

CHAPTER 3

GUIDELINES FOR SALT MARSH RESTORATION IN SAN LEANDRO BAY

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In conjunction with the East Bay Regional Park District's task-force recommendations for shoreline parks, I should like to discuss the management needs of San Leandro Bay and Oyster Bay in terms of enhancing or restoring more natural shoreline conditions.

There is no longer any question that marshlands and estuaries are valuable.¹¹ In urban areas they can provide green open space necessary to uplift the morale of man; a place where the skies are not obliterated by edifices, where there is the silence of sunlight dancing upon the open waters, the solitude of a heron stalking the shores, where some sense of the natural environment can be had close to home. Economically, estuaries provide many free services including cleaning polluted air and water, assimilating wastes, serving as recreational sites and commercial shellfish and fish rookeries, and absorbing noises from airports (the Oakland Airport is in the immediate vicinity of both study sites). Of course, estuaries have a limited capacity to perform these functions, and can easily be overtaxed.¹¹

Ecologically, marshlands are one of the most productive biotic associations in the world, due to the nutrients washed in from tributaries. These nutrients are utilized on land by plants such as cordgrass, which are seven times as productive per unit biomass as wheat, and in the water by phytoplankton and microscopic invertebrates. Other than the plenitude of nutrients, the major factor affecting the productivity of marshes is the quality of the water, especially the degree of salinity, which can change the flora. Historically, the waters of San Francisco Bay were much cleaner because extensive marshlands served to filter out particulate matter. Entering waters were slowed down as they traveled through the plants, and the detritus dropped from suspension to be utilized in the food chain of the marshes. It is this process that is used as a means of tertiary sewage treatment because the biological oxygen demand (BOD), total dissolved solids (TDS), and chemicals such as nitrogen and phosphorus are readily reduced.³ Because extensive marshlands fix atmospheric carbon, they reduce the level of carbon monoxide polluting the air, replacing it with CO₂.

Lastly, one must consider the value of the marshes to wildlife. Many commercially important species of fish breed in the shallow inlets of the marshes, or go there to feed, and due to the effects of past dredging and filling of the marshes, the fisheries have been greatly reduced.¹² Shellfish have also been reduced, but they are returning in numbers since they are no longer exploited commercially. This has been due to their filter feeding habits which concentrate heavy metals and pollutants. Now that the water quality of the Bay has improved substantially, it is expected that the shellfish beds will again be utilized for recreation in 1980. Millions of migratory waterfowl winter on the marshes and waters of the Bay, and there are also many resident birds and animals that depend upon the marshland habitat.³

San Leandro Bay (Figure 1) today is decidedly a remnant of what it once was: marshes extended inland to the Coliseum BART station, Alameda was a peninsula and San Leandro Bay flowed south into San Francisco Bay. In 1915 there were 2000 acres of marsh in San Leandro Bay; presently there are about 70 acres. These marshes used to be one of the Audubon Society's best birding locations on the West Coast; now the land is variously used for suburban homes, light industry, an industrial park containing much vacant land, recreational boating and as a dump on Mt. Trashmore. Much of the shore line is rip-rap strewn with flotsam. The water quality of the Bay is affected by leachate from Mt. Trashmore, small amounts of industrial waste, and runoff from the landscape, and from the tributary channels in wet weather. Open water birds are still common San Leandro Bay, but local marsh residents no longer breed where house sparrows and pigeons are common and weeds have replaced the native food source. Still, there are 138 species of birds which can be seen on the Bay.⁸ The marsh vegetation has been reduced to the two indicator species, *Salicornia virginiana* and *Spartina foliosa*, which blend in with the introduced weeds along most of the shoreline.

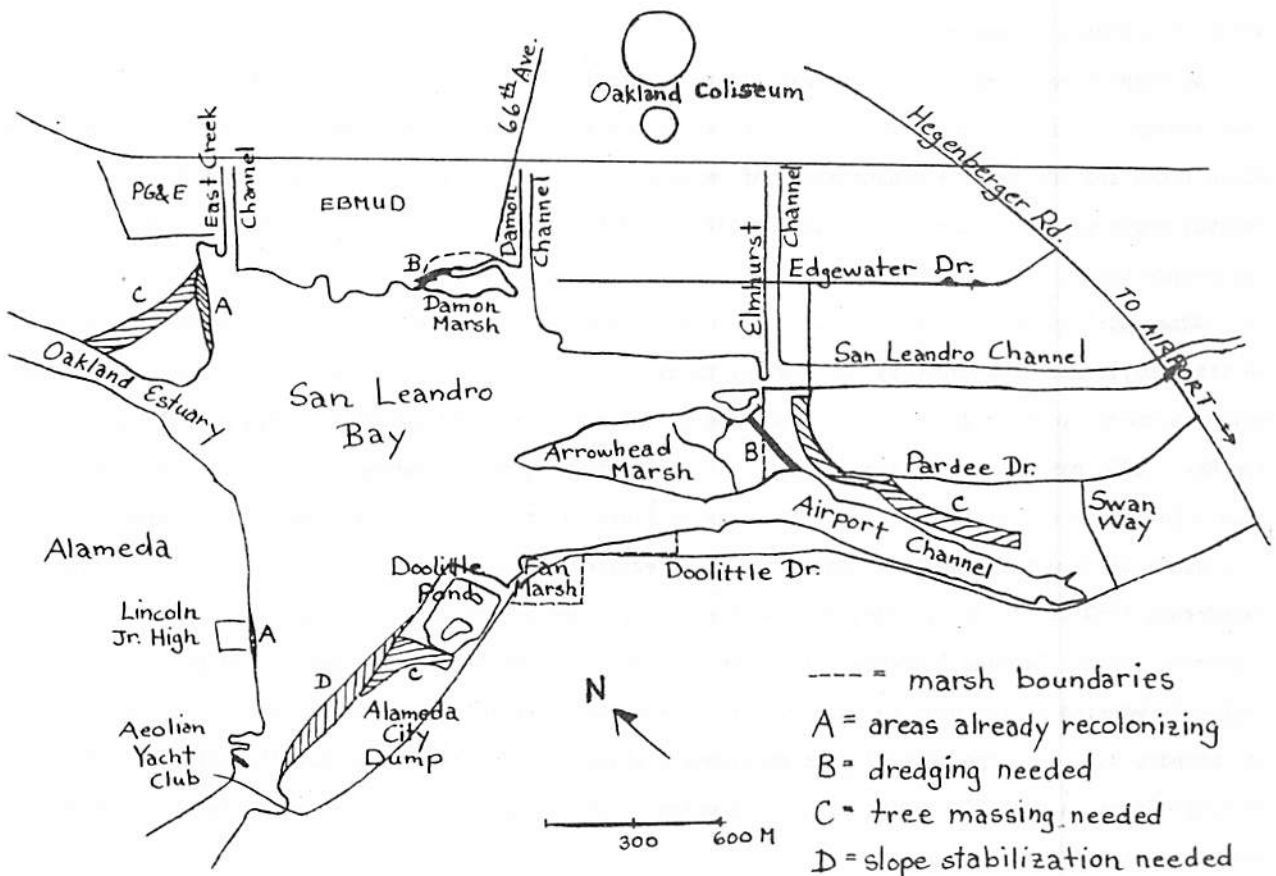


Figure 1. Map of San Leandro Bay

Source: San Leandro Bay Resource Development Plan

In the water there is an abundance of algae, crustaceans, mollusks and smaller fish, at least where there are shallows dominated by the two marsh plants.

Oyster Bay, covered in detail in another chapter, is presently owned and operated by the Oakland Scavenger Company as a garbage dump atop landfill. Since the original shoreline was inland from the landfill, one can hardly speak of "natural conditions" on this man-made landscape. Presently the waters around Oyster Bay contain shellfish beds contaminated by the effluent of the San Leandro Sewage Treatment Plant which releases effluent into the channel to the north of the park site. This facility will be closing in 1980, greatly increasing the attractiveness of the beds. Along this channel there are presently a number of stunted, brown *Salicornia virginiana* and hardy *Haplopappus racemosus*, both upper marsh plants. The gastropod *Nassarius obsoletus* is abundant on the channel mudflats at low tides, gliding between the creeks of leachate percolating from the dump. The dump site is covered around the periphery by annual grasses and weeds down to the rip-rap at water's edge, except on the south-eastern shore facing a small marsh. Here the fill has been planted with eucalyptus and conifers and supports dense brush, to create a better view for the businesses on the other side of the marsh. These businesses on Neptune Drive are inadequately fenced off from the marsh, which is small but seems to be vigorous, judging from the numbers of shore birds seen feeding, and from the growth of *Salicornia virginiana* and *Spartina foliosa*, which is dominant in new marshes.⁹

At Point Pinole and to a larger extent at the Martinez Waterfront, the District has begun to deal with the problems of marsh restoration, including water quality, grading and slope stabilization, re-planting marsh flora and the general organization of an aquatic park site. With these two parks as small but successful predecessors, I can now discuss specific guidelines for restoring the marshes at San Leandro Bay and Oyster Bay.

Water quality control is the most difficult restoration objective because it is dependent in part on state policies. The capacity for the Bay to assimilate wastes is a function of its oxygen content, which is increased by tidal movements over the water surface and the amount of fresh water flowing into the Bay. BCDC has all but halted further filling operations, so the surface of the Bay will remain constant, but Southern California still threatens to flush its toilets with Sacramento River water.

Controlling point sources of pollution is no easier, although progress has been made since the malodorous 1950's. In San Leandro Bay and Oyster Bay there are leachate problems associated with Mt. Trashmore and the Oakland Scavenger site (see page 82ff.). The State Water Quality Control Board is presently working on the problem, although it is admitted that full containment is hardly likely. At San Leandro Bay, once the initial park development phase is undertaken, the shoreline will be cleared of most offensive matter, leaving only the problem of uncontrolled water quality in the flood control channels during very wet weather.

In some cases it is advisable to alter the landscape of the park areas physically to encourage marshlands. Where marshes have been cut off from tidal action, as at Hayward-Johnson Landing, it is best to dredge channels into the levees. Dredging can also serve to reduce human access to areas,

and this would be most advisable at the landward edge of Arrowhead Marsh (Figure 1), which is the largest and most unspoiled marsh left in San Leandro Bay. The dredged spoil could be graded on the new island to increase the elevation of a small section and create a more diverse habitat, which would enable Arrowhead Marsh to be more widely used as an avian breeding ground. A dredged channel could also be used to protect the small Damon Marsh. Grading the shore to reduce the abrupt vertical drop would facilitate marsh re-growth in a few rip-rap locations in the San Leandro Bay. In a similar situation at Martinez, it is estimated to cost \$50,000 to re-grade 15 acres from their present 1.6 - 2.3 m. above low tide to a gradual slope from this height to low tide level so that the marsh will experience tidal action.⁴

The problem of garbage strewn on the marshes has more than one source. In the past the marshes were considered garbage dumps by the public and the presence of active land fill sites certainly does not discourage the practice. At present, premeditated dumping is probably not as much of a rubbish source as is the slovenliness at nearby dumps, littering by recreationalists, and the actions of the winds and tides. Since both municipal dump sites are closing down, as the area becomes parkland, there will be a different attitude towards the marshes, and cleanup operations can be done manually by District employees or the California Conservation Corps.

The disposal of dredge spoil is now a problem that has been studied in detail, especially by the Army Corps of Engineers Dredged Material Research Program. Boyd describes the idea of creating marshes on dredged spoil as a mitigation measure for the continuing process of "reclaiming" marshes by covering them with fill.² As a result of that work, studies along the East and Gulf Coasts were undertaken to discover the parameters of plant growth on dredged spoil, with fairly uniform results.

The San Francisco Bay Marine Research Center at Point Pinole, and the Coastal Engineering Research Center at Pine Knoll Shores, North Carolina, both studied the effects of *Spartina* spp. in controlling erosion. At Pine Knoll Shores *Spartina alterniflora*, when grown from seed or transplants, successfully controlled the erosion of a beach harmed by a development project. Fertilizer was found beneficial on the sandy substrate.¹³ At Point Pinole *Spartina foliosa* was grown on a graded section of Whittell Marsh where the banks are generally over a meter tall, and although I found no published results, personal observation verifies that the procedure has been successful, although colonization has been slow.

The Dredged Material Research Program's laboratory work showed that fertilizer has an effect on only coarsely grained substrate, that *Spartina alterniflora*, *S. foliosa*, *S. patens* and *Distichlis spicata* all did well on any substrate, although clay is the best, and that *Distichlis spicata* (which resembles crab grass) grew well from seed.¹ Woodhouse notes that local seed sources are the best to use in these experiments.¹³



Spartina foliosa (x 1/10)

Figure 2. *Spartina foliosa*
Source: LAB

There is one study from the Bay Area:⁵ the Corps of Engineers grew *Spartina foliosa* (Figure 2) and *Salicornia virginiana* (*S. pacifica*) [Figure 3] on dredged material deposited near the mouth of Alameda Creek. *S. foliosa* was grown from seed, seedlings, cuttings and plugs, and at the end of the 18 month study period all methods had produced mature stands. Plugs, which naturally are mature from the onset, give immediate results, as needed in erosion control, and remain the densest stands. The problem with seeds is that 95% of them are inviable (though they are good birdseed) because only one seed per inflorescence contains an embryo. Another factor found to affect *S. foliosa* growth was the presence of debris, which matted

down or broke off plants when the tides washed over the mud.

Salicornia virginiana grew well from all sources also, but the vacant control plots did better than any test plots, showing that planting *S. virginiana* is unnecessary. Seedlings are the best source if it is ever necessary to introduce *S. virginiana*, although cuttings produce the largest plants at the end of 18 months. In conjunction with these two common marsh plants, the fauna of the Alameda Creek tract increased in time to include annelids, arthropods, mollusks and protozoans. This study concluded that since the area was still young, diversity could be expected to increase.⁵

It is simplistic to think of salt marshes only in terms of their dominant plant species; there are many others present in a mature association, and indeed the ecotone from mudflat to lower to upper marsh to grassland or brush is the most beneficial to wildlife. At Point Pinole's Whittell Marsh spring is a time of

brilliant colors: *Lasthenia glabrata* gives the higher ground an intense beautiful yellow interspersed with wildflowers of other hues, such as brass buttons, owl's clover and sea-lavender. Also found in this *Salicornia virginiana*-dominated area are *Happlopappus racemosus*, *Suaeda californica*, *Grindelia humilis*, *Frankenia grandiflora*, *Jaumea carnosa*, *Triglochin maritima* and *Distichlis spicata*.^{6, 7}

The Natural Resources Management Plan for Oyster Bay recommends that floristic diversity be increased and include rare species. It further suggests using native thorny vegetation to repulse visitation to the marsh, but doesn't mention any species upland from the marsh itself. For the benefit of wildlife, which don't necessarily limit themselves to one association, an ecotone is necessary. This marsh area should first be



Salicornia virginiana (x 1/4)

Figure 3. *Salicornia virginiana*
Source: LAB

cleaned of debris, then planted with additional marsh and grassland species and finally fenced off naturally so that few, if any, people have access to it.

In San Leandro Bay we have the same problem: loss of native above-marsh communities. Wherever possible, the native communities should be encouraged for the waterfowl. Mt. Trashmore could in part be converted to this use, as it is already heavily covered by vegetation towards Doolittle Pond, and mallards nest in this vegetation. The eastern shores contain much vacant land, such as at the end of Pardee Drive, and these could be used as nesting sites once the planned dense stand of trees is planted. A step in the right direction has been taken at Lincoln Jr. High School on the Alameda shore across from Mt. Trashmore. Above a newly colonized marsh which already contains many *Modiolus demissus* and small fish, the students have planted a native species garden between the stark new school and the vertical drop near the shore. This spring there is at least one duck family taking advantage of the situation. At the northern end of the Bay the estuary could also be given to upland grasses protected by trees. When marsh areas are fenced off from the public by shrubbery, there is much less chance of disturbance and littering.

Little is known about direct introduction of animal species. Aquatic life seems to colonize very well on its own, and any effort to introduce invertebrates to the mudflats seems wasted. Likewise, the insects do a fine job of colonizing new marsh sites. In fact, the only problem is with introduced rats which live along levees, rip-rap, and in buildings, and with feral cats. Rats rob nests and carry disease to other rodents, but do not live on inundated marshlands. If dry hiding places were eliminated the problem would disappear. Cats are effective predators and may simply be taking the place of raccoons and fox, but when the numbers of waterfowl are precarious, predator control may seem necessary. Trapping seems to be the only acceptable way to deal with feral cats.

Once the marshland in Oyster Bay and San Leandro Bay is cleaned of debris, protected from human intrusion by plants or deep water, and the plants have recovered, there will be time to think about waterfowl and endangered species which dwell in salt marshes. The migratory birds should return in larger numbers to San Leandro Bay once it is attractive to them, but endangered species are not as mobile. Species such as the salt marsh harvest mouse, the California clapper rail and the black rail all bred at one time near San Leandro Bay, and if a colonizing population could be located, there is not much difficulty surrounding the operation. They would not leave their new home for the unfavorable environs, food is available and predation would probably be no problem. I suggest that Arrowhead Marsh could be used for such a project because of its fairly large size.

There will be plenty of room for human activity in these two new parks, but little of it should occur on the marshes, which suffer from human contact. At the end of Pardee Drive an observation area is suggested, perhaps with wooden trails over some marshes not cut off by the Arrowhead Channel.⁸ This is an acceptable use. Once water quality at Oyster Bay is improved, public access to the shellfish beds is possible, for they can withstand some use.

In conclusion, it is suggested that the small marsh at Oyster Bay be cleaned, planted to increase species diversity, and fenced off from Neptune Drive and the park by impenetrable vegetation well before

the park ever opens. The northern channel at Oyster Bay will be able to support marshes in the future, but for the present the cost is too great for the meagre benefits. At that future time dredged spoil should be used to increase the elevation and slope the sides of the channel. *Spartina foliosa* will have to be planted, followed by the introduction of other species if it doesn't colonize quickly on its own.

The Natural Resource Management Plan for San Leandro Bay is generally thorough, although there are some exceptions.⁸ The marsh restoration areas along Lincoln Jr. High School in Alameda and south of the PG&E warehouse already have been colonized naturally and would benefit only by cleaning up debris, while no marsh plants at all grow on the banks of Mt. Trashmore opposite the Aeolian Yacht Club. This area needs slope stabilization and grading at water level with dredged material to allow colonization to take place naturally. Damon Marsh and Arrowhead Marsh should be made into islands to insure that the wildlife can breed undisturbed, and efforts should be made to increase non-marsh undisturbed areas to increase the diversity of habitat open to wildlife. Later, attempts to re-introduce endangered species to Arrowhead Marsh should be undertaken.

Although San Leandro Bay is but a remnant of what it once was, and has been mismanaged, there is every chance that attention to the physical and biological parameters of marshland restoration can render the area attractive as a park and wildlife refuge. The re-introduction of a more diversified biota and a more natural shoreline will insure that the benefits society and wildlife enjoy from estuaries will not be lost.

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