.e., less that 70 percent of normal rainfall between October and May) such that soil moisture drops to a level at which plant survival is compromised, supplemental irrigation shall be initiated. Supplemental irrigation shall be continued until natural rainfall levels replenish soil moisture.

Removal and Control of Invasive, Non-Native Plant Species

Invasive, non-native plant species shall be removed from the Soquel Creek riparian corridor. Removal shall include the entire plant, including the roots that are subject to re-rooting, except for the roots of eucalyptus, acacia, and pine trees.

Periwinkle, Honeysuckle, and Morning Glory

Periwinkle (also known by its genus name of *Vinca*), honeysuckle, and morning glory are fast-growing, perennial species. They grow by underground runners and have covered many areas along the creek. Due to their invasive and aggressive growth and their ability to choke out all other understory plants, it is necessary to control these species to ensure successful restoration of native riparian areas. For small infestations that contain some native plant growth, the vines can be removed by hand, although repeated efforts will be necessary to eliminate the species from a site. For a large infestation with little native plant cover, the currently recommended method of control is to hand grub the ground to remove all above-ground plants as well as underground runners. The grubbed areas shall be seeded with native perennial grasses to provide erosion control. Due to the persistence of these species, repeated efforts will be required to remove above- and below-ground plant parts. Once the infestation has been significantly decreased, the site shall be revegetated with native riparian shrubs and trees.

English Ivy, Cape Ivy, and Algerian Ivy

These species are very fast-growing and perennial ivies. These plants grow by underground runners and, although they are commonly found in native habitats near urban and rural developed areas, they have spread into all areas of the Soquel Creek corridor. Due to their invasive and aggressive growth, their ability to choke out all other understory plants, and because they climb up tree trunks into the overstory, it is necessary to control these species to ensure successful restoration of the riparian and wetland areas. For small infestations that contain some native plant growth, the vines can be removed by hand, although repeated efforts will be necessary to eliminate the species from a site. For a large infestation with little native plant cover, the recommended method of control is to hand grub the ground to remove all above-ground plants as well as underground runners. The grubbed areas shall be seeded with native perennial grasses to provide erosion control. Due to the persistence of these species, repeated efforts will be required to remove above- and below-ground plant parts. Once the infestation has been significantly decreased, the site shall be revegetated with native riparian shrubs and trees.

Acacia

Black and green wattle acacia are the most commonly observed along Soquel Creek. The tree is fast growing and reproduces through root suckers and by seed. Control measures include cutting

the trees and/or root sprouts flush with the ground. As stump sprouting often occurs, apply an herbicide topically (e.g., Round-up or Garlon) on the cut stumps. Young tree sprouts can be hand-pulled. All felled trees and associated plant material, particularly mature seed heads shall be removed from the site.

Eucalyptus

The majority of eucalyptus trees along Soquel Creek are blue gum eucalyptus. The tree is fast growing and reproduces through trunk sprouts and by seed. Control measures for the site include cutting the trees and/or trunk sprouts flush with the ground surface and the immediate topical application of an herbicide (e.g., Round-up or Garlon at full strength) to the cut stumps. Re-application may be necessary for large stumps with substantial root masses. Young seedlings can be hand-pulled. All felled trees and associated plant material, particularly bark peels and mature seed heads, shall be removed from the site.

French Broom

The French broom occurs throughout previously disturbed areas of the Soquel Creek corridor. French broom reproduces primarily by seed, although vegetative reproduction and stump sprouting also occur. Seeds are thought to be viable for as long as 80 years. Control measures for the site include hand pulling of all plants in winter when soil moisture is highest. A weed wrench may be needed to remove the larger individuals. Cutting, mowing, or weed-whacking of broom plants is not recommended. Soil disturbance shall be minimized, since bare soil fosters broom seed germination. All pulled plant material, particularly plants with flowers and seeds, shall be removed from the site.

Pampas Grass

This non-native perennial grass is well known by its large tussock of leaves and tall white–cream flowering plumes. Reproduction is mainly by seed, and seedlings can germinate in a variety of soil types. Pampas grass is highly invasive, especially in the coastal fog belt, where freezing temperatures do not occur. Well-established plants shall be removed by implementing the following measures:

- Remove all flowering plumes prior to opening (before July) and place flower plumes into sturdy bags to prevent seed release.
- Chop the leaf clumps with a Pulaski and shovel; the entire crown shall be removed so that crown sprouting is prevented. A chain saw or weed eater with a rotary blade can be used to remove leaves to reach the base of the crown.
- All plant parts, including the root crown, shall be removed from the site.
- The crown can be cut in quarters and removed; the crown shall be turned upside down to expose the roots to the air.

- Workers shall wear gloves, long sleeves, and long pants, as the leaves can cut skin

APPENDIX D. EXISTING CONDITIONS ON THE RISPIN PARCEL AND IN ADJACENT AQUATIC HABITAT, FEBRUARY–MARCH, 2002.

Rispin Parcel

The fishery biologist and a certified erosion control specialist walked the parcel in spring 2002. A flat plateau, or "bench", existed adjacent to the road where the Mansion was originally constructed. South of the Mansion on the bench, acacia dominated the trees. Coast live oak were observed near the Mansion close to Wharf Road and on the bench to the north of the Mansion. An elderberry bush, a common riparian species, was growing on the edge of the bench to the north of the Mansion at the top of the slope. A large open area extended to the north of the Mansion on the plateau.

A cyclone fence encircled the Mansion and was situated at the top of the steep slope. The Mansion sat within 10 feet of the slope. A paved road went from the south side of the Mansion onto the plateau to the south. A compacted dirt driveway went from the paved road to the garage of the mansion on the south side. The fence was placed on a wooden retaining wall. In many places, the fence was partially crushed to gain access to the Mansion enclosure and to the steep slope below. The retaining wall was failing in several places. A network of trails led down the steep slope through an understory of mainly ivy and some periwinkle. All of the larger eucalyptus and many of the redwood trees had ivy vines growing up their trunks.

A steep, 65% slope separated the plateau at the Rispin site and the floodplain that was adjacent to Soquel Creek. Although no serious, recent erosion was observed, its potential was high during heavy rainfall due to the steep slope. A probable old mudslide scar was observed by the erosion control specialist on the slope to the south of the Mansion. Several large eucalyptus trees grew on the mudslide scar. It is recommended that no additional runoff be released onto the slope from any future development because of the high landslide potential. Effective mitigation measures should be in place prior to any construction of additional structures or parking areas on the Rispin parcel to prevent increased flashy runoff toward the creek, increased soil erosion, increased water pollution (particularly early in the rainy season), increased risk of slope failure, and increased sedimentation to Soquel Creek. All of these factors may negatively impact environmental conditions for steelhead in Soquel Creek Lagoon downslope of the site.

Storm drains on Wharf Road at the Clares Street corner apparently merged and connected to the 15-inch culvert buried in the bench south of the Mansion that ran downslope to the dissipater. All storm runoff from the library parking lot enters the gutter on Wharf Road and flows into the same drainage system. In addition, storm water runs down the street the full length of the Rispin parcel from the walk/bike path south to the same drainage system and culvert leading to the dissipater.

The drainage culvert from the road was exposed in places as it traveled downslope to an energy dissipater. A well-used trail paralleled the culvert down to the energy dissipater. This trail is likely to be used by anglers to gain access to the creek. There was evidence of runoff being directed down the upper portion of this trail. The concrete dissipater was positioned at the base of the steep slope where the edge of the floodplain began. The water from the dissipater traveled 55 feet across the floodplain to the stream channel. Minor gully erosion was observed in this channel and there was a plume of fine sediment deposited in a delta in Soquel Creek at the outlet of this channel.

Mature eucalyptus trees dominated the southern portion of the steep slope to the east of the mansion that dropped down to the floodplain beside the creek. Four Monarch butterflies were observed flying among the eucalyptus. Over-wintering Monarch butterfly habitat is considered to be an environmentally sensitive habitat requiring protection under Section 30240 of the California Coastal Act. Where the steep slope approached the stream channel in the absence of a floodplain at the south end of the parcel, eucalyptus trees were quite close to the channel (within 15–20 feet). The understory on the steep slope and portions of the floodplain was primarily English ivy, periwinkle, and poison oak. In the vicinity of the grove of eucalyptus trees, these trees provided 60+% of the valuable shade canopy for the stream. Acacia dominated the floodplain terrace on the Rispin side. A large acacia was overhanging the creek. Small willow and alder were growing at the water's edge adjacent to the floodplain on the Rispin side.

Adjacent to the Mansion and slightly upstream, a grove of redwood was present on the steep slope. Adjacent to the Mansion on the upslope side of the redwoods was a big leaf maple within approximately 20 feet of the Mansion. A large Monterey pine was observed next to the redwood grove. A large burnt redwood stump was observed, with a partial fairy ring of second growth, indicating former old growth redwood on the parcel. The tree canopy closure over the creek ranged from 42% downstream of the Mansion, where the eucalyptus grove dominated, to 38% adjacent to the mansion and redwood grove, and to 34% just upstream of the Mansion. These low values resulted partially from the poorly developed riparian vegetation and trees on the upper bluffs on the east side of the creek, across from the Mansion parcel. Between the Mansion and the southern end of the parcel, more than 60% of the shade canopy to Soquel Creek was provided by the eucalyptus grove.

The right (west) bank, upstream of the Mansion, was very steep and potentially erosive, with the floodplain being on the left bank across the creek from the Mansion. The west bank was vegetated with big leaf maple, California buckeye, and a second grove of second-growth redwood. Tall *Pittosporrum spp.* shrubs (a non-native species) were common near the Mansion. North of the Mansion, several big leaf maple trees were observed growing near the

creek on the Rispin side and upslope to an elevation equal to that of the Mansion. Anecdotal accounts from an older resident in Capitola and the limited size of the eucalyptus indicated that no eucalyptus grew on the slope prior to construction of the Rispin Mansion in 1922. The presence of big leaf maple on the slope north of the Mansion indicated that, prior to the eucalyptus grove, big leaf maple and possibly other riparian species inhabited the slope immediately downslope of the Mansion. The Mansion was constructed in 1921. Construction of the foundation involved placement of retaining walls on the slope and backfilling behind them to create a level building site (**Haro, Kasunich and Associates, Inc. 2003**). Based on the presence of typical riparian species growing up the slope to the north of the Mansion and a 1926 aerial photograph of the area, it appeared that the Mansion had been constructed within or near the edge of the general riparian corridor.

Near the walk bridge on the right (west) bank, pampas grass had invaded. The ground adjacent to the walk/bicycle bridge and associated pathway appeared stable, although there was one well-used shortcut trail leading from the pathway upslope on the west side. The understory was thin. One big leaf maple was growing on the upslope side of the walk/bike path. The west footing to the bicycle bridge was being undermined by the eroding slope beneath. Water was apparently draining from the slope beneath the footing. The drainage pipe leading from the walkway grate emptied onto the slope above the creek. Part of the grate was plugged with leaves.

On the east side of Soquel Creek (left bank looking downstream) there were alder and willow close to the stream and coast live oak with one large eucalyptus on the bluff. On the floodplain on the east side, there were alder, one large cottonwood, and a large sycamore.

Stream Habitat Adjacent to the Rispin Parcel

The stream channel was dominated by sand, although there were two riffles adjacent to the Rispin parcel that spanned approximately 760 feet of creekside from the downstream (southern) end of the parcel to the walk bridge and 950 feet total upstream to the bedrock outcrop at Nob Hill and the approximate northern end of the parcel. The longest riffle began approximately 130 feet downstream of the walk bridge and was 80 feet in length. A second riffle was located further downstream, just upstream of the bedrock exposed on the east bank and downslope of the Mansion. This exposed bedrock on the left bank created scour for a pool. Large woody debris was seen on the west bank. Juvenile steelhead were observed in the vicinity of the bedrock pool area within the summer lagoon. It was only above the riffle near the walk/bike bridge that we were certain the channel was above tidal influence. Sub-optimal, but usable spawning habitat existed just above the second riffle (downstream of the walk bridge). From visual estimates of excavated stream material, the spawning substrate was approximately 30% sand, 20% 0.25–1 inch, 20% 1–2 inches, 10% 2–3 inches, and 20% 3–6 inches in diameter.

Adult steelhead were observed in the pool adjacent to the bedrock outcrop at Nob Hill in winter 2002 waiting for sufficient streamflow to migrate upstream (**Jennifer Nelson, CDFG Fishery Biologist, pers. comm.**). CDFG personnel also observed illegal snagging of adult steelhead in this pool and the pool beneath Highway 1 in winter of 2002. Alley observed at least two steelhead redds (nests) in a glide in the Nob Hill reach on 5 April 2002. They were at the top of the cobble bar that was forcing the channel against the west bank where streambank erosion was present. A salmonid redd and past adult spawning activity was observed in this vicinity in previous years, as well. At least 6 adult steelhead were observed in the pool beneath the Highway 1 Bridge on 5 April.

APPENDIX E. WATER TEMPERATURE AND OXYGEN CONSIDERATIONS FOR RESTORING COHO SALMON AND MAINTAINING STEELHEAD IN SOQUEL CREEK

The relationship between water temperature and metabolic rate (measured as oxygen consumption) is basic to fish physiology and important in understanding fish distribution and ecology. Fish being ectotherms (cold-blooded), their body temperatures increase along with metabolic rate as water temperature increases. At higher temperatures, steelhead oxygen requirements and food demands increase, and steelhead are forced to fast-water habitat or other sources of abundant food. References that indicate that oxygen consumption by fishes increases with water temperature include Fry (**1947**), Beamish (**1964**), and Beamish (**1970**). Many fisheries textbooks refer to this relationship. An example is The Chemical Biology of Fishes by Malcolm Love (**1970**). The positive relationship between water temperature and metabolic rate in fishes leads to higher oxygen requirements as water temperature increases (**Nikolsky 1963**).

Brett (**1956**) defined lethal temperature theoretically as that temperature at which 50% of a fish population could withstand for an infinite time. At the lethal temperature and beyond, there is a period of tolerance before death, known as the resistance time (**Fry 1947**). Because of the resistance time, fish are able to tolerate diurnal fluctuations exceeding lethal temperatures (**Fry et al. 1946**). Between the upper and lower lethal temperatures is found the preferred temperature for each species. Fry (**1947**) defined the preferred temperature as the temperature range in which a given fish population will congregate when given the choice of an infinite range of temperatures.

Lethal temperature limits and the preferred temperature of a species can be altered through acclimation to changing environmental temperatures. As the acclimation temperature increases, the lethal and preferred temperatures progressively increase (**Brett 1956**). This process allows a species to survive over an extended temperature range. A review of the literature concerning the effects of high temperature on steelhead-rainbow trout shows considerable variation in results between different researchers. This was partially due to differences in laboratory conditions under which the studies were conducted. Uncontrolled variables such as water chemistry, season, day length, acclimation level, physiological condition, size, age, sex, reproductive condition, nutritional state and genetic history of tested fish may influence their response to water temperature levels.

Sub-lethal effects of high temperatures on salmonids include increased metabolic rates and decreased scope for activity, decreased food utilization and growth rates, reduced resistance to

disease and parasites, increased sensitivity to some toxic materials, interference with migration, reduced ability to compete with more temperature resistant species and reduced ability to avoid predation.

A review of the literature indicates that temperatures below 20ºC (68ºF) are best suited for the success and production of steelhead-rainbow trout (**Kubicek and Price 1976**). Snyder and Blahm (**1971**) reporting on the work of Brett (**1959**) stated that steelhead could exist at temperatures above 20ºC (68ºF), but only at the expense of feeding, growth, maturation and migration. Mantelman (**1958**) indicated that the range of 12 to 20º was most favorable for food consumption and growth of rainbow trout. Coche (**1967**) concluded that, for his stock of juvenile steelhead, temperatures between 20ºC (68ºF) and 24ºC (75.2ºF) were responsible for high maintenance requirements and low conversion efficiency of food into growth. Dickson and Kramer (**1971**) reported that the scope for activity of hatchery and wild rainbow trout was maximum at 15ºC (59ºF) and 20ºC (68ºF), respectively, and slightly less at 25ºC (77ºF). Kubicek and Price (**1976**) concluded that although temperatures less than 26.5ºC (79.7ºF) were not assumed to directly cause steelhead mortality in the Big Sulphur Creek drainage (tributary to the Russian River), temperatures consistently above 20ºC (68ºF) were assumed to cause sub-lethal stress that could result in decreased fish production and indirect mortality. They assumed in their monitoring that stations that had temperatures greater than 20ºC (68ºF) for less than 50% of the time in any one month were not expected to cause significant sub-lethal effects in that month, unless that station reached a marginal or lethal maximum temperature. Charlon (**1970**) found that steelhead acclimated at 24ºC (75.2ºF) experienced a lethal temperature of 26.35ºC (79.4ºF). Alabaster (**1962**) found steelhead acclimated to 20ºC (68ºF) to experience a lethal temperature of 26.6ºC. McAfee (**1966**) found steelhead lethal temperatures in the range of 24-29ºC (75.2º-84.2ºF) with unspecified acclimation temperatures.

Because of the existing spawning challenges for coho and typical summer water temperatures found in the mainstem of Soquel Creek below the Moores Gulch confluence, no acceptable water temperature goal can realistically be attained for coho downstream of Moores Gulch. It is highly unlikely that coho salmon can successfully spawn in the mainstem below the Moores Gulch confluence in most years (**Appendix J**; page 147). With their early spawning period and the sandy conditions, the coho redds are extremely vulnerable to scour and sedimentation from later winter and spring storms. However, if there was successful spawning in these mainstem reaches or if juveniles produced by spawning in the upper watershed moved down into these reaches, juvenile coho would easily starve because they could not utilize productive fastwater habitat as steelhead do. Although the lethal temperature limit for coho is similar to that for steelhead, they would likely starve at temperatures above 18–20ºC (65–68ºF) in the lower and middle mainstem. Coho can potentially tolerate temperatures nearly as high as those tolerated by

steelhead, but the coho usually are found at much cooler temperatures. In Washington, stocked coho were found to do well in streams where temperatures exceeded 24.5ºC for more than 100 hours and reached 29.5ºC (**Bisson et al. 1988**). However, those were very productive sites, and other species (including steelhead) were scarce. The warm lagoon at Waddell Creek failed to support coho in 1996, even though it was productive and coho were present immediately upstream of the lagoon. Apparently coho could not compete with steelhead in this warm, large pool situation. However, in smaller and/or cooler pools, coho tended to successfully exclude young-of-the-year steelhead (**Smith unpublished**). Even if water temperatures below 18ºC could be attained in some portions of the middle mainstem of Soquel Creek, few coho would likely survive in the long pools, where food is in short supply.

In some years in the future, coho might successfully spawn and rear in the low-gradient Reaches 7, 8, and 9 between the Moores Gulch confluence and the Hinckley Creek confluence on the East Branch (**Figure 4**; page 161). However, these reaches, as well as Reach 10 above the Hinckley Creek confluence, are currently too warm during some summers and will require restoration of tall riparian trees (redwood, Douglas fir, and sycamore) to bring adequate stream shading and sufficiently cool water temperatures in the summer.

In the Mattole River system (northern California) coho were found only in tributaries where the maximum weekly average water temperatures were 16.7ºC (62ºF) or less and the maximum weekly maximum temperatures were 18.0ºC (64ºF) or less (**Welsh et al. 2001**). To arrive at these temperature criteria, they determined the average daily water temperature for the weeks under consideration and determined the average maximum daily water temperature for those weeks. Then they correlated the maximum for all of the average weekly temperatures and the maximum for all of the average maximum weekly temperatures to coho presence or absence. Because of the generally sandy substrate in the Soquel Creek system, and the presence of steelhead, the temperature limits found in the Mattole River are probably the appropriate goal for re-establishing coho in Soquel Creek. In Scott and Waddell creeks in Santa Cruz County, coho have been found at warmer sites, but only where the pools were very productive (small pools, abundant algae, extensive, productive riffles upstream of the pools, etc.) (**Smith pers. observation**).

Steelhead are tolerant of higher water temperatures than coho salmon. In Soquel Creek, water temperature is primarily a food issue. In lower Soquel Creek and the lagoon, water temperature is probably not directly lethal. But higher temperatures increase food demands and restrict the steelhead to faster habitats for feeding, especially above 21ºC (70ºC) (**Smith and Li 1983**). The lethal level for steelhead would probably be above 26-28ºC (79-82ºF) for several hours during the day. But this is rarely, if ever reached, unless significant tidal overwash has occurred in the lagoon. Even so, warmer temperatures could result in slow growth or starvation in steelhead if

food supply becomes very limited. As part of annual steelhead monitoring on the San Lorenzo River in 1997-2001, Alley (**2001**) regularly measured water temperatures of 21ºC+ (69.8ºF+) in August and September in the lower and middle River in a number of reaches from Paradise Park to Brookdale, except during the cool and high-flow summer of 1998. Cool water from tributaries aided in reducing mainstem temperatures. These mainstem reaches provide habitat for large yearling steelhead and fast-growing young-of-the-year fish. High growth rate in the lower mainstem San Lorenzo River in all years and in the middle River during high baseflow years leads to relatively high densities of smolt-sized juveniles compared to the remainder of the watershed, despite typical summer water temperatures in excess of 21ºC.

Regarding Soquel Creek Lagoon in summer, where food is more abundant than upstream, a management goal for steelhead shall be to maintain water temperature below 20ºC (68ºF) at dawn within 0.25 m of the bottom and an afternoon maximum below 22ºC (71.6ºF) near the bottom. Maximum daily water temperature shall not reach 26.5ºC (79.5ºF). Water temperatures above 20ºC (68ºF) are considered limiting to juvenile coho salmon in the presence of steelhead (depending on food abundance), and temperatures below 16ºC (60.8ºF) are preferred (**J. Smith, personal communication**). Therefore, the management target for making Soquel Creek Lagoon habitable for coho shall be to maintain summer water temperature below 20ºC (68ºF). However, we do not believe that Soquel Creek Lagoon may be cooled sufficiently for juvenile coho salmon.

The management goal for steelhead regarding water temperature in stream habitat upstream of the lagoon shall be maintenance below 20ºC (68ºF) in April and May when baseflow still remains above summer low-flow and juvenile salmonids are feeding and growing rapidly. From June1 to September 1, the water temperature shall not rise above 20ºC (68ºF) more than 4 hours a day (15% of the month) and preferably the maximum daily temperature, averaged weekly, shall not rise above 21ºC (70ºF).

Cooler temperatures may be difficult without significant riparian corridor recovery in lower Soquel Creek (downstream of the Moores Gulch confluence) due to the wide floodplain and lack of riparian canopy closure at several locations. Therefore, maintaining fastwater feeding habitat by protecting maximum streamflow in lower Soquel Creek is especially important. Upstream of Moores Gulch, where the Creek passes through more canyon-like reaches without such wide floodplains, cooler water may be maintained through adequate protection of the riparian corridor and maintenance of adequate summer baseflow.

Fortunately, steelhead in Soquel Creek do not face competition or predation from more warm water adapted species, either introduced or native species such as the pikeminnow (Ptychocheilus

grandis) (formerly none as the squawfish). Though pikeminnow is absent from the San Lorenzo River, in other drainages where pikeminnow is present, steelhead abundance in warmer habitats has been significantly reduced, especially in pools.

SUPPORTING EVIDENCE FOR TEMPERATURE TOLERANCES OF STEELHEAD

There are many central coast examples of steelhead surviving and growing well at water temperatures above 21ºC. Many of these come from coastal lagoons and lower reaches of unshaded drainages, but only where food is abundant. When food is abundant, growth is actually better at warmer temperatures because digestive rate is increased, allowing fish to consume more food and grow more quickly.

The Soquel Creek Lagoon in Santa Cruz County is inhabited by juvenile steelhead each summer and is valuable nursery habitat. As a typical example, on 22 July 1988 at 0820 hr the minimum lagoon temperature was 20.8º C, and by 1449 hr the minimum lagoon temperature was 22-23º C at all stations throughout the water column, (**Habitat Restoration Group 1990**). Large, fast-growing steelhead were collected from this lagoon in fall, 1988, indicating their survival well above 21º C. In late July 1989, Smith observed 300+ steelhead juveniles at the mouth of Noble Gulch in Soquel Lagoon where the water column temperature ranged from 21.4 to 22.4º C at 1555 hr.

On 21 July 1992 in Soquel Lagoon, the minimum temperature measured at 4 sites before 0700 hr was 21.2º C (**Alley 1993**). At 3 of the 4 monitoring sites the minimum was 23º C. By 1700 hr on that day, the minimum water temperature measured was 25.2º C at one site and 26º C at the other monitored site. These sites were representative of the entire lagoon. Large, fast-growing steelhead were collected in abundance in Soquel Lagoon in fall, 1992, after these warm summer conditions.

On two occasions (August and September) in Soquel Lagoon in 1993, steelhead juveniles fed at the surface in early morning with minimum water temperature above 20.6 º C (**Alley 1994**). Water temperature was likely to increase at least 2º C through the day. More than 1,100 juvenile steelhead were captured in the lagoon in fall 1993 (**Alley 1994**).

Steelhead have been detected at water temperatures as high as 26º C in Pescadero Creek Lagoon (San Mateo County) and at 24º C on a regular basis in Pescadero and San Gregorio Lagoons (San Mateo County) (**Smith 1990**) and Uvas Creek in Santa Clara County (**J. Smith, pers. observation**).

Oxygen Considerations - Steelhead and Coho Salmon

Steelhead in Soquel Lagoon can likely survive oxygen levels in the cooler, early morning as low as 2 mg/l, based on results of monitoring of San Simeon Creek Lagoon (Alley 1995). However, the water quality goal for Soquel Creek shall be to maintain oxygen levels above 5 mg/l because activity is likely restricted at lower oxygen levels. This goal is easily met in flowing stream habitat where riffles recharge oxygen, but may not be in the lagoon under conditions in which saltwater has been trapped by sandbar closure without sufficient lagoon inflow. Artificial sandbar breaching after the initial sandbar formation has been shown to cause both temperature and dissolved oxygen problems (**Smith 1990**).

Local field data are lacking for establishing the minimum oxygen requirements for coho salmon juveniles. However, it is highly likely that warm water temperature associated with starvation would become limiting to coho in the San Lorenzo River system long before low oxygen levels would become a factor. It is probable that oxygen levels in flowing stream and riverine habitat would be ample for coho salmon, as is the case for steelhead. Saline lagoon conditions may reduce oxygen levels in deeper portions of the water column below the tolerance for coho, as with steelhead. The 5 mg/l oxygen goal for steelhead in the San Lorenzo system would also be adequate for coho salmon.

SUPPORTING EVIDENCE FOR OXYGEN TOLERANCES IN STEELHEAD

Steelhead have been observed at oxygen levels below 4 mg/l in many locations along the central coast. Steelhead were captured from isolated pools (stream discontinuous) at 3-4 mg/l oxygen and 16º C water temperature in 1988 in Waddell and Redwood creeks in Santa Cruz and Marin counties, respectively (**J. Smith, personal observation**), but coho were absent from the pools in Redwood Creek where levels dropped to 3 mg/l. In August 1989 on the Carmel River, juvenile steelhead were observed in pools at three different sites where oxygen ranged from a minimum of 2-4 mg/l at the different sites before dawn to a maximum of 14-15.5 mg/l (super saturation) in the afternoon, with water temperature ranging from 61º F (16.1º C) in the morning to 72º F (22.2º C) in late afternoon (**D. Dettman personal comm.**).

In San Simeon Creek Lagoon in 1993, steelhead survived to at least mid-August, despite morning oxygen levels in the 1.7-2.8 mg/l range. Juvenile steelhead were observed on 10 June, and 29 July at the same location (**Alley1995**). On 11 June the maximum oxygen concentration at that station was 2.7 mg/l at 0603 hr (at the surface), with water being 14º C (**Alley 1995**). On 8 July the maximum oxygen level was 1.7 mg/l with water at 16º C at 0525 hr (**Alley 1995**). On 29 July the oxygen concentration was at a maximum of 2.8 mg/l with water temperature of 17.5º C at 0530 hr (Alley 1995). An adult steelhead was observed in the lagoon during sampling on 10-11 August (**J. Nelson, CDFG, personal comm.**).

At low temperatures, it was reported that rainbow trout withstand oxygen concentrations of 1.5 to 2 mg/l (**Moyle 1976**). Rainbow trout were found in Penitencia Creek (Santa Clara County) at 3 mg/l oxygen with 20º C water temperature (**J. Smith personal comm.**).

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APPENDIX F. MATRICES OF POLICIES AND ACTIONS RELATED TO MANAGING AND ENHANCING ENVIRONMENTAL CONDITIONS AND PROVIDING EDUCATION AND FUNDING SOURCES

Table F-1. Policies and Actions Related to Fishery Issues. (Priorities assigned as High (H), Medium (M) and Low (L).)

Fish Habitat Restoration/ Protection	Riparian Vegetation Enhancement	Sandbar Construction Activities	Lagoon Manage-ment	Emergency Sandbar Breaching	Sediment Reduction	Reduce Summer Water Temperature
1.1.1-2&4 Identify and restore critical habitat, short and long range projects (H)	1.2.1 Re-circulate Stream Care Guide (H)	1.3.1 Proper Grading (H)	1.4.1 Amel-iorate sewage spills (H)	1.5.1 Proper sandbar notching (H)	1.6.1 Fund proposals to fix sediment sources (H)	1.7.1-2 Support design and implementation of restoration of riparian corridor (H)
1.1.3. Create exper-imental habitats (M)	1.2.2 Provide incentives to streamside residents (H)	1.3.2 Screen Intake Pipe (H)	1.4.2 Reduce fall turbidity (H)	1.5.2 Post Warning Signs (H)	1.6.2 Review Timber Harvest Plans (M)	1.7.3 Protect lagoon inflow, maximizing it in drier years (H)
1.1.5 Create contin-uous riparian canopy along lagoon (M)	1.2.3 Restore degraded riparian corridor (H)	1.3.3 Minimize saltwater (H)	1.4.3 Repave roads in early summer (H)	1.5.3 Notify lagoon monitor prior to breach (H)	1.6.3-4 Recommend No-cut buffers to CDF for For logging, and support other erosion control to reduce sediment (H)	1.7.4 Reduce chance of tidal overwash to the lagoon (H)
1.1.6 Proper Begonia Festival Managemen t (H)	1.2.4 Remove nonnative riparian species (H)	1.3.4-5 Minimize Construction Time (H)	1.4.4 Use paddlers for Begonia Fest. floats (H)	1.5.4-5 Post-pone sandbar breaching with flume managemen t (H)	1.6.5 Ask County to Update status of Highland Rd Slide (M)	
1.1.7 Encourage tighter fishing regulations when adults are stranded (H)		1.3.6-7 Hand rake sea plants out of lagoon (H)	1.4.5 Proper Begonia Fest. Management (H)	1.5.6 Re-open flume to improve water quality if sandbar re-closes after initial breach (H)	1.6.6 Retrofit City storm drains with detention basins (H)	
1.1.8 Leave wood in the creek (H)		1.3.8 Close lagoon nightly during sandbar construction (H)	1.4.6-7 Notify CDFG if stream intermittency and lagoon level drops (H)		1.6.7 Fund proposal to study feasibility of sediment basin on Bates Creek (M)	

Fish Habitat Restoration/ Protection	Riparian Vegetation Enhancement	Sandbar Construction Activities	Lagoon Manage-Ment	Emergency Sandbar Breaching	Sediment Reduction	Reduce Summer Water Temperature
1.1.9 Install and maintain silt and grease traps on City Storm drains and those from commercial properties (H)		1.3.9 Make sandbar high to prevent tidal overwash (H)	1.4.8 Vandal-proof the flume (H)		1.6.8 Locate long-term sediment spoil sites (H)	
1.1.10 Advocate coho recovery (H)		1.1.10 Retain wood in lagoon (H)	1.4.9 Proper flume management for small fall storms (H)		1.6.9 Support retention of instream wood throughout drainage (H)	
1.1.11 Participate in 6-county effort to analyze fishery policies (M)		1.3.11 Open flume before closing sandbar (H)	1.4.10 Prolong intact sandbar in the fall (H)		1.6.10 Procure local open space for surface runoff retention (H)	
1.1.12 Replace Stockton Ave Bridge with free-span or retrofit existing bridge (H)		1.3.12 Use fishgate/ shroud to rid saltwater; provide fish passage (H)	1.4.11 Notify CDFG to prevent mortality of stranded fish during stream intermittency (H)		1.6.11 Provide political support for County efforts to reduce sediment on unpaved rural roads (H)	
		1.3.14 Repair flume (H)	1.4.12 Post no-fishing signs at the lagoon and downstream of Highway 1 in off-season (H)			
		1.3.15 Hire fish moni-tor for sandbar work and summer water quality measurement (H)	1.4.13 Remove excess lagoon algae mechani-cally (M)			
		1.3.16 Submit monitoring reports to agencies (H)	1.4.14-18 Maintain flume passage of			

			adults until June 15 and smolts until July 1 (H)			
Fish Habitat Restoration/ Protection	**Riparian Vegetation Enhancement**	**Sandbar Construction Activities**	**Lagoon Manage-Ment**	**Emergency Sandbar Breaching**	**Sediment Reduction**	**Reduce Summer Water Temperature**
			1.4.20 Leave fallen trees in the lagoon (H)			
			1.4.21 Larger trees destined to be removed under City permitting should be felled into lagoon (M)			
			1.4.22 Continue to monitor steelhead population in the lagoon and pursue funding for censusing throughout watershed (H)			

Table F-2. Policies and Actions Related to High Bacterial Counts, Promoting a Watershed Perspective, Enhancement of the Rispin Mansion Property, Education Regarding Natural Resource Protection, Reducing Non-Point-Pollution, Addressing Streambank Erosion and Obtaining Funds for Projects. (Priorities assigned as High (H), Medium (M) and Low (L).)

High Bacterial Counts	Watershed Perspective And Cumulative Impacts	Rispin Mansion Enhancement	Education in Resource Protection	Protection of Instream Flow	Reduce Non-Point Source Pollution	Address Streambank Erosion in Nob Hill Reach	Funding Sources
2.1 Enact Policies and Actions for reduced non-point-source pollution (H)	3.1 Incorporate a watershed component to General Plan (H)	4.1 Proposals for tree removal should face adequate environmental review (H)	5.1 Eventually develop guidelines for riparian delineation (M)	6.1 Recommend/ require maximum percolation for new development (H)	7.1 Enforce stormdrain maintenance and retrofitting with detention tanks and energy dissipators (H)	8.1 Choose an alternative for addressing the streambank erosion (H)	9.1 Make grant writing a priority task for a hired Education Coordinator (H)
2.2 Enact recommendation 1.3 regarding removal of estuary plant material prior to lagoon formation (H)	3.2 Support watershed restoration efforts with staff joining technical advisory committees (H)	4.2 Protect the eucalyptus grove and redwood, propagating redwood and Douglas fir seedlings as replacements on canyon slopes (H)	5.2 Use media to enhance awareness and participation (M)	6.2 Support water conservation to increase summer baseflow (H)	7.2 Connect Esplanade runoff to sewer system during summer (H)	8.2-3 If the bank is to be stabilized, implement a crib wall approach with potential hydraulic modeling (H)	9.2 Explore funding sources such as CDFG, Coastal Conservancy and Packard Foundation (H)
2.3 Install gull-proof trash cans in sufficient quantity (H)	3.3 Provide funding, programs and internships for watershed husbandry (H)	4.3 Protect acacia on the plateau, propagating appropriate vegetation there for replacement (H)	5.3 Annually circulate non-point-source pollution flier (H)	6.3 Encourage CDFG to establish baseflow levels for steelhead and coho salmon and riparian (H)	7.3 Continue to enforce maintenance of storm drain connections (H)	8.5 Implement post-project monitoring (H)	9.3 Have public participation in earmarking funds for creek projects (H)
2.4 Control Esplanade restaurant runoff-hooking up roof and deck runoff to the sewer system and properly dispose of refuse (H)	3.4 Start an incentive program for staff who do environmental work with annual awards and recognition (H)	4.4 Revegetate northern clearing with native species (M)	5.4 Provide environmental videos related to water use and pollution to Esplanade businesses for viewing by employees (H)	6.4&13 Contact CDFG and nurseries if surface flow may be lost. Prevent dewatering of the channel (H)	7.4 Identify an environmental officer to enforce regulations and ordinances (H)	8.6 Plant native riparian vegetation on east bank and remove nonnative vines to increase vegetative support. (H)	9.4 Pursue funding for urban stream restoration (H)

High Bacterial Counts	**Watershed Perspective And Cumulative Impacts**	**Rispin Mansion Enhancement**	**Education in Resource Protection**	**Protection of Instream Flow**	**Reduce Non-Point Source Pollution**	**Address Streambank Erosion in Nob Hill Reach**	**Funding Sources**
2.5 Install gull sweeps on Esplanade Roofs (H)	3.5 Notify state and federal agencies in writing of City opposition to planting steelhead from other drainages in Soquel Creek (M)	4.5-6 Install stormwater detention facility and underground tank for drains if feasible (H)	5.5 Disseminate a hazardous chemical flier (H)	6.5 Pursue funding to continue steelhead population censusing throughout watershed	7.5 Perform management consistent with California's non-point-source pollution control Program (H)	8.7 Project or not, baseline conditions should be surveyed with subsequent tracking in future years (M)	9.5 Encourage high schools to seek funding for Soquel Creek projects (H)
2.6 Screen and add prongs to the railroad trestle (M)	3.6 Create resource guide with contacts for environmental problems (M)	4.7 Stabilize drainage channel to creek (M)	5.6 Produce, and make available to restaurants, placemats to teach children about protecting the lagoon (M)	6.6 Support efforts to maximize summer baseflow through reduced diversion and maximum groundwater recharge (H)	7.6 Obtain stormwater runoff permits (H)		9.6 Encourage universities to use Soquel Creek for research purposes (H)
		4.8 Repair/replace retaining wall (H)	5.7 Display a 3-D watershed map at public events (H)	6.7 Pursue funding to monitor summer streamflow (H)	7.7 Implement the Model Urban Runoff Plan for Small Cities (H)		
		4.9 Replace fence at top of slope (H)	5.8 Establish riparian viewing stations with signage (H)	6.8-9 Encourage water diver-sion as far down stream as possible and at night (H)	7.8 Address pollution sources, especially the Nob Hill Center, Noble Gulch and the Esplanade (H)		
		4.10 Prevent any increase in impermeable surfaces from future restoration (H)	5.9 Create signage and newspaper postings about summer streamflow level and bacterial	6.10 Support efforts to determine instream flow require-ments for salmonids	7.9 Minimize storm drain runoff from Noble Gulch in the dry season (M)		

			counts (H)	and a stream monitoring system to inform diverters of critical flow levels (H)			
High Bacterial Counts	**Watershed Perspective And Cumulative Impacts**	**Rispin Mansion Enhancement**	**Education in Resource Protection**	**Protection of Instream Flow**	**Reduce Non-Point Source Pollution**	**Address Streambank Erosion in Nob Hill Reach**	**Funding Sources**
		4.11 Replace road with porous blocks if used in future restoration (H)		6.11 Support and pursue appointment of a Water Master (H)	7.10 Cap the drain under the railroad trestle and redirect runoff into the sewer (M)		
		4.12 Make driveway more permeable (M)		6.12 Support efforts to protect fish refugia where human impacts are minimal (H)	7.11 Use vacuum-type street sweepers on pavement draining into the lagoon, especially before the rainy season (H)		
		4.13 Develop and implement a drainage plan immediately (H)		6.14 Support efforts to forecast critically low summer flows to stimulate water conservation (H)	7.12 Have existing and new commercial businesses responsible for routine sweeping of paved areas (H)		
		4.14 Construct footpath to creek (M)		6.15 Support screening of all water diversions (H)			
		4.15 No other new trail construction (H)					
		4.16 Provide erosion control during removal of exotic plants					

		and re-vegetation (H)					
		4.17 Remove Cape Ivy on trees (H)					
		4.18 Remove acacia on floodplain and replant with natives (M)					
High Bacterial Counts	**Watershed Perspective And Cumulative Impacts**	**Rispin Mansion Enhancement**	**Education in Resource Protection**	**Protection of Instream Flow**	**Reduce Non-Point Source Pollution**	**Address Streambank Erosion in Nob Hill Reach**	**Funding Sources**
		4.19 Remove pampas grass (M)					
		4.20-1 Improve drainage around west footing of Peery Park bridge (H)					
		4.22 Discourage short-cuts at Peery Park bridge with vegetation (M)					

APPENDIX G. MATRIX OF PRIORITIZED PROJECTS AND STAFFING REQUIREMENTS ARRANGED BY ENVIRONMENTAL ISSUE, EDUCATIONAL PROGRAMS AND FUNDING SOURCES

Table G-1. Matrix of Prioritized Projects, New Staff Positions and Appointments Resulting from Policies and Actions in the Plan Update. (Priorities are ranked by row. Project numbers coincide with recommendation numbers in the Plan Update. (F) indicates that project requires a funding source.)

Priority Classification by Row	Fish Habitat Restoration/ Protection	Sandbar Construction And Lagoon Management	Sediment Reduction	Reduce Water Temperature by Riparian Vegetation Enhancement and Streamflow Protection	Watershed Perspective, Cumulative Impacts And Education in Resource Protection	Reduce Non-Point Source Pollution	Funding Sources
1	1.1.6- Proper Begonia Festival Management and Water Quality Monitoring. (F) 1.1.3- Create experimental habitats- Fish Cover Structures (F) 1.17 Request that Caltrans shield creek from Highway 1 lights	1.3.14- Repair flume. (F) 1.4.22- Continue to monitor lagoon steelhead population (F) and 6.5-pursue funding for censusing throughout watershed (F)		6.11 Support and pursue appointment of a Water Master	3.1 Incorporate a watershed component to General Plan 1.1.12 Replace Stockton Ave Bridge with free-span or retrofit existing bridge for flood control. (F)	7.4 Identify an Environmental Officer to enforce regulations and ordinances	9.1 Hire an Education Coordinator to make grant writing a priority task (F)
2		1.4.12- Post no-fishing signs at the lagoon and downstream of Highway 1 in the off-season		1.2.1- Re-circulate Stream Care Guide (F)		2.3- Install gull-proof trash cans in sufficient quantity. (F) 2.4 (7.2)- Control Esplanade restaurant runoff- hooking up roof and deck runoff to sewer system and properly dispose of refuse. (F) 2.5 Obtain approval and install gull sweeps on Esplanade roofs (F)	

Priority Classification by Row	**Fish Habitat Restoration/ Protection**	**Sandbar Construction And Lagoon Management**	**Sediment Reduction**	**Reduce Water Temperature through Riparian Vegetation Enhancement**	**Watershed Perspective And Education in Resource Protection**	**Reduce Non-Point Source Pollution**	**Funding Sources**
3				6.7- Pursue funding to continuously monitor summer streamflow. (F)	Policies and Actions 5.2-5.7- Use media, pollution flier, environmental videos, hazardous chemical flier, placemats, 3-D watershed map (F) 5.8- Create riparian viewing stations with signage. (F) 3.6- Create resource guide with contacts for environmental problems. (F)	2.6 Obtain approval and screen railroad trestle, adding prongs. (F)	
4				Vegetation Projects for Rispin Property 4.1-4.4- Related to limited tree removal and tree plantings. (F) Rispin 4-17-4-19- Related to removing cape ivy, acacia on floodplain and pampas grass. (F) Vegetation Projects for the Riparian Corridor 1.1.5, 1.2.3 and 1.2.4- Related to Continuous riparian canopy, riparian restoration, non-native vegetation removal (F)			

Priority Classification by Row	**Fish Habitat Restoration/ Protection**	**Sandbar Construction And Lagoon Management**	**Sediment Reduction**	**Reduce Water Temperature through Riparian Vegetation Enhancement**	**Watershed Perspective And Education in Resource Protection**	**Reduce Non-Point Source Pollution**	**Funding Sources**
5			Rispin Property Erosion Control Projects 4.7-4.16- Related to drainage channel, retaining wall, fencing, water percolation, footpaths, drainage plan. (F) 4.21-4.22- Drainage work and preventing short-cuts around Peery Park Bridge. (F)			7.7 Develop and Implement the Model Urban Runoff Plan for Small Cities. Projects 7.1-7.8- Maintain storm drains, detention basins, permits, address pollution from Nob Hill Center, Noble Gulch and Esplanade. (F) 1.1.9- Install and maintain silt and grease traps on City storm drains (F) and those from commercial properties. 1.6.10 Procure local open space for surface runoff retention. (F) Rispin Property Drainage 4.5-4.6- Detention basins (F)	

APPENDIX H. DESCRIPTION OF ENHANCEMENT PROJECTS TO INCREASE FISH COVER IN THE SUMMER LAGOON

Introduction

In 2001, 8-foot-by-12-foot wooden barges that were normally used for Begonia Festival floats were floated in the lagoon to provide some measure of shelter (escape cover) for juvenile steelhead. However, these barges were unsightly and were the focus of vandalism (garbage dumped on them) and bird droppings. Some creek side residents complained about their presence. The barges were removed in early September to be used for the Begonia Festival, leaving any juveniles that had learned to use them as cover without any. Additionally, after a summer of floating in the lagoon, the barges absorbed considerable water and were very heavy and difficult to remove from the lagoon after the Festival. Other types of permanent escape cover have been utilized in lakes and reservoirs. However, devices used in the lagoon must be lightweight and portable or easily dismantled before winter stormflow. The following design for fish cover is an attempt to improve on the barges.

Design of the Fish Cover Structures

The basic design will be to construct a ribbed, buoyant frame with PVC pipe and to cover it with filter fabric or a tarp. Another frame will be constructed of the same dimensions but with holes in it to make it less buoyant. The buoyant frame will be suspended 8-12 inches below the water surface. The less buoyant frame will be suspended below and connected to the buoyant frame with white nylon ropes to near the lagoon bottom and anchored to the bottom. These ropes will secured between the upper and lower frame at a minimum of 5 inches apart to give the clear appearance of an enclosure to discourage birds from entering. The 5-inch width will provide ample clearance for fishes to pass through. However, the structure shall be monitored to confirm that birds avoid entering the structure and drowning.

The dimensions of the frames will be 4 feet by 8 feet, with three cross member ribs inserted width-wise at 2-foot intervals. These frames will be easily transported by pickup truck. The PVC pipe will be 1-1.5 inches in diameter, and joints will be glued and sealed between sections of pipe to make them airtight. Holes will be drilled into the lower frame of the structure to make it less buoyant. Filter fabric or dark tarp will be used to cover the buoyant frame to create a dark area underneath. Concrete, half-cinder blocks will be used as anchors at each corner of the less buoyant frame.

Structures would be most effective if connected side-to-side to increase surface area of fish cover. Being submerged, structures will not attract vandals or obstruct boat traffic. The cover will be dark and unobtrusive. Lightness of the structures will allow ease in transport and positioning.

The Department of Fish and Game does not oppose installation of these structures (**Urquhart 2002**). However, it will request that the City evaluate their success. Snorkel surveys may illustrate their effectiveness in providing cover to juvenile steelhead.

Estimated Cost of Fish Cover Structures in 2002

Twenty-four structures are recommended initially to make any significant difference in fish cover in the lagoon. The estimated cost per structure will be in the range of $200-$300, making the cost of construction in the range of $4,800 to $7,200. The cost of installation will be approximately $1,000. If supervised volunteers are willing to aide in construction and installation, the cost might be cut by 50%. The cost of removal would be in the $500 range. The structures shall remain in the lagoon until just prior to sandbar breaching. The total cost of the enhancement project would be in the $7,000 to $9,000 range without volunteers and $3,500 to $5,000 with volunteers. It may be difficult to obtain volunteers for removal because the timing cannot be planned. City employees may have to annually remove the structures prior to impending stormflows and the loss of the sandbar. If the structures are handled with care, the frames and ropes shall be re-usable for many years.

Placement of Salvaged Rootwads with Attached Trunks in the Summer Lagoon

Obtain salvaged rootwads with attached trunks at least 1 foot in diameter from CalTrans, County Public Works and private construction sites to be placed in the summer lagoon for fish cover. If the wood is placed upstream of the Stockton Avenue Bridge, pieces shall not be longer than 10-15 feet to insure that they easily pass under the bridge during stormflows. If wood is placed downstream of the Stockton Avenue Bridge, it may be longer than 10-15 feet. However, it shall be placed in such a way that it does not interfere with annual fall sampling of juvenile steelhead in the lagoon by beach seining. Convenient access points to the lagoon will be required for placement of wood. If the access near the trestle is used, woody material will have to be moved away from this potential boat launch location. Placement of this large woody material shall be along deeper edges of the lagoon. Deeper areas on the east side of the lagoon would be prime locations of placement. Wood may initially float, necessitating minor anchoring to hold the pieces in place until they sink. This activity is intended as a continuing effort each summer with large woody material remaining only temporarily in the channel. Approval from the California Department of Fish and Game may be required.

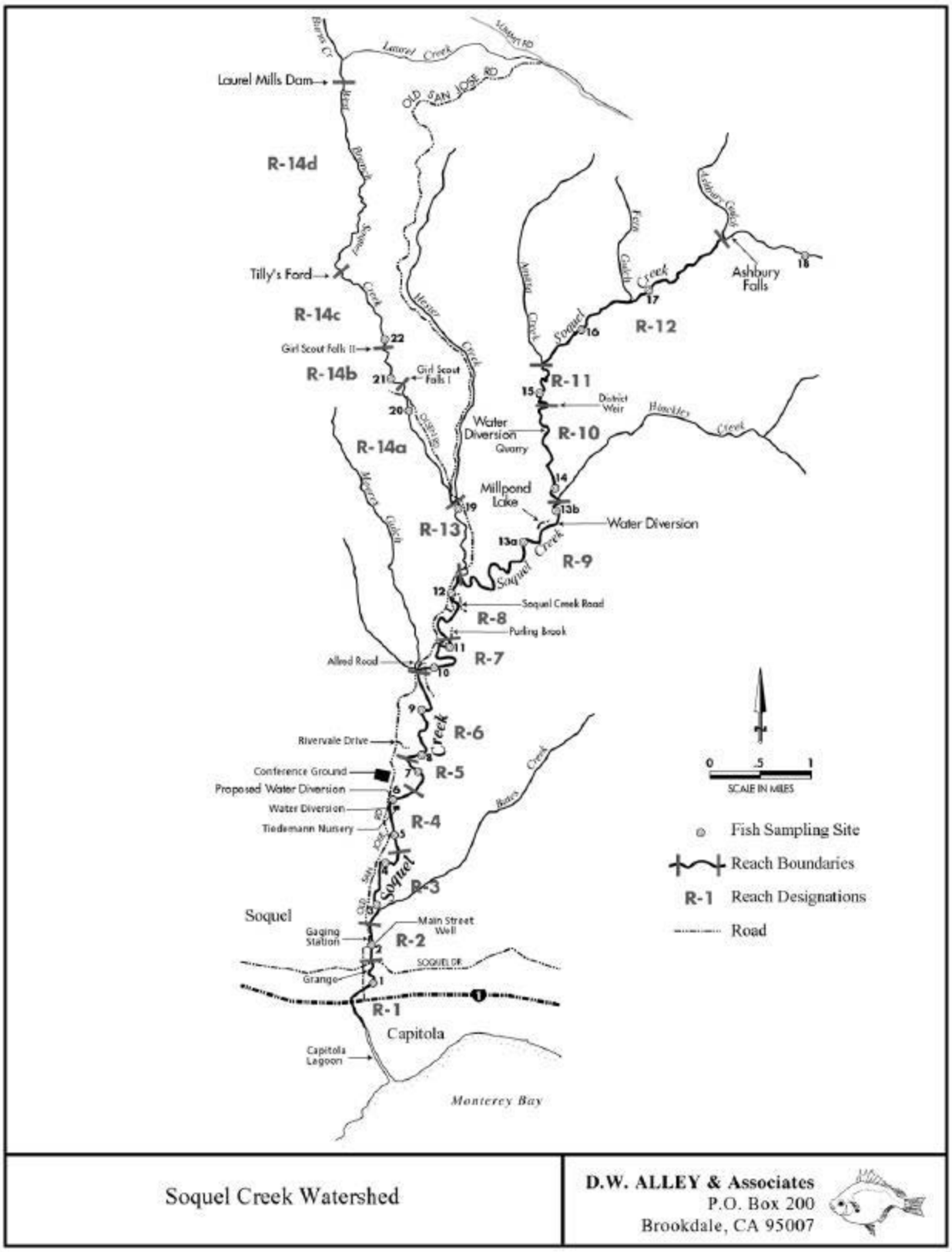
Estimated Cost of Placement of Salvaged Rootwads in 2002

The cost may be primarily in transport by flatbed truck and potential use of a crane or other heavy equipment for placement of salvaged rootwads in the lagoon. Anchors may be fabricated from 50-pound bags of cement.

APPENDIX I. PRELIMINARY COST ESTIMATE FOR RIPARIAN HABITAT RESTORATION AND VEGETATION MANAGEMENT IN 2002.

Task	Quantity	Unit Price	Subtotal	Task Total
Removal of Invasive, Non-native Plant Species (herbaceous species) from Riparian Forest (approx. 19 acres)	4 person crew for 5 days/acre	$5,000/acre		$95,000
Erosion Control Seeding of Treatment Areas (approx 10 acres)	4 person crew for 1 day/acre	$1,000/acre		$19,000
Planting of Treatment Areas for native woody plant species (no irrigation) (approx. 3 acres)	Procure plants (1,000 plants) Install plants Install cages Supervisor	$5/plant $30/plant $5/plant + tax $240/day	$5,000 $30,000 $5,400 $1,200	$41,600
TOTAL				**$155,600**
MAINTENANCE AND MONITORING (PER YEAR)				
Erosion Control Maintenance	Specialist: 1.5 days Crew: 3 days Materials	$85/hour $100/hr (crew rate) $800	$1,020 $2,400 $800	$4,200/year
Invasives and Revegetation Maintenance	4 person crew for 24 visits/year	$960/visit		$23,040/year
TOTAL				**$27,240/year**

APPDENDIX J. SOQUEL CREEK WATERSHED PHOTOGRAPHS AND MAP.


Laurel Mills Dam
Laurel Creek
OLD SAN JOSE RD
R-14d
Tilly's Ford
R-14c
Girl Scout Falls II
R-14b
Girl Scout Falls I
R-14a
Water Diversion
Quarry
District Weir
R-11
R-10
R-12
Ashbury Falls
Millpond Lake
Water Diversion
R-13
R-9
Soquel Creek Road
R-8
Purling Brook
Allred Road
R-7
R-6
Rivervale Drive
Conference Ground
R-5
Proposed Water Diversion
Water Diversion
Tiedemann Nursery
R-4
R-3
Soquel
Main Street Well
Gaging Station
R-2
SOQUEL DR
Grange
R-1
Capitola
Capitola Lagoon
Monterey Bay
SCALE IN MILES
Fish Sampling Site
Reach Boundaries
R-1 Reach Designations
Road
Soquel Creek Watershed
D.W. ALLEY & Associates
P.O. Box 200
Brookdale, CA 95007

Main Street Bridge Culvert, Bates Creek 28 August 2002

Bates Creek Landslide #1 below Dirt Road Cut 28 August 2002

Bates Creek Dam (26 ft high), 6,900 ft Above Main Street 28 August 2002

Mainstem at Upper End of Cherryvale Road, Upstream of Proposed Water District Diversion Site 1 August 2002

Good Mainstem Spawning Gravel Site Near Northern End of Cherryvale Road
1 August 2002

Poor Mainstem Spawning Gravel at Tail of Corner Pool Above Rivervale Drive
1 August 2002

Douglas Fir Fallen from Vertical Bluff Into Pool at Upper End of Mountain School Bend 1 August 2002

Large Wood Cluster on Floodplain Near Rivervale Drive 1 August 2002

Mainstem Soquel Creek near Purling Brook Road 11 October 2001

Giant Old Growth Redwood Stump, Trunk 10 ft diameter, Root mass 18 ft Diameter
East Branch Downstream of Hinckley Creek 6 August 2002

Foothill Yellow-legged Frog on East Branch Between Mill Pond and Hinckley Creek 7 August 2002

East Branch Stream Channel Above Hinckley Creek 7 August 2002

East Branch- Ashbury Falls Boulder Field, 165 ft Long 14 October 2002

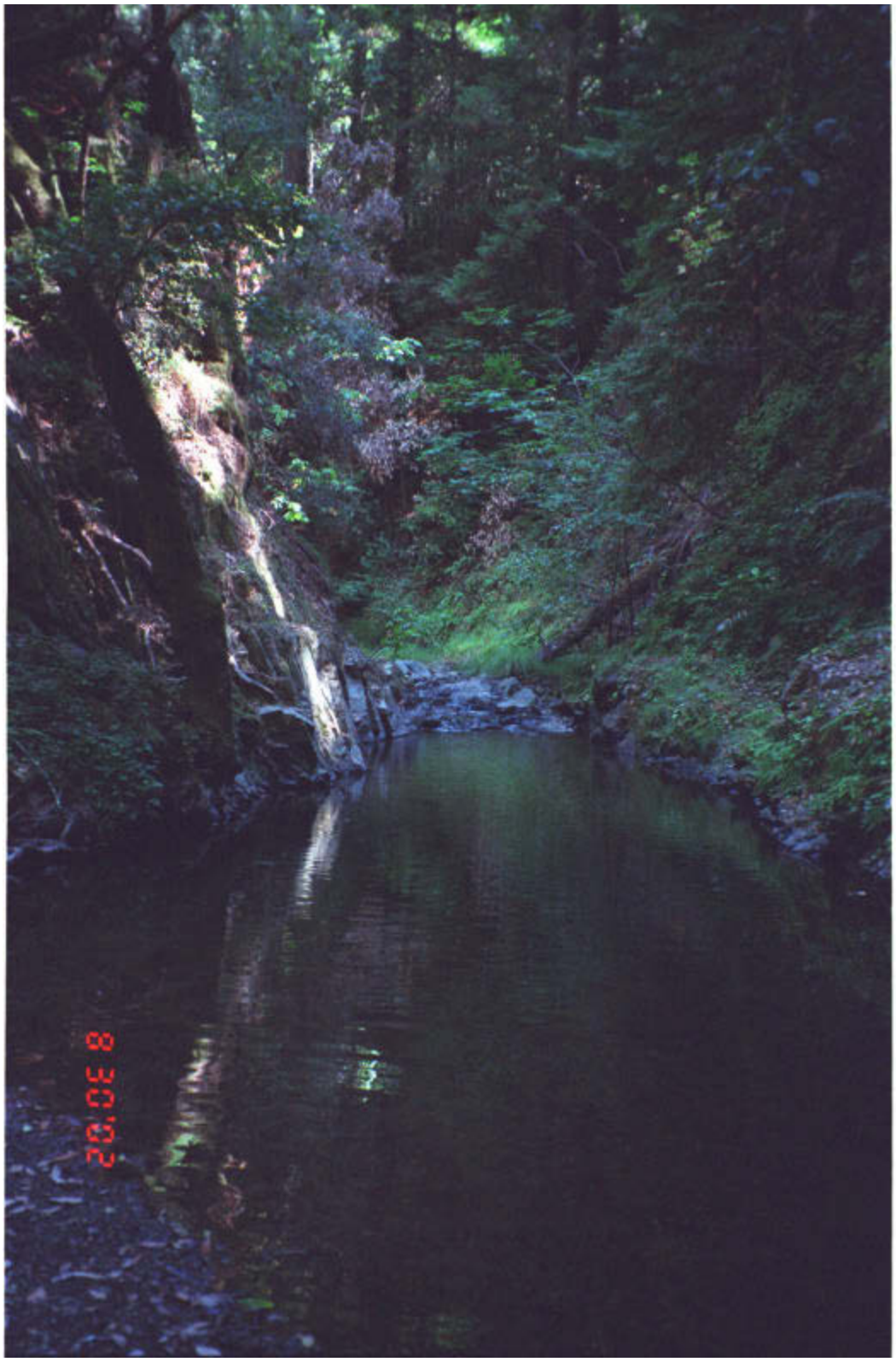
East Branch- Ashbury Falls Bedrock Shelf #7, 6.5-9 ft high by 40 ft wide, 170 ft Upstream of Boulder Field

East Branch Above Ashbury Falls Boulder-Bedrock Complex; Typical Boulder Pools
14 October 2002

Soquel-San Jose Road Box Culvert Over Hester Creek 16 August 2001

West Branch Girl Scout Falls I #13, 7-foot Drop, 15 ft Long Chute 30 August 2002

West Branch Girl Scout Falls II, 2-Step, 12-15 ft drop, 12 ft wide at Bankfull
30 August 2002

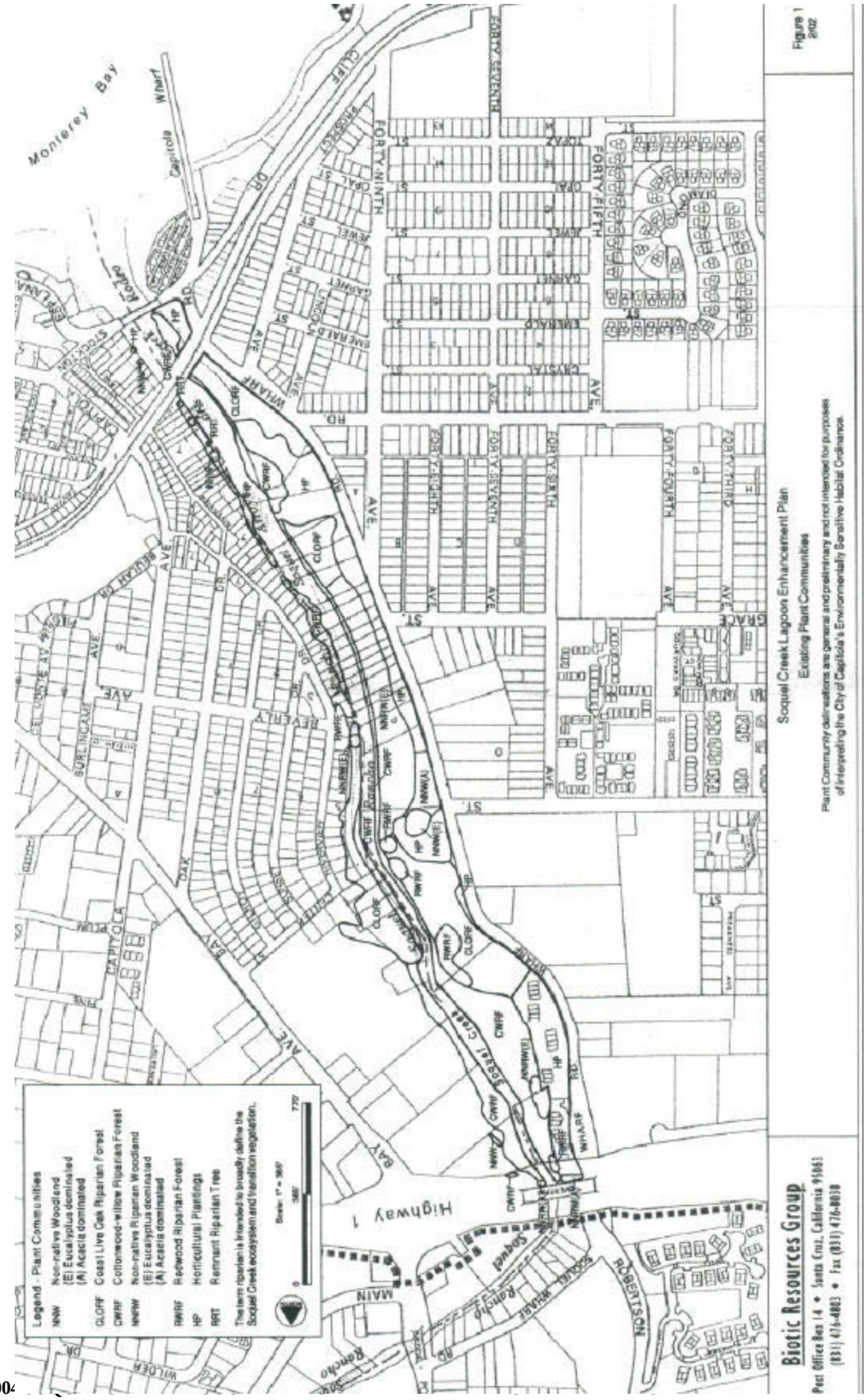


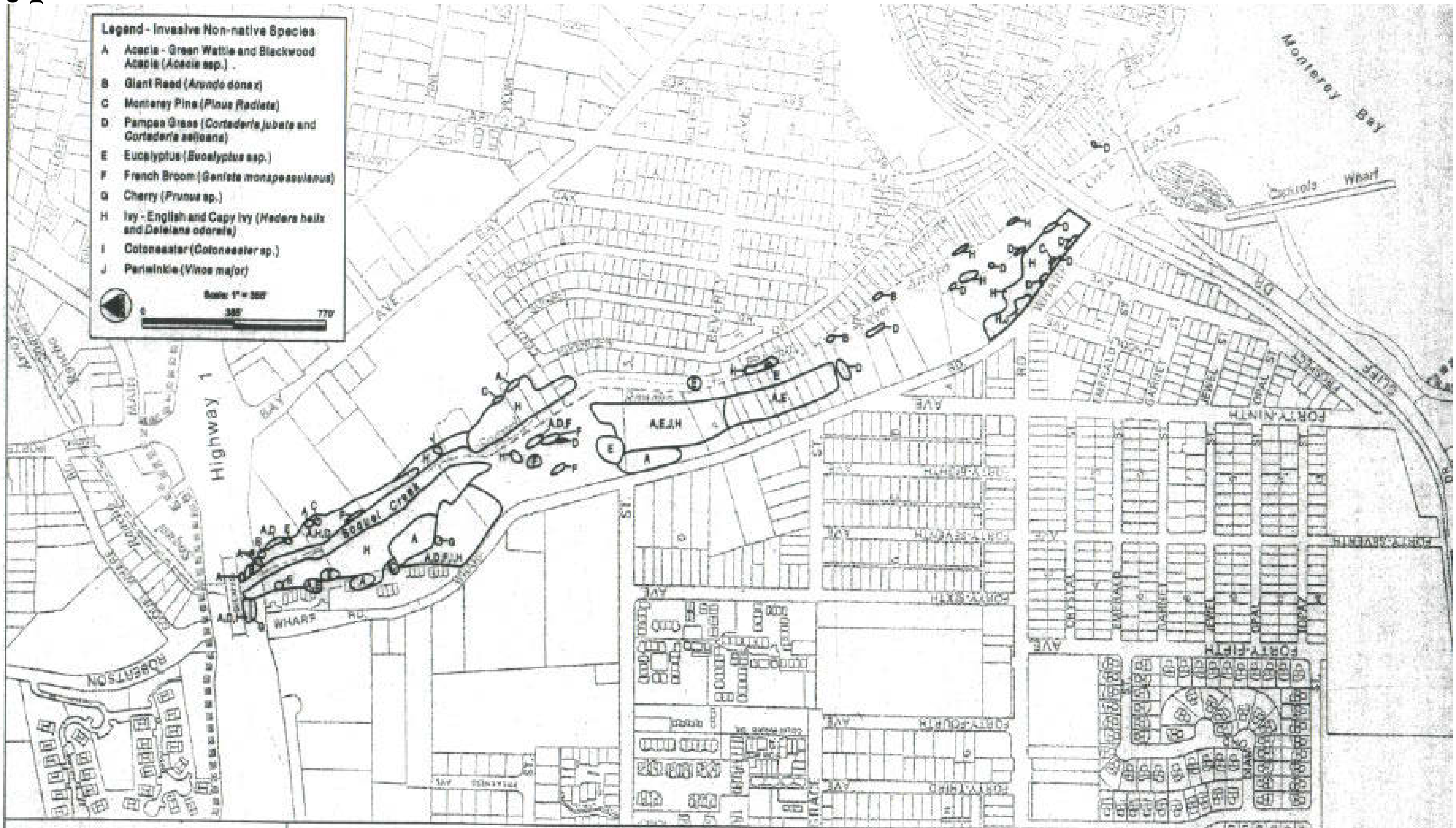
West Branch Bedrock Pool Between Girl Scout Falls I and II
30 August 2002

West Branch Landslide #26, 200-250 ft high, 422 ft wide, Active, 12,350 ft Above Olsen Rd 30 August 2002

West Branch- Laurel Mill Dam (Concrete) 12 ft High at Notch, 45 ft Wide 30 August 2002

FIGURES


Legend - Plant Communities
NNW Non-native Woodland
(E) Eucalyptus dominated
(A) Acacia dominated
CLORF Coast Live Oak Riparian Forest
CWRF Cottonwood-willow Riparian Forest
NNRW Non-native Riparian Woodland
(E) Eucalyptus dominated
(A) Acacia dominated
RWRF Redwood Riparian Forest
HP Horticultural Plantings
RRT Remnant Riparian Trees
The term riparian is intended to broadly define the Soquel Creek ecosystem and transition vegetation.
Scale: 1" = 385'
0
385'
770
Monterey Bay
Capitola Wharf
Highway 1
Soquel Creek
Soquel Ranch
MAIN
ROBERTSON
BAY
AVE
OAK
TAPIOCA
BEVERLY
WILLOW
WHARF
CLIFF
FORTY-SEVENTH
FORTY-EIGHTH
FORTY-FIFTH
TOPAZ
OPAL
JEWEL
GARNET
EMERALD
CRYSTAL
GRACE
Biotic Resources Group
Post Office Box 14 • Santa Cruz, California 95061
(831) 476-4802 • Fax (831) 476-8038
Soquel Creek Lagoon Enhancement Plan
Existing Plant Communities
Plant Community delineations are general and preliminary and not intended for purposes of interpreting the City of Capitola's Environmentally Sensitive Habitat Ordinance.
Figure 1
2002

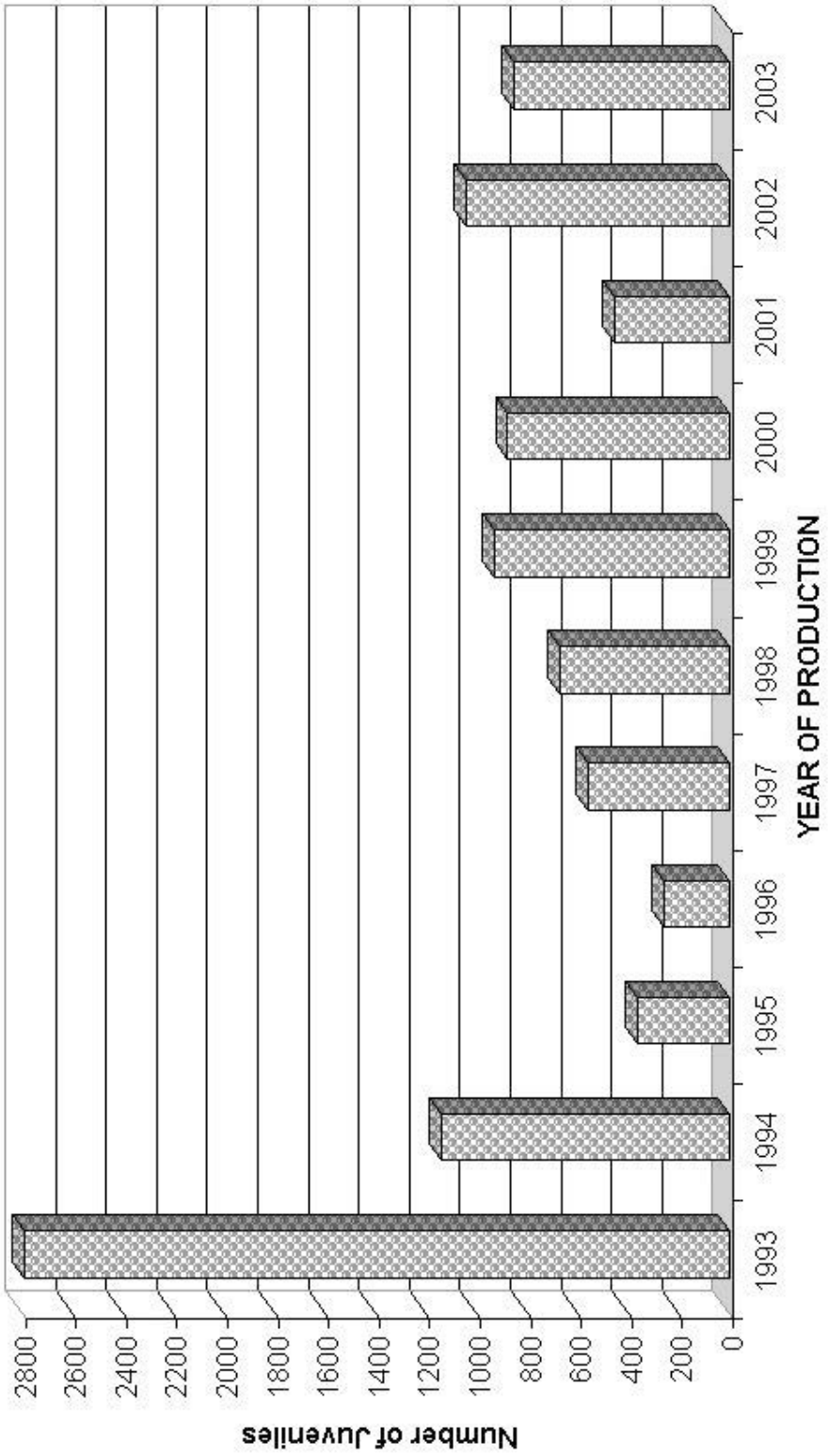


Biotic Resources Group
Post Office Box 14 • Santa Cruz, California 95063
(831) 476-4803 • Fax (831) 476-8038

Soquel Creek Lagoon Enhancement Plan
Invasive Non-native Plant Species

Figure 2
2/03

Figure 3. Juvenile Steelhead Production in Soquel Creek Lagoon, Estimated by Mark and Recapture for 1993-2003.



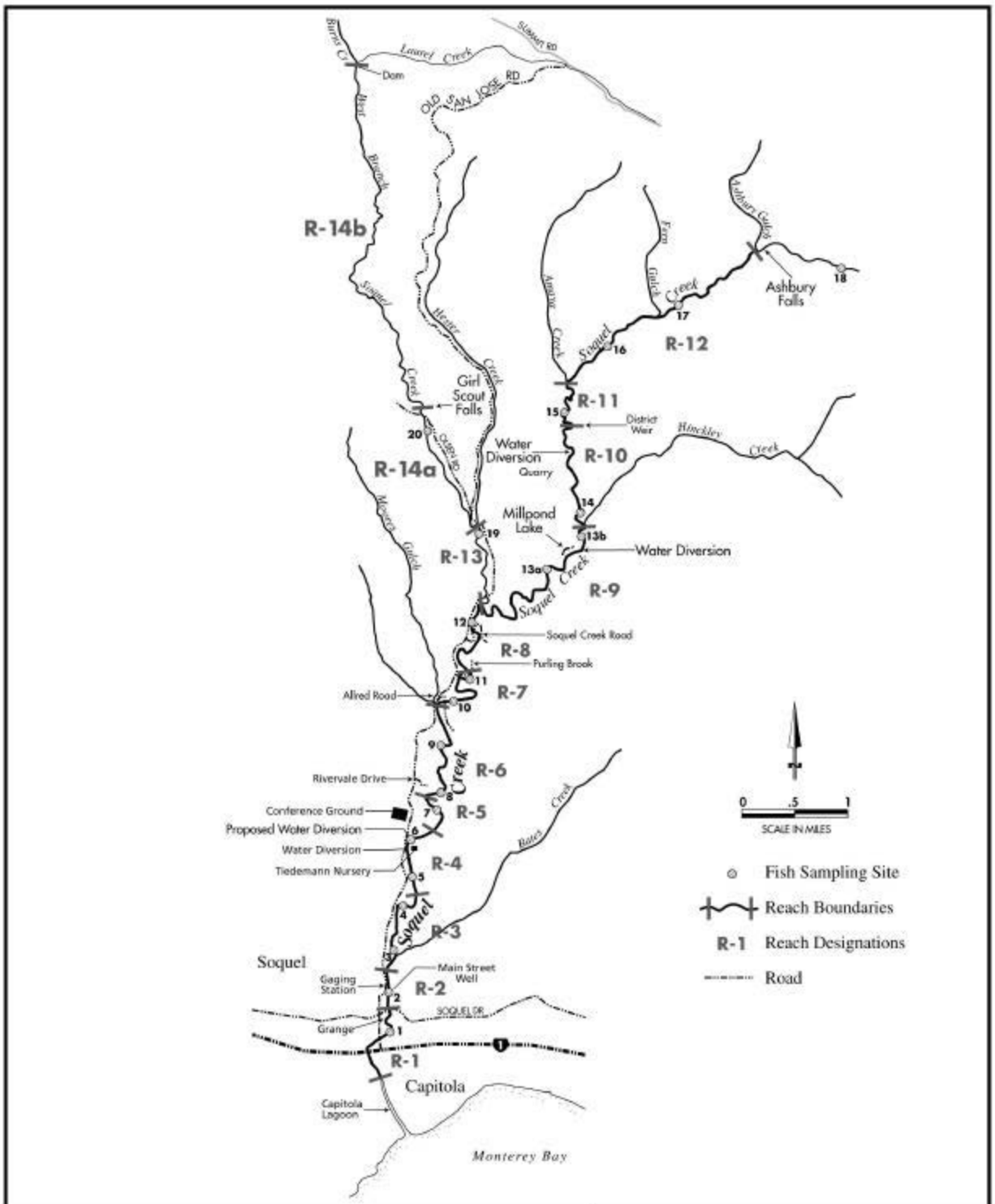
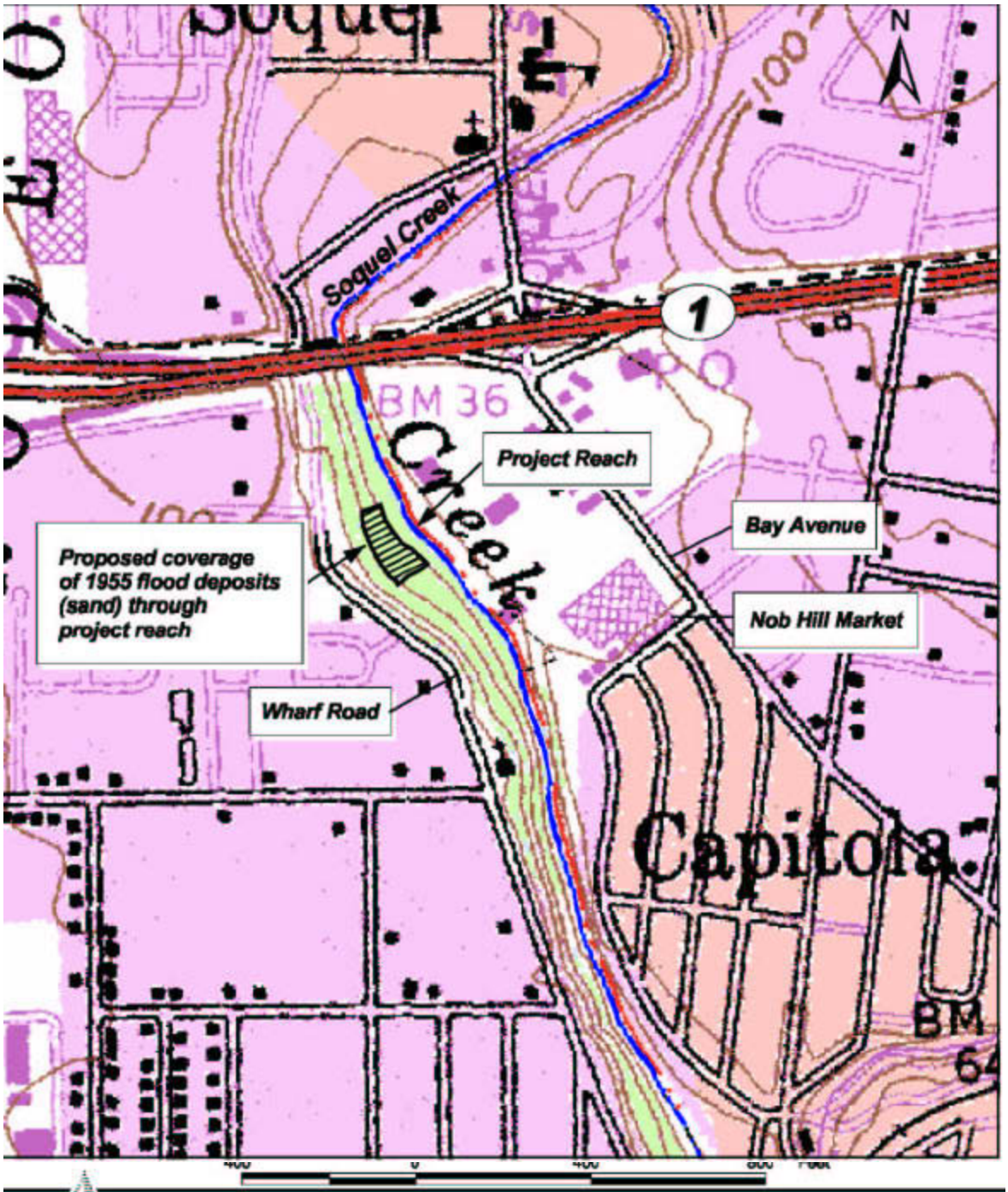


FIGURE 4
Reach Designations & Fish Sampling Sites
in the Soquel Creek Drainage

D.W. ALLEY & Associates
P.O. Box 200
Brookdale, CA 95007



Balance Hydrologics, Inc.

Figure 5: Location of Nob Hill Reach Bank Stability Project, Soquel Creek,Capitola. CA.

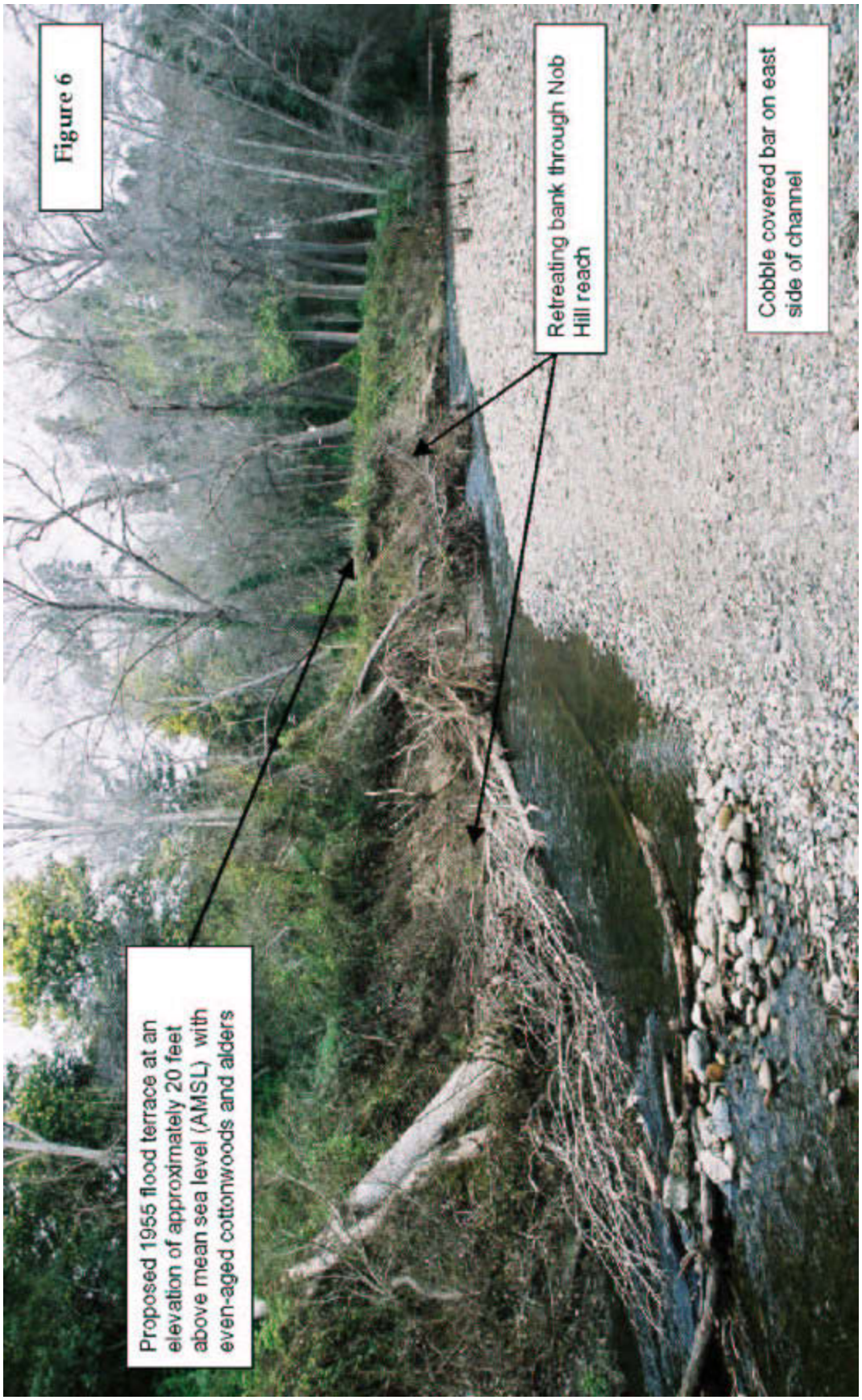

Proposed 1955 flood terrace at an elevation of approximately 20 feet above mean sea level (AMSL) with even-aged cottonwoods and alders
Retreating bank through Nob Hill reach
Cobble covered bar on east side of channel

Figure 6

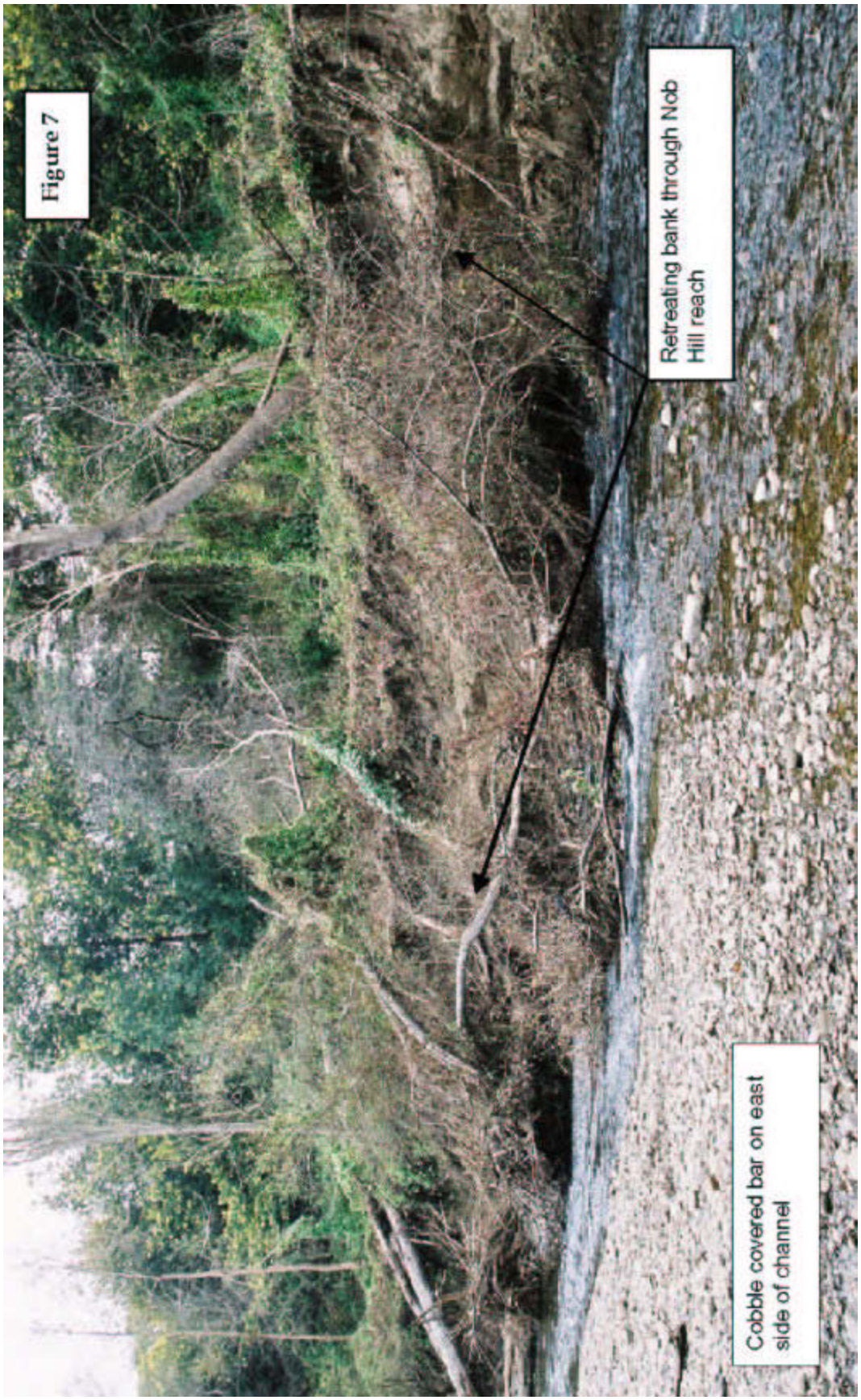

Retreating bank through Nob Hill reach
Cobble covered bar on east side of channel

Figure 7

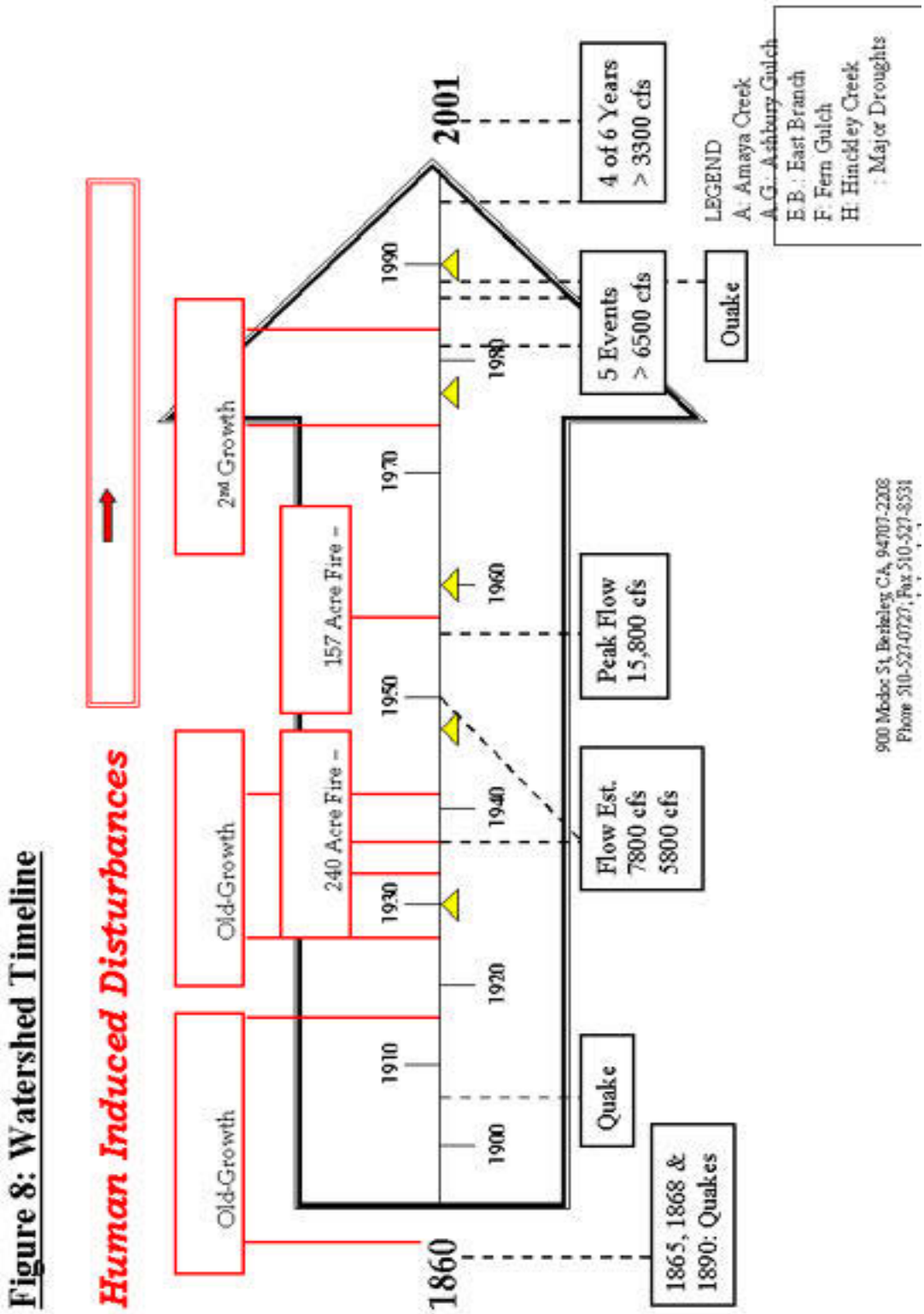


Figure 8: Watershed Timeline

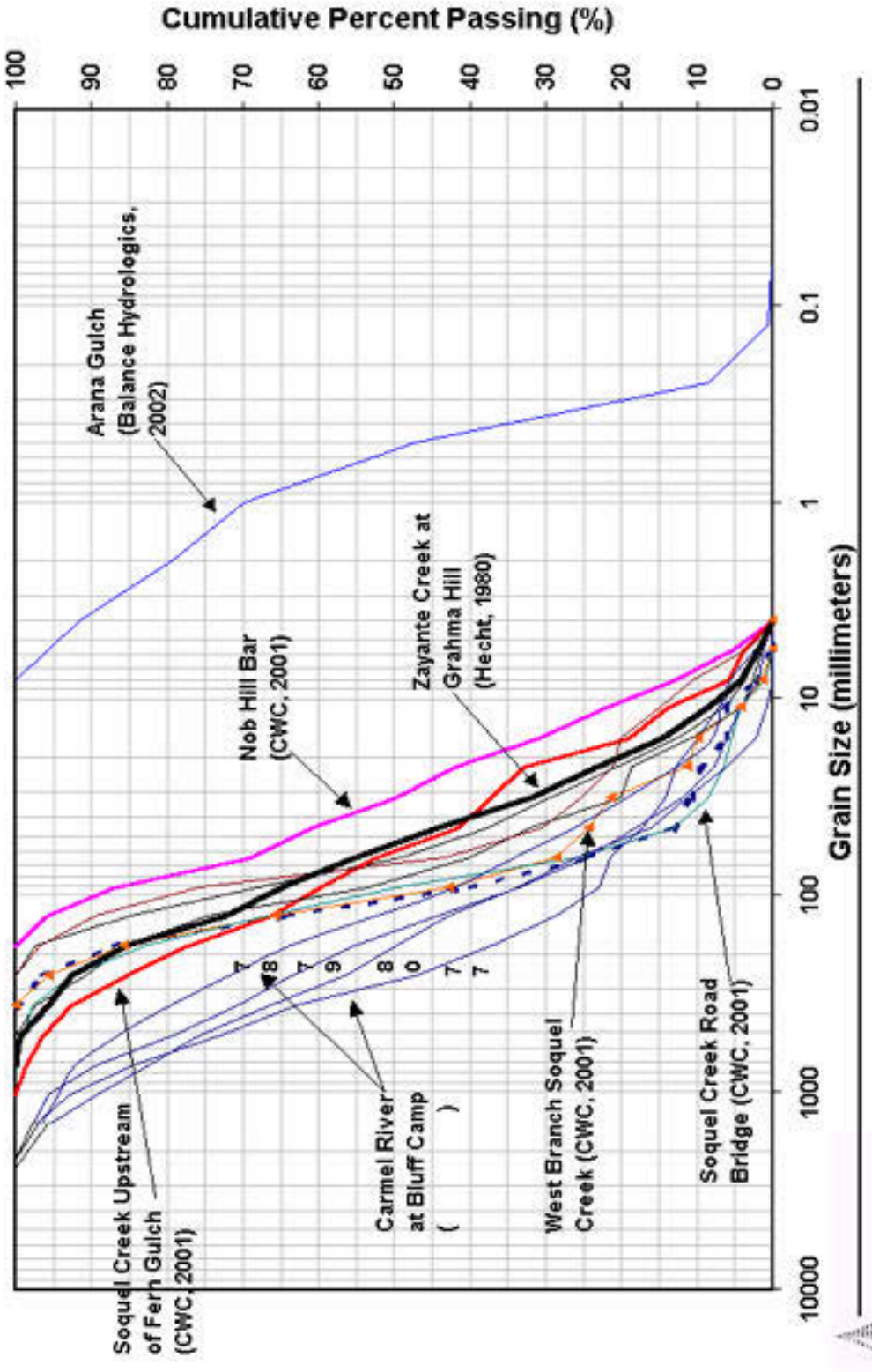


Figure 9: Surficial bed material size distribution for 8 locations in Soquel Creek with distributions for the Carmel River, Arana Gulch and Zayante Creek also shown.
Surficial bed material was sampled in Soquel Creek during the fall of 2001 by the Coastal Watershed Council as a part of our joint watershed assessment efforts.

Balance Hydrologics, Inc.

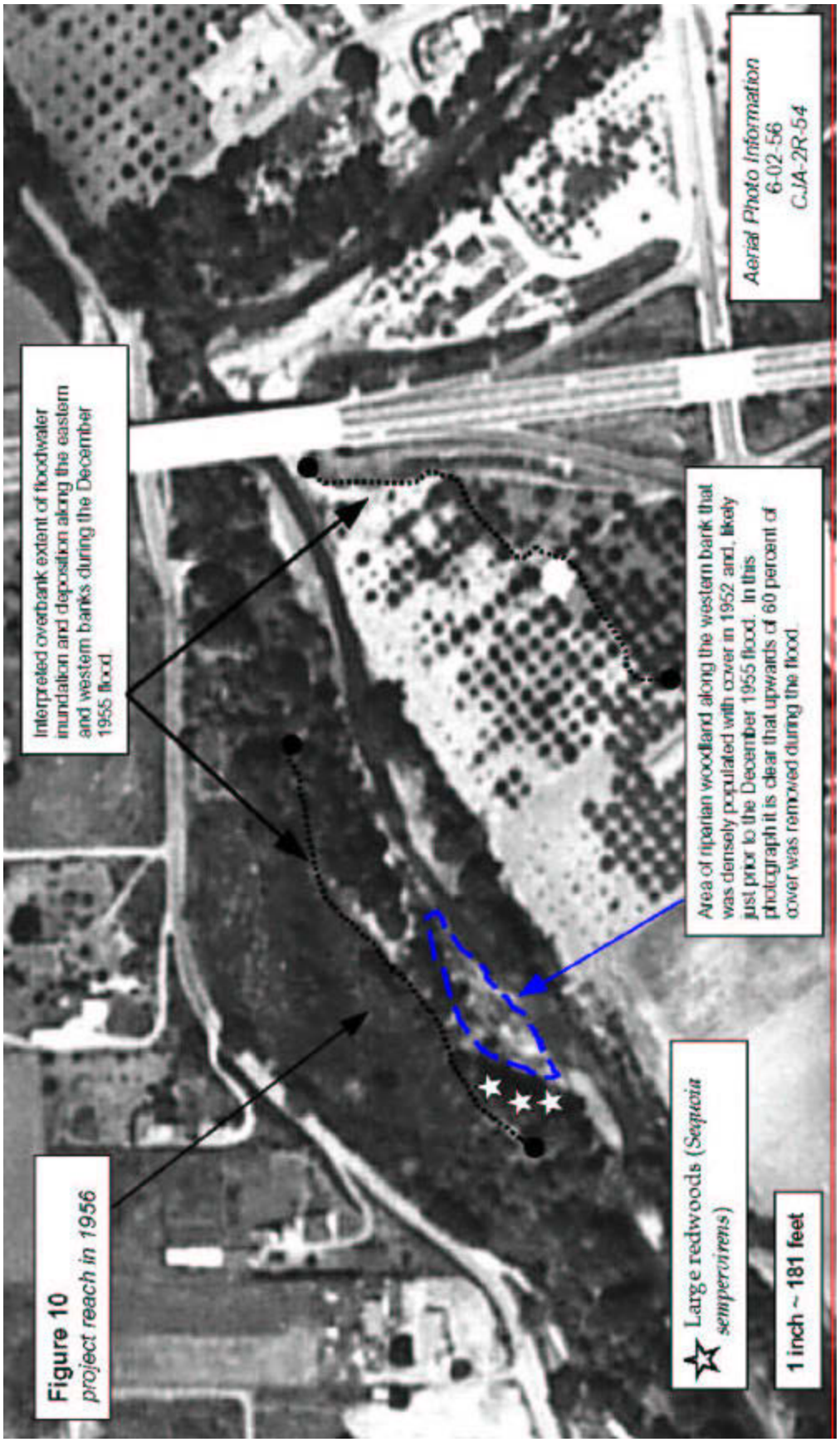


Figure 10
project reach in 1956


Cluster of redwoods (*Sequoia sempervirens*) present in all aerial photographs reviewed. The eastern most redwood is currently in danger of slumping into the channel.
Cobble covered bar on east side of channel

Figure 11

BALANCE HYDROLOGICS, Inc.

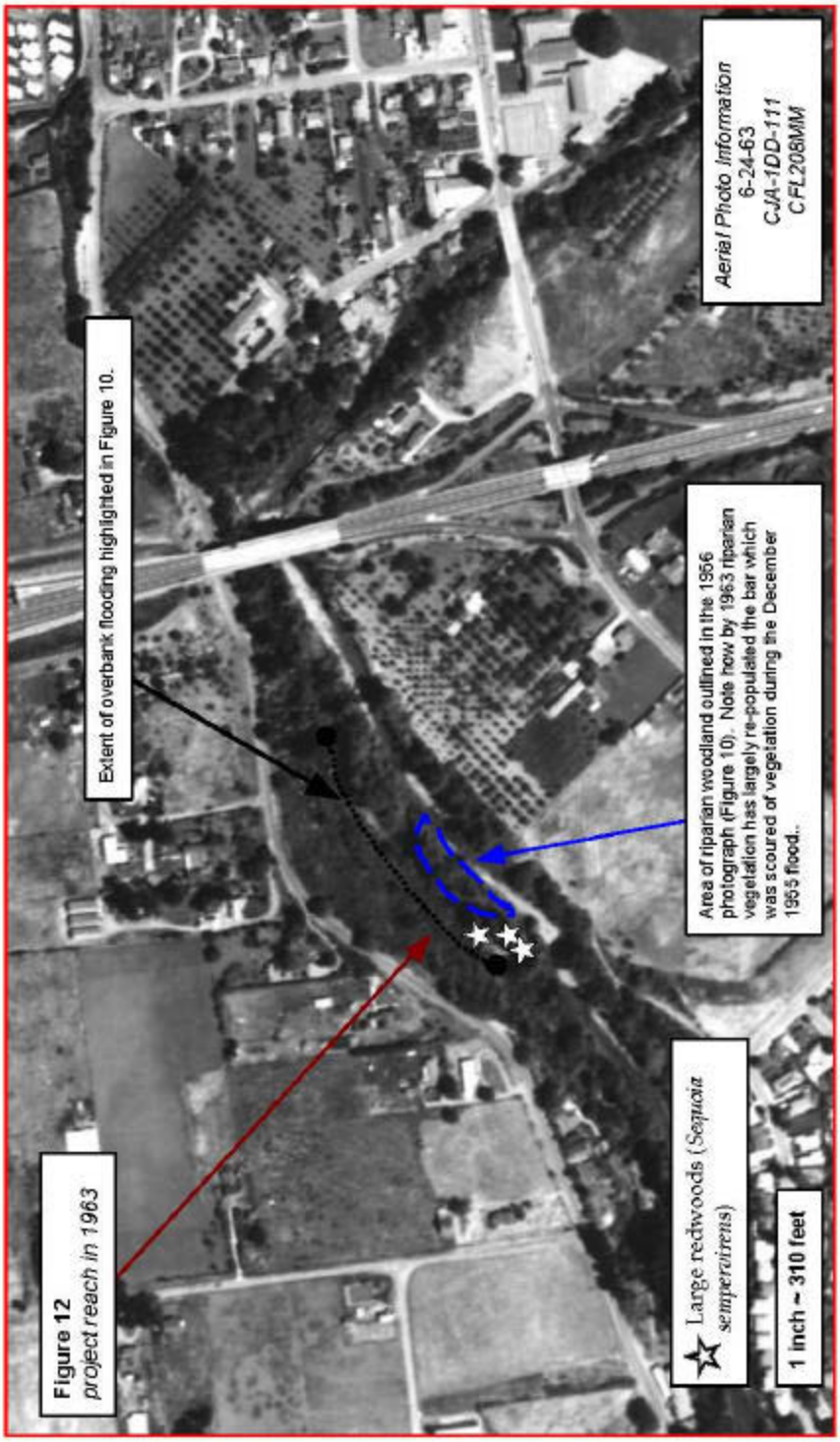


Figure 12
project reach in 1963

File name: 201033_Figure 12.doc

900 Modoc St, Berkeley, CA, 94707-2268
Phone 510-527-0727; Fax 510-527-853
www.balancehydro.com

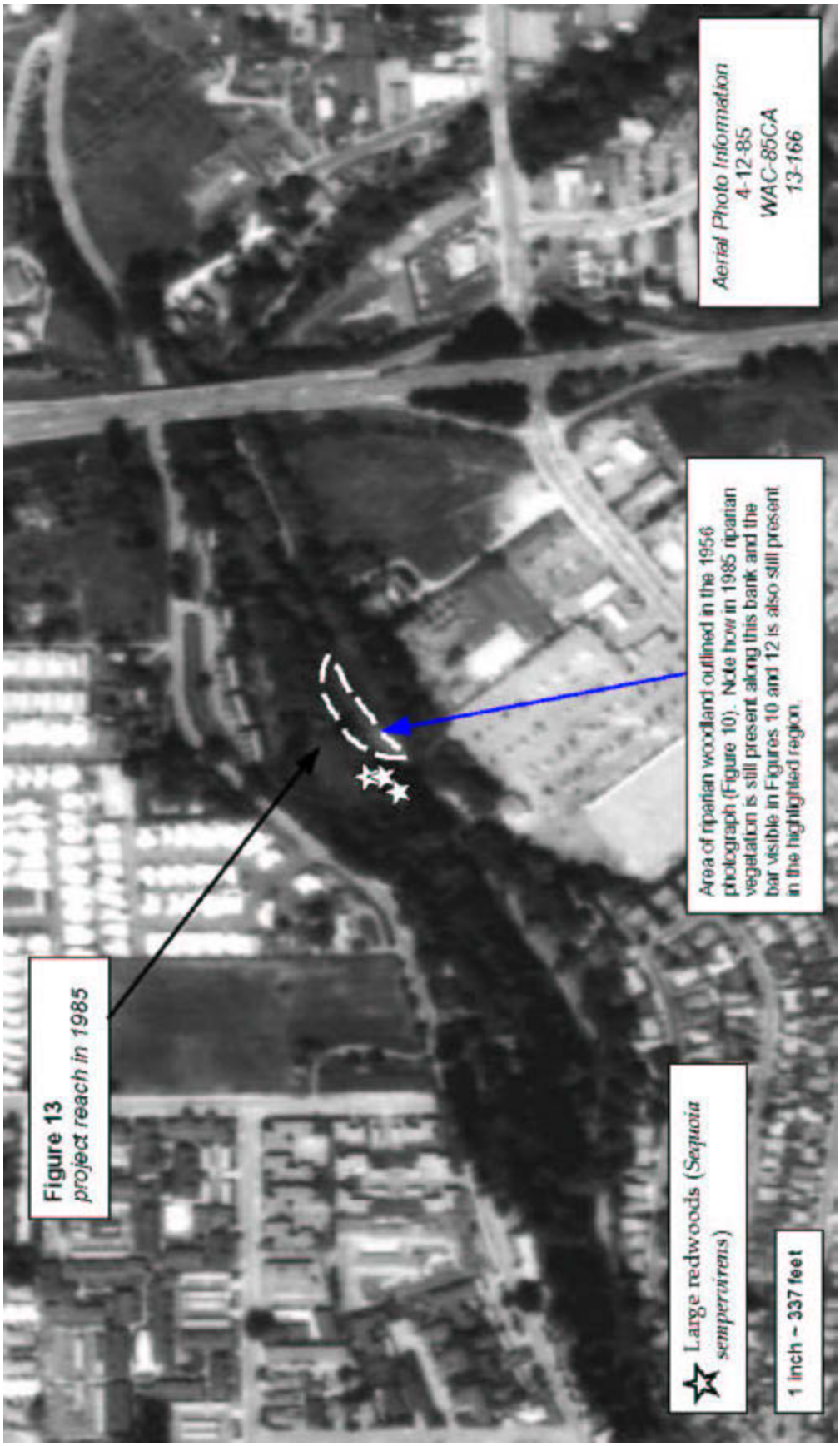


Figure 13
project reach in 1985
Aerial Photo Information
4-12-85
WAC-85CA
13-166
Area of riparian woodland outlined in the 1956 photograph (Figure 10). Note how in 1985 riparian vegetation is still present along this bank and the bar visible in Figures 10 and 12 is also still present in the highlighted region.
Large redwoods (Sequoia sempervirens)
1 inch = 337 feet

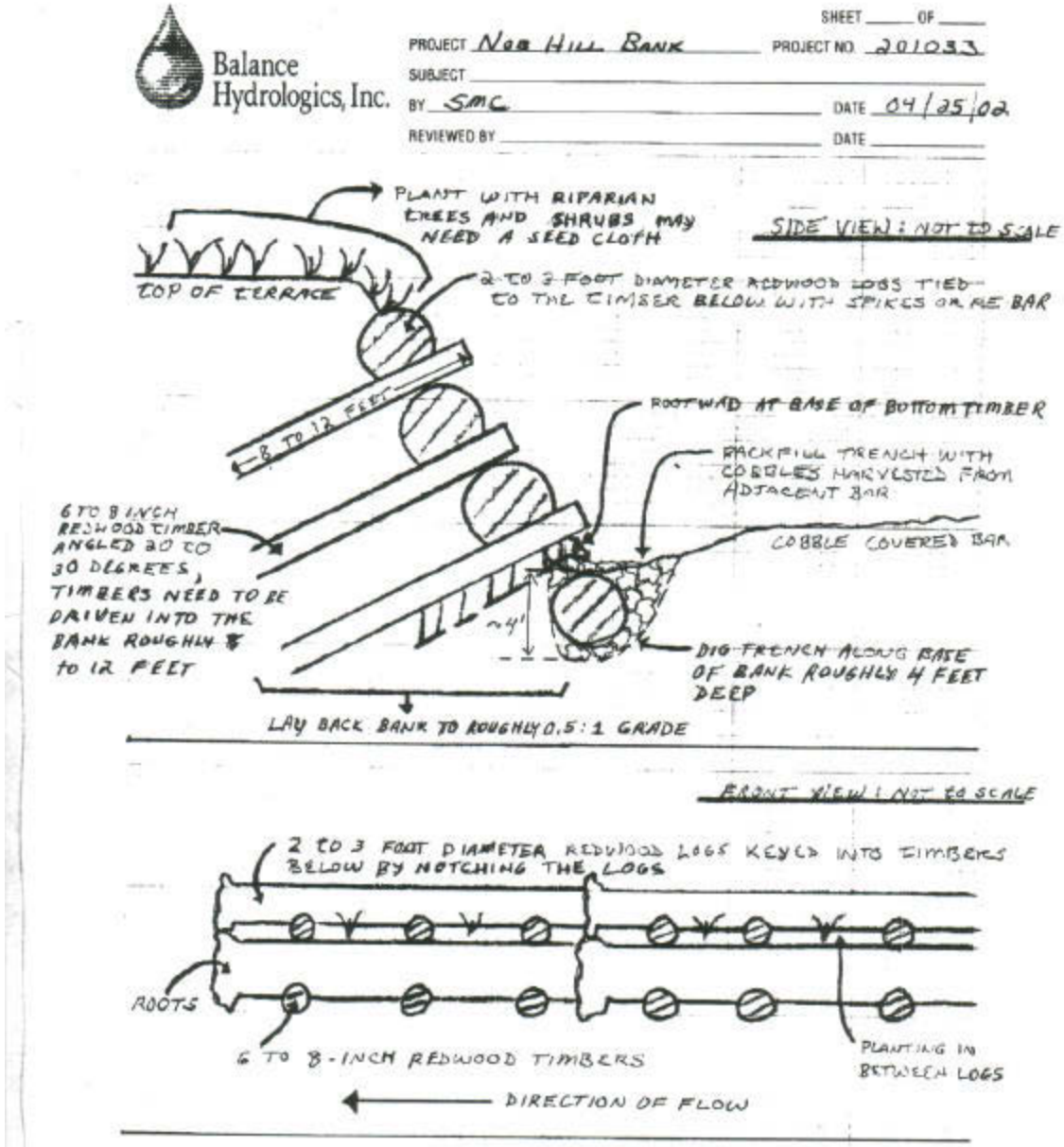


FIGURE 14: CONCEPTUAL CRIB WALL DESIGN

DESIGN NOT TO SCALE, INTENDED FOR PLANNING PURPOSES ONLY.

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