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Environmental Research, Assessment and Planning

Biological Assessment of Wetland Environments Impacted by Culvert Repairs at the Mouth of Moro Cojo Slough

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Contents

1. Summary

Historical information on the hydrology, vegetation and wildlife of Moro Cojo Slough is very limited. Nevertheless, there is no evidence that the recent culvert repairs at Moss Landing Road caused significant ecological impacts to wetland habitats and organisms. The only endangered species that lives at the mouth of the slough and was likely to be influenced by culvert repairs is the brackish water snail. This species is as abundant today as it was in past surveys and generally occupies the same shallow, submerged habitats. The minimum water level in the lagoon should be maintained at the level it has been in October and November 1988; between -1.5 and -2.0 feet NGVD. We recommend that at least one of the Moss Landing Road culverts be equipped with an adjustable gate which will permit controlled inflow of salt water to maintain the present lagoon habitat at the slough mouth. The adjustable gate would also allow for maximum flexibility in planning for future enhancement and restoration of wetlands as established in a comprehensive wetland management plan for Moro Cojo.

2. Introduction

The culverts draining Moro Cojo Slough (Figure 1 and 2) have a long and controversial history, which has become even more complex with recent changes in county, state and federal laws and policies on wetland protection, restoration and mitigation for development. These laws and policies also conflict with past drainage practices of Monterey County Flood Control and Moss Landing Harbor District in Moro Cojo Slough. Past drainage practices generally served two purposes: to protect and create land for grazing and agriculture and to prevent flooding at Moss Landing and Castroville Boulevard. Therefore, it is not surprising that recent efforts to repair the culverts at the slough mouth led to strong approval on one hand and considerable protest on the other.

The tide gates and culverts were installed to drain the slough of freshwater and prevent tidal flow up slough. However, they have leaked significant quantities of salt water into the slough since their initial installation (Gordon 1977). This leakage probably helped to maintain a shallow, brackish environment at the slough mouth with no regular tidal flushing. Although the culverts have been repaired or replaced a number of times in the past, the biological impacts of these activities have never been evaluated.

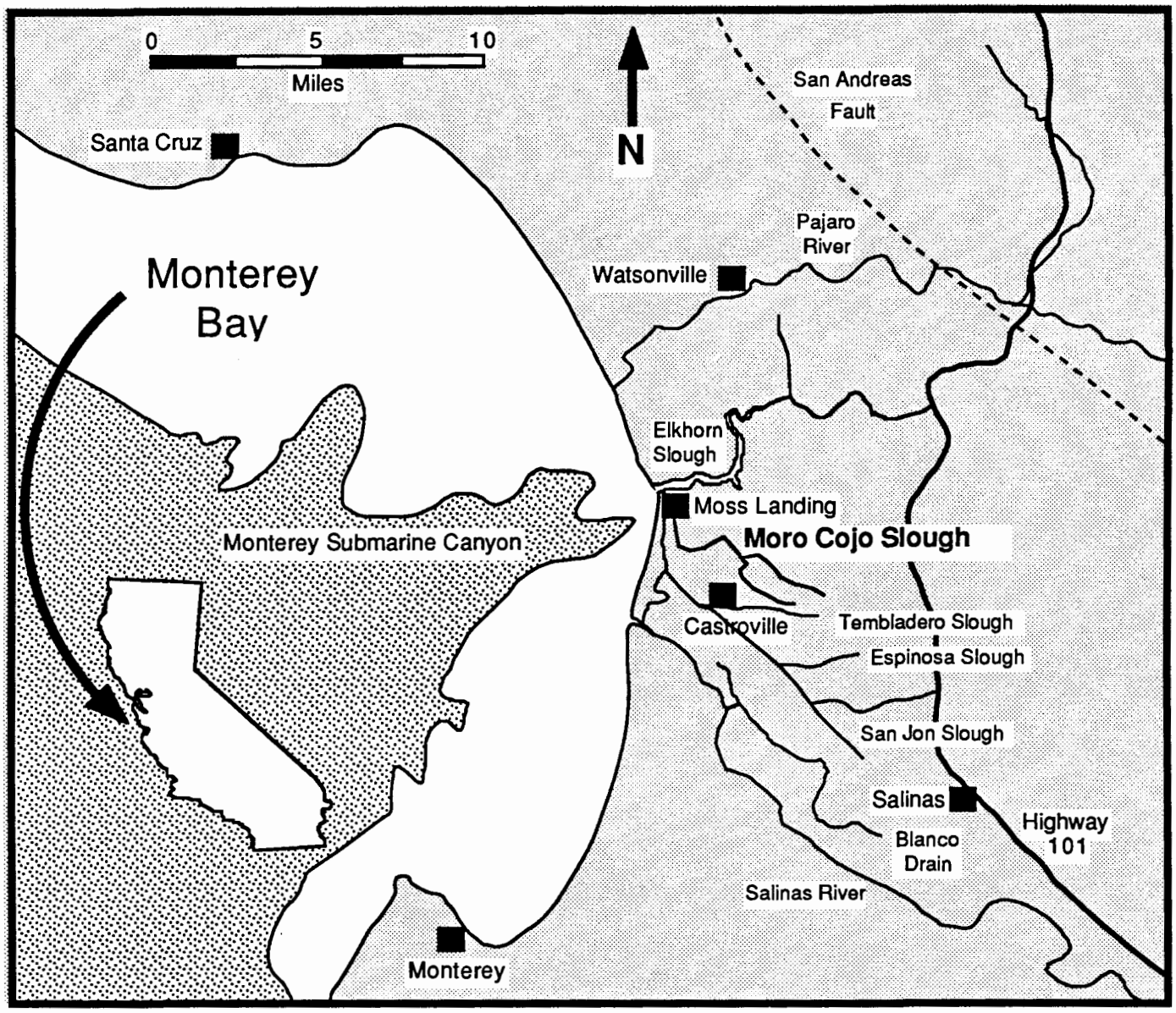

Figure 1. The Monterey Bay area showing the lolcation of Moro Cojo Slough in relation to other wetland habitats.

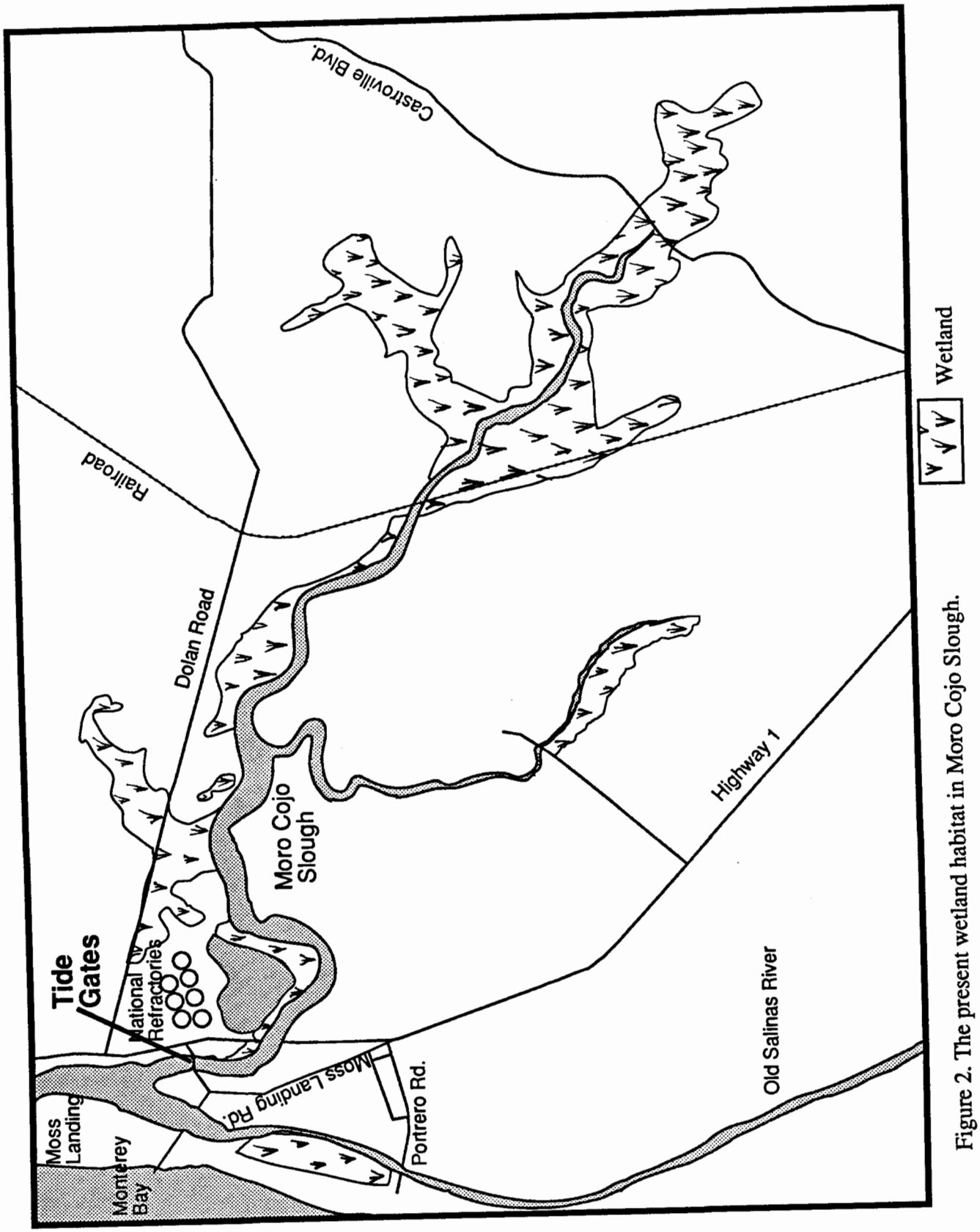

Figure 2. The present wetland habitat in Moro Cojo Slough.

This biological assessment concerns the impacts of recent manipulations of the Moss Landing Road culverts by the county, particularly in March 1988. It does not resolve the land use and environmental policy conflicts. This resolution depends on developing a wetland management and enhancement plan for Moro Cojo Slough. However, the biological assessment does recognize several key issues that must be addressed in the management plan and suggests some realistic management options.

The assessment is divided into several sections concerning historical changes in wetland habitat, wetland conditions before the recent culvert construction, changes in the wetland environment since the culvert problems, impacts to rare, threatened and endangered species, and unresolved planning and management problems at the root of the recent controversy. The short and long-term solution to the management of water drainage from Moro Cojo must be developed in a sound wetland management plan.

3. County, State and Federal Wetland Regulations

The county, state and federal governments have a number of laws and policies concerning conservation, development, and mitigation in coastal wetlands. The primary county policy for wetlands is contained in Monterey County Coastal Implementation Plan (Regulations for Development in the North County Land Use Plan Area) under the Environmentally Sensitive Habitat Development Standards for Riparian, Wetland and Aquatic Habitats (20.144.040:C-2). These policies are consistent with the California Coastal Act and federal Clean Water Act and Endangered Species Act. The Corps of Engineers permit for culvert repair or replacement requires a number of conditions including that the activity not jeopardize any endangered species or critical habitat. The agreement between the Department of Fish and Game and Monterey County Public Works specifies that the culvert repair and replacement will not completely restrict flow of tidal water into Moro Cojo Slough. (See Appendix for several pertinent documents).

4. Wetland History

The recent changes in wetland communities and habitats in Moro Cojo Slough cannot be assessed without understanding the considerable historical changes caused by human activities in the watershed. The general history of wetland change in Moro Cojo Slough is similar to changes throughout Monterey Bay as described in the Elkhorn Slough wetland management plan (ABA Consultants 1988). Before California became a state in the 1850's,

there was little farming in either the Salinas or Pajaro Valleys. The Spanish maintained small gardens and grazed domestic animals over large rancheros. Although native Indians burned large parts of the landscape, they did not cultivate significant areas. American settlers started the extensive cultivation of the region which continues today (Gordon 1977). Agricultural manipulation of the watershed caused the most important ecological changes in the Moro Cojo Slough.

The first description of wetland habitats was made by the Coast and Geodetic Survey in 1854 (Figure 3). Their notes indicate an extensive, wet landscape all along the coast of central Monterey Bay. Sloughs, ponds, springs and running water were abundant. The notes indicate that freshwater was so abundant that cultivated crops could be grown year-round without irrigation. Although very large areas of wetlands were diked, ditched and drained by the turn of the century, several of the older local residents recall the large number of freshwater springs along the coast and throughout the watershed. The late Bill Lehman described an artesian spring that flowed all year near the present location of the North County School District building. The spring was on the west side of Moss Landing Road, which was the main north-south coastal highway until Highway 1 was constructed in the mid 1930's. Spring water was drained through a ditch in the dirt road and sometimes directed to the south to irrigate an adjacent field. For the several years of whaling in Moss Landing, again in the 1930's, the station took all its freshwater from a 10 foot well just north of the present Whole Enchilada Restaurant. Everything in the whaling plant was regularly washed with freshwater, so the flow from this well must have been high (personal communication with Bill Lehman). Freshwater springs flowed into and around the Elkhorn Slough until recent years (ABA Consultants 1988). Our point is to emphasize that the coastal region around Moro Cojo Slough was extremely wet- freshwater and wetlands were extensive and undoubtedly magnificent.

Wetland habitats at the mouth of Moro Cojo Slough are shown from the 1854 survey before agricultural reclamation of wetlands commenced (Figure 3). There were no roads and no culverts blocking the Moro Cojo at this time.

The most dramatic changes in Moro Cojo wetlands were caused by diking, ditching and draining beginning in the late 1800's. The wetlands were reclaimed for agriculture and grazing primarily by Chinese farmers for other landowners (Lydon 1985). The next maps produced by the Coast and Geodetic Survey were made in 1910. The Supplementary Survey or map notes from Pajaro River Southward (1910) describes the mouth of the Moro

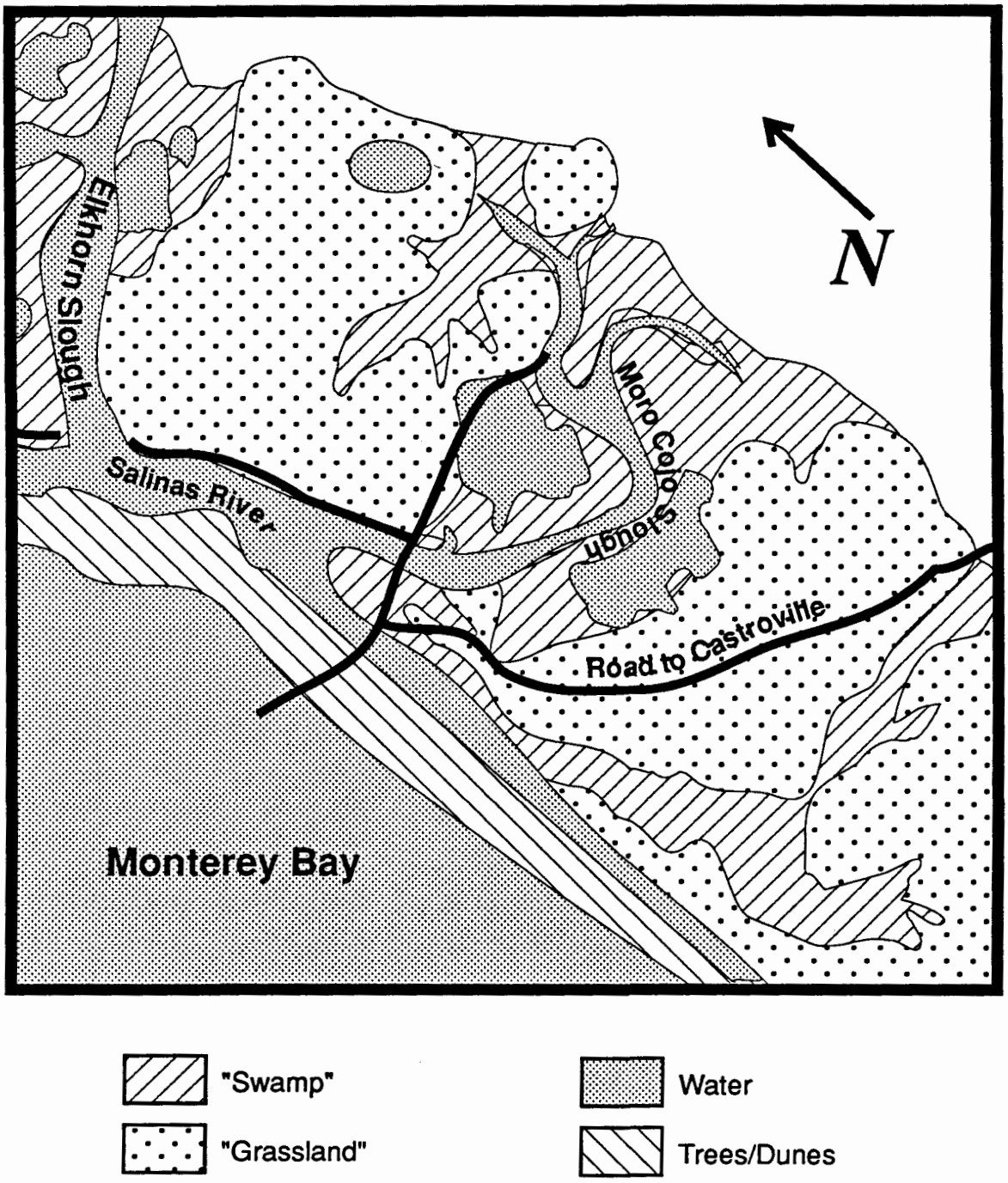

Figure 3. U.S. Coast Survey: Map of part of the coast of California from Pajaro River Southward, May 1854.

Cojo: " the flow in and out of this slough is now partially controlled by a gate at the crossing of the county road near Moss Landing. The marshy areas shown on the old sheet [the 1854 map] do not now exist. There is good pasture ground close up to the banks of the slough, and a short distance away on either side the land is under cultivation." The Descriptive Report (1910) states that hay and barley were the main crops between the Pajaro and Salinas River mouths. By the turn of the century, the main channel of Moro Cojo Slough was a drainage ditch and most of the surrounding wetlands were reclaimed and thus destroyed. At this time, one large culvert (about 6 foot in diameter) let water flow out of the slough and a flap gate prevented water inflow from the adjacent Old Salinas River (now the Moss Landing Harbor). This early gate often leaked salt water into the slough (Gordon 1977).

The first aerial photographs of the region were taken in 1931. They reveal a large southern branch of Moro Cojo extending to the northeast edge of Castroville. This area was diked, ditched and drained in the 1930's. The general configuration of the slough and the wetlands surviving along the channel flank have not changed significantly in aerial photographs from 1949 to the present (Figure 4). The area presently known as Moro Cojo Slough was created by wetland reclamation and flood control (Figure 2) .

4.1 Historical Hydrology

The most dramatic changes in the hydrology of Moro Cojo Slough were caused by wetland reclamation, the regional decrease in freshwater, the diversion of Salinas River, and culvert emplacement at Moss Landing Road. The regional influence of reclamation was discussed above. An extensive wetland system was reduced to a channel flanked by a narrow band of surviving wetlands. The Salinas River mouth was just north of Moss Landing Harbor until 1908, when it was permanently maintained at its present location to the south. This change in surface flow was part of a regional decrease in freshwater to the watershed. Reservoirs, wetland reclamation, flood control, and especially well pumping have lowered the water table and dried the landscape. So the input and retention of freshwater in Moro Cojo have decreased steadily since the later 1800's and more rapidly with improved pumping technology since the 1940's (ABA Consultants 1988).

The culvert under Moss Landing Road prevented regular tidal inflow to Moro Cojo from the Old Salinas River and Elkhorn Slough, which were flushed by tidal waters for at least part of the year before the harbor was constructed. Since the harbor was opened in 1947,

tidal influence is much greater in Elkhorn Slough and Old Salinas River, but regular tidal exchange with Moro Cojo is still prevented by the culverts. However, saltwater periodically leaks through the gates or rushes in when the gates are obstructed by large objects. Therefore, since the turn of the century salt water has been present at the mouth of Moro Cojo for much of the year and has influenced the entire drainage system in episodic events. Water quality also varied tremendously among seasons and between years. In general, the mouth of the slough has been a shallow (less than 1 meter in depth) brackish-water lagoon and a highly seasonal estuary for over 80 years, and the influence of freshwater has decreased dramatically during this period.

4.2 Historical Vegetation

The major wetland vegetation at the mouth of Moro Cojo was probably pickleweed, *Salicornia virginica*, even before the disruptive human manipulations of the watershed beginning in the late 1800's. Occasional inundation by salt water is sufficient to establish and maintain saltwater vegetation and is effective at killing freshwater and other non-salt-tolerant plants. When the Salinas River flowed through Moss Landing before 1908 (Gordon 1977), the Moro Cojo and Elkhorn Sloughs must have been frequently invaded by saltwater and the salinity of slough waters was probably brackish for at least weeks or months (ABA Consultants 1988). This marine and brackish influence is supported by several types of evidence.

1) Old root mats of pickleweed and benthic foraminiferans (marine and brackish water microfossils) occur throughout sediment cores from Elkhorn Slough for at least the last 4000 years (Schwartz et al. 1986). Although cores were taken from the back of Elkhorn Slough, the mouths of Elkhorn and Moro Cojo Sloughs were ecologically and hydrologically similar in 1854.

2) Local Indian middens that are over 1000 years old and located all around the Moro Cojo and Elkhorn Sloughs also contain a large quantity of shell debris from clam species that must live in protected marine or brackish waters (MacGinite 1935, Gordon 1977, Jones 1978).

3) Brackish water was observed directly by local residents in the mouth of the Moro Cojo just before the course of the Salinas River was changed in 1908 and since that time (personal communication with Bill Lehman).

The grassland that occurred around the Moro Cojo slough in the 1854 map was probably dominated by wetland plants such as the salt grass *Distichilis spicata* . Large stands of salt grass commonly occur at the upper edge of the pickleweed marsh and at the upper edge of the tide or standing water (Zedler 1982). These habitats are generally not muddy and are much dryer than pickleweed areas. Therefore, salt grass was probably identified as grassland in the 1854 map and pickleweed as marsh (Figure 3). Since both pickleweed and salt grass are used to characterize salt marshes today (Zedler 1982, Josselyn 1983), the cover of wetland vegetation was probably much greater than the 1854 maps show (Figure 3).

Further inland the slough contained many emergent brackish and freshwater plants such as rushes and sedges. These plants covered the largest area of wetland habitat in the slough extending beyond Highway 156 to the east and into Castroville to the south. These were the great tule marshes that are only known by long-time residents and their families and friends. There has been no scientific exploration of the ecological or geological history of Moro Cojo Slough.

4.3 Historical Wildlife

The extensive freshwater marshes and their widespread ponds harbored extremely large numbers of waterfowl and were prime duck hunting areas until the 1940's (personal communication with Bill Lehman). Salmon, steelhead and striped base were also numerous throughout the slough. The abundance of fish is illustrated in a story told by Bill Lehman. When he was a boy (around 1910), his father rented boats to hunters who went into Moro Cojo. One of his regular chores was to check the boats in the morning for steelhead. Apparently, so many fish attempted to enter the slough that some leaped into the row of boats and became stranded.

There are no reports of intertidal flats at the mouth of Moro Cojo before or after the culverts were installed. The major habitats were vegetated salt, brackish and freshwater marshes and shallow brackish and freshwater ponds. The brackish ponds probably harbored many of the same benthic invertebrates and fishes that are present today including the brackish water snail (see below). However, except for the commercial and sport fish, there is no information on the submergent plants, other fishes and invertebrates that once lived in the historical habitats of the slough.

5. Environmental Setting Before Recent Culvert Repairs

Like the historical wetland environment, information on the recent hydrology, vegetation and wildlife of Moro Cojo Slough is extremely limited. There are no published studies and only three unpublished reports that provide relevant information. Hansen (1976) did a qualitative survey of the slough's natural history in the 1970's. Kellogg (1980) investigated the endangered brackish water snail (*Tryonia imitator*) in the slough and Allen and Reilly (1980) qualitatively surveyed the major plants and birds around the slough mouth. Fortunately, there are a number of local naturalists and residents who have watched and explored the slough for several decades (see Gordon 1977), especially since 1970.

5.1 Wetland Hydrology

The hydrologic environment at the slough mouth is dominated by three processes: seasonal input of freshwater from rain, late-season freshwater runoff from cultivated farms, and uncontrolled leakage of salt water through the culverts at Moss Landing Road. The seasonal input of rainwater is remarkably variable from year to year. During the heavy storms of the 1982-83 winter, the slough and surrounding landscape were covered with more ponded freshwater than at any time since the early 1970's (personal observations). The adjacent fields were flooded for several months and the town of Moss Landing was flooded during several high-tide sequences. During rainy years, freshwater remained in the channel of the slough into the summer as far east as Castroville Boulevard. Similar winter flooding was common after heavy rains during the last century (personal communication with Bill Lehman).

In contrast, the last two years have been extremely dry with little rain water input to the slough. East of the railway trestle, the slough channel was dry before early spring in both years. During March 1988, the channel was filled with salt water all the way to Castroville Boulevard after the culvert repair problems (see 5: Environmental Impacts of Recent Culvert Repairs).

These yearly variations in freshwater are known to have important ecological impacts on the plants and animals that live in wetlands along the Southern California coast (Zedler 1983, 1986). Unfortunately, there is no information on how freshwater inputs impact the Moro Cojo Slough or any similar wetland drainage in central or northern California.

Pumping of irrigation or flood water from cultivated fields is not regulated by any government body. It is not considered a point source of potential pollution. Therefore, we have no information on the seasonal and yearly inputs of freshwater to the slough from these activities, although our personal observations suggests that these inputs may be very important in producing and maintaining the hydrographic environment of the slough during the dryer seasons. The potential inputs of pesticides and herbicides from agricultural drainages is unknown (Oakden and Oliver 1988).

The third major determinant of the slough's hydrology is leakage from the tide gates at Moss Landing Road. As noted earlier, this leakage probably occurred since the first culverts were installed (Gordon 1977) and produces the brackish or salt water lagoon at the mouth of the slough. There is no information on how the leakage varies from year to year or between seasons of the year. What is known, however, is that the mouth of the slough is strongly influenced by salt water and that this condition has persisted for many years (Gordon 1977). In addition, the water can often become hypersaline after the rainy season (Hansen 1976).

5.2 Wetland Vegetation

The old channel of Moro Cojo Slough is flanked by a pickleweed marsh where *Salicornia virginica* is the dominant plant cover (over 90%). Six species of salt marsh plants are common at the mouth of Moro Cojo. They are the native perennial species: pickleweed, salt grass, fleshy Jaumea (*Jaumea carnosa*), alkali heath (*Frankania grandifolia*), and coastal gum bush (*Grendelia latifolia*); and the introduced annual species, fat hen (*Atriplex patula*). Additional salt marsh plants around the slough mouth include Pacific silverweed (*Potentilla egedii*), brass buttons (*Cotula coronopifolia*), salt marsh sand spurry (*Spergularia marina*), rabbitfoot grass (*Polypogon monspeliensis*), and Australian saltbush (*Atriplex semibaccata*).

The pickleweed marsh is flat and relatively narrow, sloping steeply up to the dikes that border almost the entire Moro Cojo. The dikes are narrow habitats that harbor a wide variety of annual grasses and herbs as well as salt marsh species, especially salt grass. The dikes separate the pickleweed marsh from two upland habitats: grazing fields and cultivated

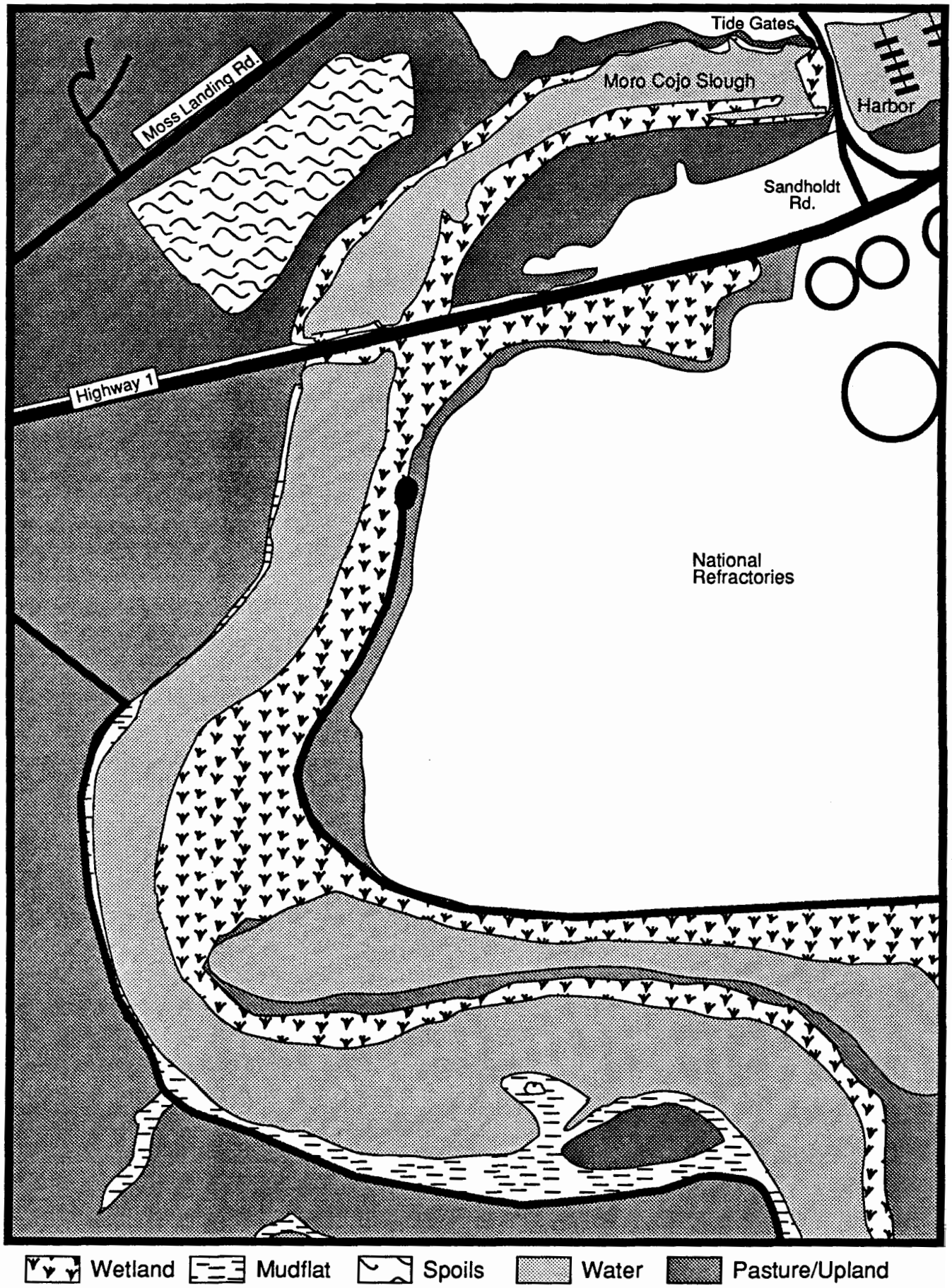

Figure 4. The mouth of Moro Cojo Slough based on the 1987 aerial photographs. There was no discernable change in the wetland habitats after the culvert installation problems in 1988.

row crops (Figure 4). The fields contain a complex mixture of annual grasses, herbs, and patches of salt marsh plants. None of the resident wetland or upland plants are rare, endangered or threatened along our coast. The primary row crops are artichokes.

At the mouth of the slough, diked areas were also used to dump dredged material from the harbor during the 1960's and 1970's. The dump sites occur on the east side of Moss Landing Road along the section of the slough which is west of Highway 1 (Figures 2 and 4). Several species of salt marsh plants colonized these spoils: pickleweed, salt grass and fat hen. The salt marsh species co-occur with a number of annual grass and herb species. The diked areas are several feet above the elevation of the native salt marsh habitat in the adjacent Moro Cojo Slough. Granite Construction dumped piles of soil on part of the dredge spoil site in 1983 and 1984, but most of the piles were removed in 1987. However, the dumping and excavation dramatically reduced the cover of salt marsh plants in this area.

Finally, two aquatic plants are abundant in the water of the slough mouth. They are the green algae, *Enteromorpha* spp., and the submerged plant, *Ruppia maritima*. They occur on both the east and west sides of Highway 1.

5.3 Wetland Wildlife

The most conspicuous animals in the wetland are birds. A number of shorebirds and waterfowl use the wetland. The most important values of California wetlands are habitat for endangered species, stopping places for migrating birds, education and research, and aesthetics (Onuf et al. 1978). The birds in the wetland are important for three of these four values. None are endangered species at present.

Past surveys of bird use of the slough involved a few days in only one period of the year (Madrone Associates 1976, Allen and Reilly 1980). Since the seasonal and yearly variations in shorebird and waterfowl use of our coastal wetlands is extremely variable (for example, Ramer 1985), these past observations are very incomplete. This is true for all the wildlife observations in Moro Cojo. Long-billed dowitchers were abundant with fair numbers of American coots and Forster's terns during the Madrone survey, while northern phalaropes were most abundant with fair numbers of dowitchers, black-necked stilts, and gadwalls during the Allen and Reilly survey. Allen and Reilly identified a total of 14 shorebird species and 3 other bird species in their short survey. Our observations over

many years indicate that dabbling ducks, other waterfowl, and common egrets are also common at the slough mouth.

Since there is no regular tidal exchange between the ocean and Moro Cojo, there are no intertidal mudflats. The slough mouth is a very shallow, brackish to hypersaline lagoon. As a result, the number of shorebirds that feed in the slough is much less than the number in Elkhorn Slough, where there are extensive intertidal flats and rich infaunal invertebrate communities which are the major shorebird prey (Nybakken et al. 1977).

The major fish identified in past surveys of Moro Cojo (U.S.F. & W.S. 1981, Moss Landing Marine Labs, unpublished data) are threespine stickleback, mosquito fish, yellowfin goby, Pacific staghorn sculpin, and jacksmelt. Schools of small fish are common near the slough mouth. We have observed them around the culverts near Moss Landing Road, where the water quality is likely to be most like sea water from culvert leakage. Fishes probably move in and out of the slough with seasonal and yearly changes in water quality. Once again fish populations are very poorly sampled and known from Moro Cojo.

The benthic or bottom dwelling invertebrates are much easier to sample from a particular part of the slough and to observe through time. These animals are the primary prey for both the birds and fishes that utilize the slough (Nybakken et al. 1977). Nevertheless, the only past samples were taken by Madrone Associates (1976) and Kellogg (1980). The Madrone study was done at the mouth of the slough, where they found several highly euryhaline invertebrate species. These were polychaete worms (*Capitella capitata*, *Streblospio benedicti*, *Polydora ligni*), amphipod crustaceans (*Corophium* spp. and *Anisogammarus* (now *Eogammarus*) *confervicolus*), and the endangered brackish water snail (*Tryonia imitator*). The Madrone report undoubtedly misidentified this snail as *Assiminea californica* (Kellogg 1980). Hansen (1976) also lists a number of insect species found around Moro Cojo. The most important in the lagoon is the water boatman (Corixidae), which can often be the most conspicuous invertebrate in the slough because it swims above the bottom in large numbers. We have also observed mysid crustaceans (*Neomysis* sp.) swarming around the culverts, and bay mussels (*Mytilus edulis*) attached to the old culverts on the Moro Cojo side of Moss Landing Road.

Our October survey also showed evidence of gray fox, opossum, skunk, and deer along the edge of the slough.

6. Environmental Impacts of Recent Culvert Repairs

Although culvert repairs permitted a large input of salt water into Moro Cojo Slough, there is no evidence of significant degradation of slough habitats, vegetation or wildlife. However, it is essential to emphasize the paucity of information both before and after the repair problems. Our assessment depends on comparing the highly qualitative historical observations to our brief qualitative survey of the site during October 1988. Although we made a number of additional qualitative observations of slough hydrology and wildlife both before and after the recent culvert repair problems, the ecology of Moro Cojo is as poorly known today as it was when Hansen (1976) argued for a more comprehensive investigation of the system. This lack of knowledge contrasts markedly to the extensive information concerning the hydrology, vegetation, wildlife and general natural history of Elkhorn Slough (for example see bibliography in ABA Consultants 1988).

6.1 Hydrologic Changes

During March 1988, culvert repair activities at Moss Landing Road permitted a large volume of sea water to enter Moro Cojo Slough. No quantitative measurements of water elevation and cover were made before or after the event. However, our qualitative observations indicated that the channel was dry on the east side of the railway trestle before March 1988 (Figure 2). The channel filled with sea water all the way to Castroville Boulevard and a small volume passed through the culverts under Castroville Boulevard and into the dry channel on the east side. Seawater spread about 100 feet east of the road. At the slough mouth, the elevation of the lagoon water increased about two feet. The water level decreased gradually to a level above the pre-March 1988 elevation until the culverts were manipulated again (late spring) and the water level fell almost one foot below the March 1988 level, exposing unvegetated mudflats around the mouth of the slough that are usually covered with water. During the summer, additional manipulations of the culverts restored the water level to the March 1988 level.

We visited the site during the late spring before water levels fell below the pre-March 1988 values, and recorded a water salinity of 42 parts per thousand (about 20% higher than seawater).

6.2 Vegetation Changes

The rise in water elevation covered most of the fringing pickleweed marsh. When the elevation lowered, no qualitative changes in plant cover were detected in the primary marshes during our field survey. However, the standing water did kill pickleweed in the central channel east of the railway trestle. Pickleweed invaded the eastern channel during the last several drought years when the eastern channel was dry for a much longer period of the year. Similar channel invasions by pickleweed have been observed in several other non-tidal marshes around Elkhorn Slough during the same period (Oliver et al. 1988). The eastern channel is not normal habitat for pickleweed or other salt marsh vegetation. Examination of historical aerial photographs show the eastern channel either full of water or dry and unvegetated.

The most conspicuous change in vegetation was the increase in the cover of green algae, *Enteromorpha* and *Ulva*, at the slough mouth. Slough water is usually very low in limiting plant nutrients such as nitrogen and phosphorus (Hansen 1976). The large input of sea water with high levels of nutrients (Smith 1973) probably stimulated the extensive bloom of green algae. There is excellent field and especially laboratory evidence for the control of algal blooms by nutrients (Fujita 1985).

As the water level decreased, much of the algae was stranded on the emerging pickleweed marsh. It dried here creating an unsightly brown mat over the otherwise green marsh. This mat and the exposed mudflats were aesthetically unpleasant to many local residents and naturalists, and may have caused much of the public outcry regarding the culvert repair problems (however, see section 8: Mitigation and Recommendations). The dry algal mat decayed within several months having no observable effect on plant cover in the pickleweed marsh. Although the deposition of debris in tidal marshes can have a major impact on the composition of marsh plants in many wetlands, the debris deposit must be present for many months to have a significant impact (Hartman et al. 1983, Bertness and Ellison 1987, Oliver and Mayer in preparation).

6.3 Wildlife Changes

The most conspicuous change in animal life was the large number of great egrets that roosted and fed on the east side of Highway 1 after the influx of sea water in March. Between 50 and 100 egrets were observed in this part of the slough for at least several

weeks. The egrets probably fed on small fishes, especially threespine sticklebacks that are known to colonize wetland systems after similar hydrographic disturbances (personal observations). After the water level had dropped by about one foot, there were large numbers of amphipod exoskeletons in the drift at the water's edge. Apparently the amphipods increased in number and grew in size as a result of the new influx of salt water. The exoskeletons were probably from *Eogammarus*, which may also be eaten by egrets.

The October survey, conducted by ABA Consultants and Michael Kellogg of the California Academy of Sciences, revealed a dense invertebrate fauna. The slough mouth on the west side of Highway 1 contained large numbers of water boatman, amphipods (*Eogammarus* and *Corophium*) and the marsh snail, *Battilaria attramentaria*, which was not abundant in the surveys made by Kellogg (1980). The small clam, *Gemma gemma*, was also present as well as the empty shells of several bivalves, including *Mya arenaria*, *Saxidomus nuttalli*, and *Tagelus californianus*, as well as the brackish water snail. Burrows of the mud crabs, *Hemigrapsus oregonensis* and *Pachygrapsus crassipes*, were fairly common about 1/3 of the distance towards Highway 1 from Moss Landing Road. The number of brackish water snails became more abundant closer to the Highway 1 culverts. However, there were only 1000's/m^2 compared to 10,000's/m^2 during Kellogg's surveys. In addition, there was no *Ruppia maritima* on the west side of these culverts, although it was abundant during Kellogg's surveys. This submerged plant and green algae are the major habitat for the brackish water snail (Kellogg 1980).

In contrast to the west side of the Highway 1 culverts, the east side contained dense stands of *Ruppia* and 10,000's of brackish water snails/m^2, the same habitat and snail density observed by Kellogg (1980) in his past surveys. The bubble snail, *Haminoea vesicula*, was also common close to the culverts on the east side of Highway 1. As mentioned above, *Enteromorpha* was also very dense on the east side of the highway. Water boatman, amphipods, crabs and shells of brackish water snails and *Macoma* bivalves were also common here. No sediment samples were cored and screened to collect infaunal animals such as polychaete worms, but the same species observed in previous surveys (Madrone Associates 1976) were probably present, because they are known to co-occur with the more surface-active invertebrates described above (Nybakken et al. 1977).

7. Impacts to Endangered Species

Two endangered species are known from Moro Cojo Slough: the brackish water snail and the Santa Cruz Long-toed Salamander (*Ambystoma macrodactylum croceum*). Although no California Clapper rail have been observed in Moro Cojo (e.g., Harvey 1980, Allen and Reilly 1980), there is suitable habitat for this species (Gill 1979 and Harvey 1980) and it may be present. The other endangered species known from the Elkhorn Slough and the central Monterey Bay area are outlined by ABA Consultants (1988).

The Long-toed Salamander was found at the head of Moro Cojo Slough on the east side of Castroville Boulevard by Reed (1978). This population has not been investigated since its discovery. Another local population was discovered earlier in Struve Pond and McClusky Slough (Talent and Talent 1980), which are north of Elkhorn Slough (Figure 1). The influx of salt water only entered a small section of the dried channel on the east side of Castroville Boulevard. Since the channel was initially dry, there were no larval salamanders in it. The water also drained from this part of the channel within several weeks. Therefore, the salt water would have to impact adult salamanders, which is unlikely as the dried channel is not a good habitat for them (Ruth 1988).

The one endangered species known from the slough mouth is the brackish water snail. This species has also been found locally near Hudson Landing on the east side of Elkhorn Road, Parson Slough (before tidal action was restored), Bennett Slough, and Old Salinas River. It is still very abundant in Moro Cojo Slough. The brackish water snail is small: most adults are less than 2 millimeters in length. They live in shallow, submerged waters tolerating a wide variety of salinities. The young are brooded by females and released as small snails into local habitats. The distribution and abundance of the snail may be determined by the absence of bird or fish predators that probably eat the snail in better flushed, tidal systems (Kellogg 1980).

Although the snail's distribution after the culvert repairs is somewhat different from that described by Kellogg (1980), the difference cannot be attributed to the recent culvert repairs. Moreover, the differences have no known ecological importance. The local population is still abundant and apparently as healthy as ever.

In summary, there is no evidence that any endangered species was impacted by the culvert repairs at Moss Landing Road.

8. Moss Landing Wetland Park

Although a comprehensive wetland management plan has not been developed for Moro Cojo Slough, the staff at Elkhorn Slough Foundation and local wetland ecologists have developed a preliminary plan for developing a Moss Landing Wetland Park at the mouth of Moro Cojo Slough. Since this plan is relevant to future culvert repairs and the resolution of the land use and conservation conflicts, it is briefly described here. The proposed park is centrally located along the major highway (Highway 1) and around the major cluster of existing businesses that can profit by the integration of wildlife recreation and business activities. The degraded wetland can be restored into an outstanding wildlife park. The benefits to wildlife are twofold: the restoration of degraded habitat and the education of a broad segment of society that may not be exposed to these important natural settings without a major highway and business attractions.

The town of Moss Landing is the present business center along the coast of central Monterey Bay. The most important local businesses are the fishing industry, restaurants and food stands, and antique shops. The existing wetlands can be restored to create a 30-40 acre wetland park in the middle of Moss Landing. The Elkhorn Slough Foundation presently owns 16 acres of the potential park area and several key conservation easements have been given to the county. The park will attract many visitors that can be integrated into the local business setting. The integration will be very direct for adjacent businesses which will be connected with access trails and observation platforms. Future business development can be planned around the park and its visitors.

The park will be an outstanding wildlife habitat with appropriate, non-disruptive public access. It will form an attractive green belt along Highway 1 extending into the town. The area will become an excellent resting and feeding area for shorebirds and waterfowl, with a natural zonation of wetland and upland vegetation. The hydrology of the adjacent slough should eventually be modified for both flood control and to develop the optimal habitat for wetland species, especially invertebrates and fish that will attract and feed birds (Onuf et al. 1978). The border of the park can be planted with a native shrub to improve the scenic view and shelter the birds that nest, feed and rest in the park wetland. Seasonal freshwater wetlands, fed by rainfall and not connected directly to the slough, can be developed adjacent to the salt marsh, creating a complex habitat mosaic harboring a wide variety of wetland plants and animals. The development of this plan, however, depends on the

production of a wetland management and enhancement plan for the entire Moro Cojo Slough.

9. Mitigation and Recommendations

The one major mitigation we recommend for the culvert repairs at Moss Landing Road is that the Moss Landing Road culverts be fitted with at least one adjustable gate. This recommendation is also supported in the attached letter from Robert Coates of Philip Williams and Associates, who strongly recommends slide flap gates as the most versatile option. Slide flap or similar gates can be adjusted to permit a controlled inflow of tidal waters into the mouth of the slough or closed down entirely to act like the present gates. Any future wetland management plan for the slough must permit some tidal influence at the slough mouth and prevent salt water from intruding too far up the slough. Therefore, the inclusion of an adjustable gate in the present replacement process permits a wide variety of future management options. These options must be examined and finalized in a comprehensive wetland plan for Moro Cojo. The development of this plan is mandated by the Local Coastal Plan and will be funded jointly by Monterey County and the State Coastal Conservancy.

We recommend that as an interim measure the adjustable gates be opened only slightly to maintain the present brackish water lagoon at the slough mouth. We also recommend that the Monterey County Flood Control and Public Works involve local wetland scientists in the initial gate adjustments, because the first gap settings will be experimental. They can provide important feedback on how close the permitted inflow of salt water approaches the historical leakage through the past culvert and flap-gate system. The final setting will provide for a wide range of salinity at the slough mouth depending largely on variations in freshwater inflow. The water level in the lagoon near the culverts should be kept above the minimum level to maintain the habitats as they are now. A minimum water level similar to that of October and November 1988, between -1.5 and -2.0 feet NGVD (Monterey County Flood Control, pers. comm.), should accomplish this objective. The wetland scientists who assist with setting the initial gate adjustments can also advise on the appropriate water levels. The important mitigation is to establish some controlled inflow of salt water, and a gate specifically designed for this purpose is an absolute necessity. Adjustable gates allow a number of future options that must still be determined in the wetland management plan.

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SPECIES LIST

Species observed or likely to occur in the lower Moro Cojo Slough wetlands habitats.

ALGAE
Enteromorpha spp.
Ulva expansa

VASCULAR PLANTS
Anagallis arvensis
Scarlet Pimpernel
Atriplex patula hastata
Fat Hen
Atriplex semibaccata
Australian Saltbush
Avena fatua
Wild Oat
Baccharis douglasii
Salt Marsh Baccharis
Baccharis pilularis
Coyote Brush
Brassica campestris
Common Field Mustard
Bromus mollis
Soft Chess
Bromus rigidus
Ripgut Grass
Cakile maritima
Sea Rocket
Chenopodium macrospermum
Coast Goosefoot
Chenopodium rubrum
Red Goosefoot
Cirsium occidentale
Cobweb Thistle
Cirsium vulgare
Bull Thistle
Conium maculatum
Poison Hemlock
Cotula coronopifolia
Brass Buttons
Cuscuta salina
Salt Marsh Dodder
Distichlis spicata
Salt Grass
Elymus glaucus
Wild Rye Grass
Elymus triticoides
Alkali Rye Grass
Erodium moschatum
White-stemmed Filaree
Frankenia grandifolia
Alkali Heath
Franseria chamissonis
Beach-bur
Geranium dissectum
Cut-leaved Geranium
Grindelia latifolia
Gum Plant
Heterotheca grandiflora
Telegraph Weed
Hordeum leporinum
Farmer's Foxtail
Jaumea carnosa
Fleshy Jaumea
Lavatera cretica
Tree Mallow
Lolium perenne
Perennial Ryegrass
Lotus formosissimus
Coast Trefoil
Medicago hispida
Bur Clover
Mentha pulegium
Pennyroyal
Mesembryanthemum chilense
Sea Fig
Mesembryanthemum edule
Hottentot Fig
Oxalis pes-caprae
Bermuda Buttercup
Plantago coronopus
Cut-leaved Plantain
Polypogon monspeliensis
Rabbit's Foot Grass
Potentilla egedii grandis
Pacific Silverweed
Raphanus sativus
Wild Radish
Rumex crispus
Curley Dock
Ruppia maritima
Ditch Grass
Salicornia virginica
Pickleweed
Senecio vulgaris
Common Groundsel
Silybum marianum
Milk Thistle
Spergularia marina
Salt-marsh Sand Spurry

INVERTEBRATES

ANNELIDS
oligochaetes
Polychaetes
Capitella capitata
Polydora ligni
Streblospio benedicti

MOLLUSCS
Gastropods
Haminoea vesicula
White Bubble-shell snail
Tryonia imitator
Brackish-water Snail
Bivalves (clams)
Clinocardium nuttallii
Cockle
Macoma nasuta
Bent-nosed clam
Macoma secta
Sand clam
Mya arenaria
Soft-shelled Clam
Mytilus edulis
Mussel
Ostrea lurida
Olympic Oyster
Protothaca staminea
Littleneck
Saxidomus nuttalli
Washington
Tagelus californianus
Jackknife
Tresus nuttallii
Gaper
Zirphaea pilsbryi
Pilsbry's Piddock

ARTHROPODS
Crustaceans
Corophium spp.
Eogammarus confervicolus
Hemigrapsus oregonensis
Shore Crab
Pachygrapsus crassipes
Lined Shore Crab
Traskorchestia traskiana
Insects
Ceratopogonidae (fly)
Coccinella californa (beetle)
Copromyza sp. (fly)
Drapotis sp.(fly)
Enochris sp.(beetle)
Ephydra riparia.
Shore Fly
Hydrophilidae (beetle)
Neoscatella setosa (fly)
Psyllidae (aphid)
Pelomyiella melanderi (fly)
Tricorxixa reticulata
Water Boatman
Tropisternus salsaureutus (beetle)

FISH
Acanthogobius flavimanus
Yellowfin Goby
Atherinopsis californiensis
Jacksmelt
Clevlandia ios
Arrow Goby
Gambusia affinis
Mosquitofish

Gasterosteus aculeatus
Three-spined Sticleback
Gillichthys mirabilis
Long-jawed Mudsucker
Leptocottus armatus
Pacific Staghorn Sculpin

REPTILES
Gerhonotus multicarinatus multicarinatus
California Alligator Lizard
Sceloporus occidentalis occidentalis
Northwestern Fence Lizard

BIRDS
Great Blue Heron
Great Egret
Snowy Egret
Mallard
Gadwall
Cinnamon Teal
Turley Vulture
Red-tailed Hawk
American Kestrel
American Coot
Black-necked Stilt
American Avocet
Semipalmated Plover
Killdeer
Black-bellied Plover
Willit
Northern Phalarope
Red Phalarope
Long-billed Dowitcher
Least Sandpiper
Western Gull
Ring-billed Gull
Bonaparte's Gull
Forster's Tern
Elegant Tern
Caspian Tern
Belted Kingfishers
Black Phoebe
Barn Swallow
American Robin
Loggerhead Shrike
European Starling
House Sparrow
Red-winged Blackbird
Brewer's Blackbird
Lesser Goldfinch
Savannah Sparrow

MAMMALS
Didelphis virginianus
Opossum
Scapanus latimanus
California Mole
Sorex ornatus
Ornate Shrew
Sorex vagrans
Vagrant Shrew
Canis latrans
Coyote
Mephitis mephitis
Striped Skunk
Mustela frenata
Longtail Weasel
Procyon lotor
Raccoon
Urocyon cinereoargenteus
Gray Fox
Vulpes Fulva
Red Fox
Microtus californicus
California Vole
Mus musculus
House Mouse
Ondatra zibethica
Muskrat
Peromyscus maniculata
Deer Mouse
Rattus norvegicus
Norway Rat
Spermophilus beecheyi
California Ground Squirrel
Thomomys bottae
Valley Pocket Gopher
Lepus californicus
Blacktail Jackrabbit
Sylvilagus audubonii
Audubon Cottontail

Philip Williams & Associates
Consultants in Hydrology

Pier 35, The Embarcadero
San Francisco, CA 94133
Phone: (415) 981-8363

October 26, 1988

Jim Oakden
ABA Consultants
P.O. Box 1151
Capitola, CA 95010

Dear Jim:

Thank you for the tour of Moro Cojo Slough; it is clear that the area has considerable potential. As you know, the steps in developing and implementing a management plan for the slough include: 1) defining the biological goals and translating them into hydrologic terms; 2) analyzing the constraints and opportunities; 3) developing the design alternatives; and 4) implementing the plan and developing a monitoring program. My purpose in writing this letter is to indicate some of the specific tasks and scope of work that should be included, and to focus your attention on some of the constraints and opportunities.

1. Objectives

This is primarily a task for the biologists. I assume that biological goals will include habitat for the endangered snail and for migratory waterfowl. The habitat goals will need to be specified in terms of: a) depth, duration, and frequency of inundation; and b) spatial gradients and seasonal fluctuations in salinity and other water quality parameters.

2. Constraints and Opportunities

The present culvert configuration presents both constraints and opportunities. The double box culvert under Highway One is a significant restriction on tidal action in the upper slough, especially since it is basically a fixed feature. Since the slough volume in the upper slough is far greater than in the lower slough (between Highway One and Moss Landing Road), it would take a substantial tidal range in the lower slough to create even slight tidal circulation in the upper slough. If one of the objectives is to restore some tidal circulation to the upper slough, it will be essential to install combination slide-flap gates at Moss Landing Road, where the lower slough connects to the harbor. A flap-gate propped ajar would admit salt water to the lower slough, but would likely do nothing for the upper slough. Standard flap gates would, of course, be difficult to adjust to achieve some target tidal range, but combination gates could be easily adjusted or closed down completely to restrict

salinity intrusion or to maintain flood storage capacity during an anticipated high tide/runoff event.

The cost difference between a standard 48-inch flap gate (Waterman F10) and combination gate (FC10) is about $5,500. Joe Madruga of the County Flood Control District expressed a concern about potential vandalism. That's beyond my field of expertise, but it is worth noting that the parts on a Waterman FC10 gate are heavy and tough, and the site is rather public and visible. I am concerned that installing standard flap gates now will foreclose a future opportunity to control accurately the tidal range in the upper as well as the lower slough.

The need to control intrusion of saltwater onto fields adjacent to the slough may impose a constraint on enhancement. Three potential constrictions could be modified to prevent upstream tidal action. These are: 1) the box culverts at Highway One - the design of these would make flap gate installation complex, but not impossible; 2) the railroad trestle; and 3) at or near the mouth of the South Branch.

Depending on upstream flooding constraints, the installed barrier would be either a weir or culvert with flap gate. A weir would allow ponding of freshwater and create a seasonal freshwater wetland upstream, but potential flooding of Castro Valley Boulevard would have to be analyzed with a step-backwater calculation.

Salinity is not the only important water quality constraint. Runoff from pastures and crops is probably rich in both organic and inorganic nutrients. The resulting eutrophication no doubt creates a heavy demand for dissolved oxygen. As you well know, runoff from croplands carries pesticides. Enhancing tidal circulation would help to reduce the accumulation of pollutants in the slough, but would route them more rapidly to the harbor, ocean, and Elkhorn Slough. The management plan should address efforts and available programs aimed at reducing non-point source pollutants in a way consistent with the social policy of maintaining a healthy agricultural economy.

3. Design Alternatives

Some quantitative analysis will be necessary to develop specific design alternatives and to choose the preferred alternative. The most important tool for this step is a topographic map of 1-ft.

contour intervals at a scale of 1 inch = 200 ft. This could be made by enlarging aerial photographs and surveying cross-sections of the channel. A more costly but more accurate alternative would be an aerial survey with ground control.

With a good map in hand, it would be useful to "route" a flood hydrograph against a high tide, for different gate settings. This would allow us to determine the flood risk involved in leaving one or more gates open at Moss Landing Road.

The third step would be to analyze the tidal range in different reaches of the slough, without stormwater inflow. We could do this with one of two numerical models, for different culvert configurations. If combination gates are installed, the appropriate gate setting could be determined empirically by measuring tide height in the harbor and upper and lower slough over a few tidal cycles. The latter approach might be cheaper and more reliable than a computer model.

Once the design alternatives have been analyzed quantitatively, the preferred alternative may be fairly obvious. Implementation should be fairly straightforward (provided you get good landowner and agency cooperation). A post-project monitoring phase is essential and should include measurements of salinity and tide height as well as biological observations.

I hope these comments are helpful, and that we might become involved when you undertake a complete management plan for Moro Cojo Slough. Meanwhile, I recommend that you press for combination slide-flap gates in order to keep future options open.

Very sincerely yours,

Robert Coats, Ph.D.
Principal

/cw

MOSS LANDING HARBOR DISTRICT
P. O. BOX 10
MOSS LANDING, CALIFORNIA 95039
(408) 633-2461

September 9, 1988

Joe Madruga
Asst. District Engineer
Flood Control and Water Conservation District
P. O. Box 930
Salinas, California 93902

Dear Mr. Madruga,

Please except this letter as written permission for the replacement of the existing culverts and tidegates located at Moss Landing Road. If we can be of any help to you in obtaining permits for this project please let us know.

Sincerely,

Craig Winter,
Agent for Moss Landing
Harbor District

Notification No. 761-62 THP No. —

AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION ART

THIS AGREEMENT, entered into between the State of California, Department of Fish and Game, hereinafter called the Department, RICHARD D. WYATT REP. MONTEREY CO. PUBLIC WORKS SALINAS, State of CALIFORNIA, hereinafter called the operator, is as follows:

WHEREAS, pursuant to Division 2, Chapter 6 of California Fish and Game Code, the operator, on the 12TH day of AUGUST, 82, notified the Department that he intends to substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed of, the following water: MORO COJO SLOUGH, in the County of MONTEREY, State of California, S — T — R —.

WHEREAS, the Department (represented by DOUG HUCKINS has made an inspection of subject area on the 21ST day of AUGUST, 19 82, and) has determined that the operations may substantially adversely affect existing fish and wildlife resources including: MARINE HABITAT, WATERFOWL NESTING AREAS, MARINE LIFE (CLAMS, INVERTEBRATES, ETC.)

THEREFORE, the Department hereby proposes measures to protect fish and wildlife during the operator's work. The operator hereby agrees to accept the following recommendations as part of his work: Numbers 1, 2, 3, 4, 5, 6 & 8 (See "6 BELOW) 12, 13, 18-22 on the list of recommendations on the back of this page and the following special recommendations: "LAKE" HEREIN USED SHALL MEAN "SLOUGH"

1. All work in or near the stream or lake shall be confined to the period DATE SIGNED UNTIL DEC. 1, 1982.

9 THIS PROJECT IS FOR CONSTRUCTION OF A COFFER DAM ON MORO COJO SLOUGH @ SANDHOLT RD. AND THE SUBSEQUENT INSTALLATION OF [redacted] CULVERTS + TIDE GATES. THE COFFER DAM IS NOT TO COMPLETELY RESTRICT FLOW OF TIDAL WATER INTO MORO COJO SLOUGH.

2 ALL NECESSARY PERMITS ARE TO BE GATHERED IN CONJUNCTION W/ THE DFG AGREEMENT

4 SANDHOLT RD. AND THE AREA ADJACENT TO THE RIP-RAP/PARKING AREA OWNED BY THE HARBOR DISTRICT ARE TO BE THE STAGING AREAS FOR FILL & EQUIP'T.

5 ALL PLACING & REMOVAL OF CLAY/MATERIALS IN THE SLOUGH IS TO BE DONE @ LOW TIDE TO AVOID TIDAL INFLUENCING OF MATERIAL PLACEMENT.

6 ALL IMPERVIOUS CLAY IS TO BE REMOVED @ PROJECT COMPLETION AND DISTRIBUTED @ PLACE OF ORIGIN OR OTHER SUITABLE SITE OBTAINED BY PUBLIC WORKS

7 ALL VEHICLES USED TO CONSTRUCT THE COFFERDAM AND WORK IN THE SLOUGH BOTTOM ARE TO BE FREE OF OIL, TRANS. FLUID, FUEL LEAKS ETC.

8 ANY DISTURBED VEGETATION/RIP RAP IS TO BE RESTORED TO PRIOR STATE OR IMPROVED. 9 DEWATERING OF UPSTREAM SIDE OF SLOUGH SHALL BE W/SUITABLE BAGGED MATERIAL

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

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

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

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

This agreement becomes effective on DATE SIGNED

Operator Richard D Wyatt

Title Senior Civil Engineer

Organization Monterey County Public Works Dept.

Date 9/21/82

Doug Huckins
Department Representative

Title FISH & GAME WARDEN #157

Department of Fish and Game, State of California

Date 9/21/82

If deletion was not made, cross out words within parentheses.

FG 1060 5-871 97 82406

RECOMMENDATIONS

1. Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. The disturbed portions of any stream channel or lake margin within the high water mark of the stream or lake shall be restored to as near their original condition as possible.

2. Restoration shall include the revegetation of stripped or exposed areas.

3. Rock, riprap, or other erosion protection shall be placed in areas where vegetation cannot reasonably be expected to become reestablished.

4. Installation of bridges, culverts, or other structures shall be such that water flow is not impaired and upstream or downstream passage of fish is assured at all times. Bottoms of temporary culverts shall be placed at or below stream channel grade. Bottoms of permanent culverts shall be placed below stream channel grade.

5. Plans for design of concrete sills and other features that could potentially impede fish migrations must be approved by Department engineers.

6. When any dam (any artificial obstruction) is being constructed, maintained, or placed in operation, sufficient water shall at all times be allowed to pass downstream to maintain fish life below the dam.

7. An adequate fish passage facility must be incorporated into any barrier that obstructs fish passage.

8. Any temporary dam (any artificial obstruction) constructed shall only be built from material such as clean gravel which will cause little or no siltation.

9. No equipment will be operated in live stream channels.

10. Equipment shall not be operated in the stream channels of flowing live streams except as may be necessary to construct crossings or barriers and fills at channel changes.

11. When work in a flowing stream is unavoidable, the entire streamflow shall be diverted around the work area by a barrier, temporary culvert, and/or a new channel capable of permitting upstream and downstream fish movement. Construction of the barrier and/or the new channel shall normally begin in the downstream area and continue in an upstream direction, and the flow shall be diverted only when construction of the diversion is completed. Channel bank or barrier construction shall be adequate to prevent seepage into or from the work area. Channel banks or barriers shall not be made of earth or other substances subject to erosion unless first enclosed by sheet piling, rock riprap, or other protective material. The enclosure and the supportive material shall be removed when the work is completed and the removal shall normally proceed from downstream in an upstream direction.

12. Temporary fills shall be constructed of nonerodible materials and shall be removed immediately upon work completion.

13. Equipment shall not be operated in the lake or its margin except during excavation and as may be necessary to construct barriers or fills. If work in the lake is unavoidable, a curtain enclosure to prevent siltation of the lake beyond the immediate working area shall be installed. The enclosure and any supportive material shall be removed when the work is completed.

14. Silt settling basins shall be located away from the stream or lake to prevent discolored, silt-bearing water from reaching the stream or lake.

15. Preparation shall be made so that runoff from steep, erodible surfaces will be diverted into stable areas with little erosion potential. Frequent water checks shall be placed on dirt roads, cat tracks, or other work trails to control erosion.

16. Wash water containing mud or silt from aggregate washing or other operations shall not be allowed to enter a lake or flowing streams.

17. a) A silt catchment basin shall be constructed across the stream immediately below the project site. This catchment basin shall be constructed of gravel which is free from mud or silt.

b) Upon completion of the project and after all flowing water in the area is clear of turbidity, the gravel along with the trapped sediment shall be removed from the stream.

18. If operations require moving of equipment across a flowing stream, such operations shall be conducted without substantially increasing stream turbidity. For repeated crossings, the operator shall install a bridge, culvert, or rock-fill crossing as specified in comments below.

19. If a stream channel has been altered during the operations, its low flow channel shall be returned as nearly as possible to its natural state without creating a possible future bank erosion problem, or a flat wide channel or sluice-like area. If a lake margin has been altered, it shall be returned as nearly as possible to its natural state without creating a future bank erosion problem. The gradient of the streambed or lake margin shall be as nearly as possible the same gradient as existed prior to disturbance.

20. Structures and associated materials not designed to withstand high seasonal flows shall be removed to areas above the high water mark before such flows occur.

21. No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or washings thereof, oil or petroleum products or other organic or earthen material from any logging, construction, or associated activity of whatever nature shall be allowed to enter into or placed where it may be washed by rainfall or runoff into, waters of the State. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of any stream or lake.

22. The operator will notify the Department of Fish and Game of the date of commencement of operations and the date of completion of operations at least five days prior to such completion.

DEPARTMENT OF THE ARMY

SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105 - 1905

OCT 20 1988 MONTEREY COUNTY PUBLIC WORKS

6 OCT 1988

	INITIAL	NOTE	ACTION
Public Works Director			
Assistant P.W. Director			
Administration			
Claims & Construction			
Trans. & Env.			
Cnty. Engineer			
Maintenance #955			
Special Services			
Traffic			
Road Damage Inv. & Safety			

Regulatory Branch

SUBJECT: File No. 17737S27

Mr. Richard D. Wyatt, P.E.
Senior Civil Engineer
Monterey County
Department of Public Works
312 E. Alisal Street
Salinas, California 93901

Dear Mr. Wyatt:

Thank you for your letter of August 9, 1988 concerning Department of the Army authorization for the repair and replacement of 3 tidegates and a culvert at Moss Landing Road crossing Moro Cojo Slough in Moss Landing, Monterey County, California.

Your project to repair and replace three tidegates and replace a culvert and riprap are considered permitted under a Department of the Army nationwide permit (33 CFR 330.5(a)(3)), pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), provided that the project does not deviate from the original structures configuration. The determination that your activity is covered by nationwide permit is based on our review of a vicinity map and a drawing labelled "Moss Landing Road," unnumbered, dated May 16, 1978.

This letter, confirming that your activity is covered by nationwide permit, is valid for a maximum of two years from the date of this letter. The nationwide permit expires on November 13, 1991, unless the Chief of Engineers modifies, extends or revokes it before that date (33 CFR 330.12). In addition, all conditions cited in Enclosure 1 must be followed and that the management practices also cited in this enclosure are followed to the maximum extent practicable.

Please note that your non-compliance with any condition or requirement of this letter could cancel the nationwide permit authorization for your activity, and you may be required to obtain an individual permit.

The coverage of your activity by a nationwide Department of the Army permit does not eliminate the requirement to obtain other necessary State or local approval. If you have questions, please call Joyce Minjiras of our Regulatory Branch (telephone 415-974-0418). If you wish to write, please address all correspondence to the District Engineer, Attention: Regulatory Branch, and refer to the file number at the head of this letter.

Sincerely,

Calvin C. Fong
Chief, Regulatory Branch

Enclosure

Copy furnished:

US F&WS, Sacramento, CA
US EPA, S.F., CA
CA RWQCB, San Luis Obispo, CA
CA F&G, Yountville, CA

CORPS OF ENGINEERS
33 CFR 330.5(B)

EFFECTIVE DATE: JAN 12, 1987

CONDITIONS TO BE FOLLOWED IN ORDER FOR THE NATIONWIDE PERMIT TO BE VALID

(1) THAT ANY DISCHARGE OF DREDGED OR FILL MATERIAL WILL NOT OCCUR IN THE PROXIMITY OF A PUBLIC WATER SUPPLY INTAKE.

(2) THAT ANY DISCHARGE OF DREDGED OR FILL MATERIAL WILL NOT OCCUR IN AREAS OF CONCENTRATED SHELLFISH PRODUCTION UNLESS THE DISCHARGE IS DIRECTLY RELATED TO A SHELLFISH HARVESTING ACTIVITY AUTHORIZED BY THE ARMY CORPS OF ENGINEERS.

(3) THAT THE ACTIVITY WILL NOT JEOPARDIZE A THREATENED OR ENDANGERED SPECIES AS IDENTIFIED UNDER THE ENDANGERED SPECIES ACT (ESA), OR DESTROY OR ADVERSELY MODIFY THE CRITICAL HABITAT OF SUCH SPECIES. IN THE CASE OF FEDERAL AGENCIES, IT IS THE AGENCIES' RESPONSIBILITY TO COMPLY WITH THE REQUIREMENTS OF THE ESA. IF THE ACTIVITY MAY ADVERSELY AFFECT ANY LISTED SPECIES OR CRITICAL HABITAT, THE DISTRICT ENGINEER MUST INITIATE SECTION 7 CONSULTATION IN ACCORDANCE WITH THE ESA. IN SUCH CASES, THE DISTRICT ENGINEER MAY:

(I) INITIATE SECTION 7 CONSULTATION AND THEN, UPON COMPLETION, AUTHORIZE THE ACTIVITY UNDER THE NATIONWIDE PERMIT BY ADDING, IF APPROPRIATE, ACTIVITY SPECIFIC CONDITIONS, OR

(II) PRIOR TO OR CONCURRENT WITH SECTION 7 CONSULTATION HE MAY RECOMMEND DISCRETIONARY AUTHORITY (SEE SECTION 330.8) OR USE MODIFICATION, SUSPENSION, OR REVOCATION PROCEDURES (SEE 33 CFR 325.7).

(4) THAT THE ACTIVITY SHALL NOT SIGNIFICANTLY DISRUPT THE MOVEMENT OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATERBODY (UNLESS THE PRIMARY PURPOSE OF THE FILL IS TO IMPOUND WATER).

(5) THAT ANY DISCHARGE OF DREDGED OR FILL MATERIAL SHALL CONSIST OF SUITABLE MATERIAL FREE FROM TOXIC POLLUTANTS (SEE SECTION 307 OF THE CLEAN WATER ACT) IN TOXIC AMOUNTS.

(6) THAT ANY STRUCTURE OF FILL AUTHORIZED SHALL BE PROPERLY MAINTAINED.

(7) THAT THE ACTIVITY WILL NOT OCCUR IN A COMPONENT OF THE NATIONAL WILD AND SCENIC RIVER SYSTEM; NOR IN A RIVER OFFICIALLY DESIGNATED BY CONGRESS AS A "STUDY RIVER" FOR POSSIBLE INCLUSION IN THE SYSTEM, WHILE THE RIVER IS IN AN OFFICAL STUDY STATUS.

(8) THAT THE ACTIVITY SHALL NOT CAUSE AN UNACCEPTABLE INTERFERENCE WITH NAVIGATION.

(9) THAT, IF THE ACTIVITY MAY ADVERSELY AFFECT HISTORIC PROPERTIES WHICH THE NATIONAL PARK SERVICE HAS LISTED ON, OR DETERMINED ELIGIBLE FOR LISTING ON, THE NATIONAL REGISTER OF HISTORIC PLACES, THE PERMITTEE WILL NOTIFY THE DISTRICT ENGINEER. IF THE DISTRICT ENGINEER DETERMINES THAT SUCH

HISTORIC PROPERTIES MAY BE ADVERSELY AFFECTED. HE WILL PROVIDE THE ADVISORY COUNCIL ON HISTORIC PRESERVATION AN OPPORTUNITY TO COMMENT ON THE EFFECTS ON SUCH HISTORIC PROPERTIES OR HE WILL CONSIDER MODIFICATION, SUSPENSION, OR REVOCATION IN ACCORDANCE WITH 33 CFR 325.7. FURTHERMORE, THAT, IF THE PERMITTEE BEFORE OR DURING PROSECUTION OF THE WORK AUTHORIZED, ENCOUNTERS A HISTORIC PROPERTY THAT HAS NOT BEEN LISTED OR DETERMINED ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER, BUT WHICH MAY BE ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER, HE SHALL IMMEDIATELY NOTIFY THE DISTRICT ENGINEER.

(10) THAT THE CONSTRUCTION OR OPERATION OF THE ACTIVITY WILL NOT IMPAIR RESERVED TRIBAL RIGHTS, INCLUDING, BUT NOT LIMITED TO, RESERVED WATER RIGHTS AND TREATY FISHING AND HUNTING RIGHT.

X (11) THAT IN CERTAIN STATES, AN INDIVIDUAL STATE WATER QUALITY CERTIFICATION MUST BE OBTAINED OR WAIVED.

X (12) THAT IN CERTAIN STATES, AN INDIVIDUAL STATE COASTAL ZONE MANAGEMENT CONSISTENCY CONCURRENCE MUST BE OBTAINED OR WAIVED.

(13) THAT THE ACTIVITY WILL COMPLY WITH REGIONAL CONDITIONS WHICH MAY HAVE BEEN ADDED BY THE DIVISION ENGINEER.

(14) THAT THE MANAGEMENT PRACTICES LISTED IN 330.6 OF THIS PART SHALL BE FOLLOWED TO THE MAXIMUM EXTENT PRACTICABLE. SEE PAGE 3.

PLEASE NOTE THAT:

A. NATIONWIDE PERMITS DO NOT OBVIATE THE NEED TO OBTAIN OTHER FEDERAL, STATE OR LOCAL AUTHORIZATIONS REQUIRED BY LAW.

B. NATIONWIDE PERMITS DO NOT GRANT ANY PROPERTY RIGHTS OR EXCLUSIVE PRIVILEGES.

C. NATIONWIDE PERMITS DO NOT AUTHORIZE ANY INJURY TO THE PROPERTY OR RIGHTS OF OTHERS.

D. NATIONWIDE PERMITS DO NOT AUTHORIZE INTERFERENCE WITH ANY EXISTING OR PROPOSED FEDERAL PROJECT.

CORPS OF ENGINEERS
33 CFR 330.6

MANAGEMENT PRACTICES

IN ADDITION TO THE ABOVE CONDITIONS SPECIFIED ON PAGES 1 AND 2, THE FOLLOWING MANAGEMENT PRACTICES SHALL BE FOLLOWED, TO THE MAXIMUM EXTENT PRACTICABLE, IN ORDER TO MINIMIZE THE ADVERSE EFFECTS OF THESE DISCHARGES ON THE AQUATIC ENVIRONMENT. FAILURE TO COMPLY WITH THESE PRACTICES MAY BE CAUSE FOR THE CORPS TO REGULATE THE ACTIVITY ON AN INDIVIDUAL OR REGIONAL BASIS PURSUANT TO PART 330.8.

(1) DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES SHALL BE AVOIDED OR MINIMIZED THROUGH THE USE OF OTHER PRACTICAL ALTERNATIVES.

(2) DISCHARGES IN SPAWNING AREAS DURING SPAWNING SEASONS SHALL BE AVOIDED.

(3) DISCHARGES SHALL NOT RESTRICT OR IMPEDE THE MOVEMENT OF AQUATIC SPECIES INDIGENOUS TO THE WATERS OR THE PASSAGE OF NORMAL OR EXPECTED HIGH FLOWS OR CAUSE THE RELOCATION OF THE WATER (UNLESS THE PRIMARY PURPOSE OF THE FILL IS TO IMPOUND WATERS).

(4) IF THE DISCHARGE CREATES AN IMPOUNDMENT OF WATER, ADVERSE IMPACTS ON THE AQUATIC SYSTEM CAUSED BY THE ACCELERATED PASSAGE OF WATER AND/OR THE RESTRICTION OF ITS FLOW, SHALL BE MINIMIZED.

(5) DISCHARGE IN WETLANDS AREAS SHALL BE AVOIDED.

(6) HEAVY EQUIPMENT WORKING IN WETLANDS SHALL BE PLACED ON MATS.

(7) DISCHARGES INTO BREEDING AREAS FOR MIGRATORY WATERFOWL SHALL BE AVOIDED.

(8) ALL TEMPORARY FILLS SHALL BE REMOVED IN THEIR ENTIRETY.