CORTE MADERA WATERSHED
RESOURCE EVALUATION AND INFORMATION REPORT

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INTRODUCTION TO WATERSHED PLANNING

The San Francisco Bay Regional Water Quality Control Board's (Regional Board) overall mission is to protect surface and ground waters of the San Francisco Region. The Regional Board carries out this mission in many ways, including regulation, enforcement, and pollution prevention. For example, the Regional Board has administered the National Pollutant Discharge Elimination System (NPDES) program for nearly two decades to control municipal sewage and industrial wastewater discharges. At the same time, however, urban and agricultural runoff discharges have continued mostly unchecked and contribute to the pollutant loading to rivers, streams, bays, lakes, and lagoons in the San Francisco Bay area. The Regional Board will be focusing much effort over the next few years on controlling pollution from the latter sources. The emphasis will be on preventing pollution before it occurs by managing resources more carefully, as opposed to cleaning up pollution after the fact.

To help accomplish this, the Regional Board is focusing efforts on initiating watershed management planning for several counties. The Corte Madera watershed effort has been funded through a Near Coastal Waters Grant from the U.S. Environmental Protection Agency. The Corte Madera watershed planning effort consists of three components: 1) summary of information regarding the various natural resources that comprise the watershed; 2) collection of field data to assess the current state of the resources; and 3) community planning effort to determine the most effective resource management measures. This document will discuss the results of the first two components, while laying out a framework for the third component.

A companion document, detailing the field methods for data collection and the results of those methods, was prepared to comply with the grant requirements and for use in future watershed evaluations. This document will be made available to the public and other agencies upon request.

The Regional Board firmly believes that watershed planning and protection efforts will not be effective unless solutions are defined and implemented locally. An effective watershed management plan will require formulating water quality goals and objectives for watershed protection and enhancement, and committing to specific tasks that will eventually allow the objectives, and ultimately, the goals to be met.

Tasks could include a wide range of actions, such as improved regulatory and permitting agency coordination, stronger citizen participation in watershed planning activities, improving public education on water quality and protection issues, and consistent enforcement of current regulations. Marin County municipalities already have in place an impressive array of regulatory and planning tools that, if consistently applied, could go a long way toward improving watershed conditions. **But** additional actions may also be needed. However, without broad local consensus on what preventive and remedial actions are needed and how they should be applied, any future plan will be unsuccessful.

Overview of Corte Madera Watershed and Water Quality Problems

Corte Madera Creek and its Tributaries

The Corte Madera watershed sustains a unique and varied environment. The watershed supports three distinct types of habitat along different reaches of its streams. The lower reach consists of wetland habitat, which supports estuarine fish species, migratory waterfowl and shorebirds, and two federally listed endangered species (the salt marsh harvest mouse and the California clapper rail). The lower and middle reaches of the watershed consist mostly of urban creek habitat with homes and roadways lining the creek channels. However, this area still supports a highly vegetated riparian habitat, birds and waterfowl, wildlife, and native fish. The upper reaches of the watershed encompass large open space areas and light housing development. The majority of the upper portions of the watershed's streams are dry throughout the summer months, but fill to channel capacity during winter storms.

The Corte Madera watershed drainage is comprised of Corte Madera, San Anselmo, Fairfax, Sleepy Hollow, Ross, Deer and Cascade Creeks, as well as Phoenix Lake (See Figure 1). The lower portions of the watershed encompass the remaining tidal wetlands, sloughs, and marshes in the drainage. The watershed provides value to the local community in the form of aesthetics, open space, and recreational and educational opportunities. While the exact value is difficult to estimate, the pristine creek and riparian habitat add to the value of the houses that are next to or near the creek channels. Creekside parks offer bird and wildlife viewing and picnicking opportunities to local residents. Local schools, relying on the adage, "a picture is worth a thousand words," utilize the creeks and their riparian habitats to teach biology and ecology to students.

The series of creek channels also act to convey runoff down to the Bay. While some of these creeks overflow their banks at various points in the watershed, the net effect is to carry large amounts of overland water runoff from the upper and middle reaches of the watershed out to the Bay.

The Corte Madera watershed also provides habitat to native fish and wildlife. Corte Madera Creek and its tributaries still support an anadromous steelhead run, as well as other native species. The lower marshes are home to two endangered species: the southern salt marsh harvest mouse and the California clapper rail. A harbor seal haul- out has been identified north of San Clemente Creek, a tidal channel near the mouth of the drainage (USACOE, 1992). The riparian vegetation that helps support the native fish also provides habitat to many wildlife species. Animals such as raccoons, deer, and even the occasional bobcat can be found in and around the creek areas, while bird species such as the great blue heron, black-crowned night heron, and waterfowl also inhabitant the watershed.

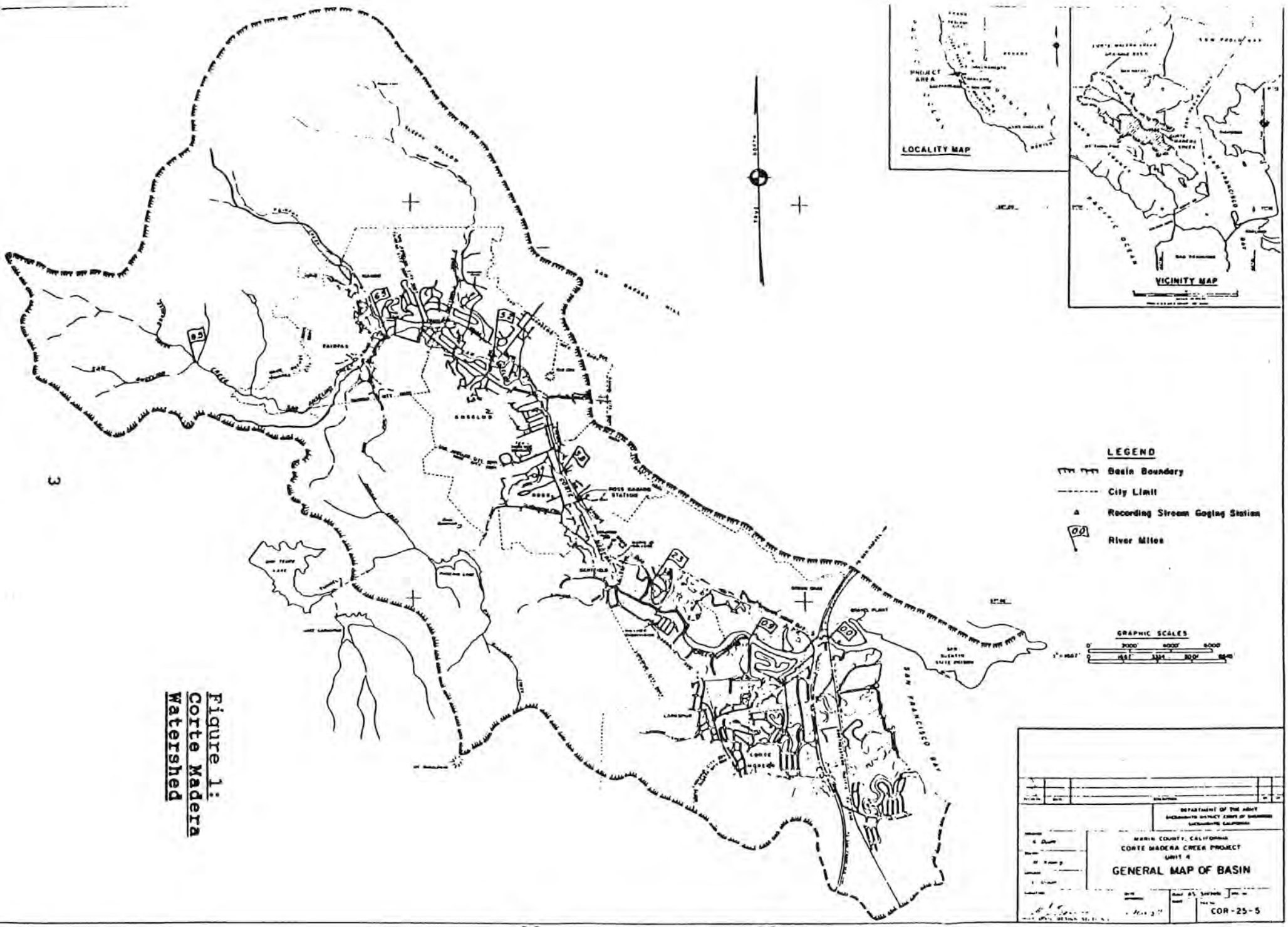

Figure 1:
Corte Madera
Watershed

Human residents depend on the watershed. Phoenix Lake is a secondary water supply reservoir operated by the Marin Municipal Water District. Groundwater is used for irrigation by schools and local residents bordering the waterways. Thus, maintaining adequate water quality and quantity in the watershed is critical to the health of both the human populace and the watershed's fish and wildlife resources.

Water Quality in the Corte Madera Watershed

Considering the degree of urbanization, The Corte Madera watershed is a fairly pristine habitat with good water quality. Yet some water quality problems still exist, largely due to nonpoint or more diffuse sources of pollution, such as stormwater runoff from urban and open space areas.

Corte Madera Creek is also characterized by localized flooding during winter storm events and by soil bank erosion. The U.S. Army Corps of Engineers has constructed flood control structures in the creek, which have reduced threats from flooding; however, the channelization may have increased the risk of flooding and erosion in other areas. Upstream of the flood control channel, soil erosion caused by the natural widening of the creek during storms, changing hydraulic peaks from landscape modifications, and the loss of streamside riparian corridors from housing increase the threat of erosion.

Finally, high coliform bacteria counts have been detected during the winter months in various segments of the creek. Factors such as the drought-concentrated runoff, population increases, animal life, street run-off, and leakage from old sewage pipes may be responsible for the high coliform counts.

PART ONE: CORTE MADERA WATERSHED RESOURCE EVALUATION

Resource Evaluation Methods: Historical Data and Field Methods

Historical Data

Early efforts focused on gathering existing data from published reports, agency field data (California Department of Fish and Game), and academic publications. Additional information was obtained through personal communications and outreach with longtime residents and environmental professionals working in the area.

Field Assessment

The parameters for the field assessment were based on their relationship to the Regional Board's beneficial uses and complementary collection parameters used by other resource agencies. The parameters or habitat factors to be studied were: 1) fisheries/ macroinvertebrates, 2) riparian habitat, 3) erosion/ geomorphology, 4) land use, 5) contributing point and non-point discharges, and 6) water quality.

The purpose of the field assessment was to: 1) assess the health of the watershed; 2) develop a standardized set of parameters to monitor and an accessible database to track the data; 3) identify and prioritize potential future data needs; and 4) catalog/document the field methods to allow for repetition of the studies by outside entities (other agencies, local agencies or schools, citizen monitoring groups).

Methods: Data Gathering

The basic parameters chosen for the watershed assessment were derived through consultations with other resource agencies, academia, and citizen watershed groups. The parameters or resources to be measured were intended to address the beneficial uses identified by the Regional Board and also be useful to other agencies in their habitat assessment activities. Further, the parameters needed to be flexible enough that most citizen monitoring or school groups could, with little or no supervision, collect supplemental data.

The methods used in gathering the data were also documented to facilitate future replication of field methods The majority of methods employed utilized simple and standard testing procedures for ease in replication and to facilitate involvement by local citizen groups.

The fisheries, macroinvertebrate, and water quality field assessments were performed at specific, documented locations to facilitate long-term monitoring and assessment activities. The remaining portion of the field survey parameters (erosion, geomorphology, land use, discharges, and riparian community) were taken every 1,500

feet along the different stream channels, moving upstream from the mouth . The assessment was designed to provide a statistically usable set of snapshots that characterized the stream system. Fifty-four sites were surveyed. In addition, staff observed and recorded potential sources of degradation or concern for over 16 miles of the stream system.

Data Base Storage

The field data was catalogued in the Filemaker Pro database software. The fisheries and water quality assessment were identified by latitude and longitude (using United States Geographical Survey quadrangles) for long term data collection. The data is designed to be used in spatial analysis and for possible future storage on a geographical information system.

Corte Madera Watershed (Location and Size)

The Corte Madera watershed is located in Marin County, California (See Figure 1). Marin County is bounded on the west by the Pacific Ocean and on the east by San Francisco Bay. The drainage is in the southeastern quarter of Marin County and includes the cities of Ross, San Anselmo, Larkspur, and Fairfax. The watershed extends from latitude 37° 55'50"N to 38° 1'30"N and from longitude 122° 30'40"W to 122°36'45"W.

Lying within the eastern watershed of Mt. Tamalpais, Corte Madera Creek drains a watershed of approximately 28 square miles, entering San Francisco Bay near the city of Larkspur. Much of the region consists of hilly and mountainous terrain covered with trees, coastal scrub, and chaparral. The creeks of the watershed flow through narrow valleys, bordered by smaller communities of the region (San Anselmo, Greenbrae, Ross, Larkspur, and Fairfax). In the lower reaches of the watershed, a constricted floodplain merges with the tidal marshes and mudflats that surround San Pablo Bay . Temperatures average 70° Fin the summer and the mid-40's in the winter. Rainfall, which occurs mostly in the winter months, can cause flooding in the watershed due to the area's steep terrain, relatively small valley floor, and concentrated urban development.

Surface Water Characteristics

The main stem of Corte Madera Creek is approximately 5 miles in length. The total length of streams within the watershed is approximately 35 miles. The tidal reaches of Corte Madera Creek are reported to be 125 acres of open water habitat at low tide. There are an additional 12 acres which are inundated at high tide. Intertidal mudflats also border the creek in some areas and total approximately 20 acres.

Streamflow

The Corte Madera watershed has a long history of flooding. Subsequent to the installation of a stream gauge at Ross in 1951, streamflows in excess of 3,000 cubic feet-per-second (cfs) have been recorded on 10 occasions. Record floods have occurred in a number of years, including 1937, 1942, 1955, 1982, and 1983 with a maximum peak discharge of over 7,200 cfs recorded in 1982 (USGS). Tidal action can also increase flooding. However in drought years, flows within the watershed have been recorded as low as 1 cfs.

During the summer months, many of the upper stream reaches lack flow. Some of the smaller tributaries retain intermittent flows, which are fed mostly by groundwater. These intermittent pools provide watering holes for wildlife and habitat for aquatic organisms, including some juvenile steelhead.

Water diversions can adversely impact stream ecology during the summer and fall months. In the summer of 1980, the California Department of Fish and Game observed over 40 water diversions along Corte Madera Creek, a portion of San Anselmo Creek, and Cascade Creek (California Department of Fish and Game, 1980, Stream Survey). Because of the seasonal nature of the stream flow in the upper reaches, water diversions reduce the period of water flow in the upper reaches , water diversions reduce the period of water flow and can dewater vital intermittent stream pools.

The recent San Francisco Bay Regional Water Quality Control Board field survey work identified 23 possible illegal water diversion along 16 miles of the drainage's creeks. Landowners are required to file a Riparian Statement of Water Diversion and Use (for a riparian claim) or an Appropriative Water Right Permit (for appropriative use) before they start constructing diversion works or diverting any water. Upstream riparian water rights should allow enough water downstream to meet permitted downstream users' needs and protect beneficial uses. There are no applications filed for any streams in the Corte Madera watershed (Pers. comm. SWRCB).

Riverbank Erosion

Streambank erosion in the watershed is a major problem to homeowners as evidenced by the steep undercut banks, exposed tree roots, and a myriad of homeowner-constructed bank protection structures. Siltation-caused by erosion has also reportedly decreased the flow capacity of the concrete flood control channel in the lower part of Corte Madera Creek. Erosion may also increase the amount of scour in the lower part of the Creek. Also, riprap and other concrete flood control structures can accelerate streambank erosion by increasing the velocity of water, thereby increasing its erosion capabilities.

A survey conducted by Regional Board staff of the Corte Madera watershed noted percentages of the channel that had been re-engineered (see Table 1). Modifications included sandbags, concrete walls, poured asphalt or concrete, riprap, railroad ties, and construction debris. Of the 54 spots surveyed, 31 percent exhibited some kind of

modification on one or both banks. While evaluating the channel's substrate, staff evaluated the particular geomorphology of the survey point against the expected degree of siltation. An evaluation was made concerning the degree of particulate matter found at the individual assessment sites. The substrate was rated as having: 1) no or little siltation; 2) moderate siltation; 3) significant siltation; or 4) total siltation. The table below shows the percentage of survey points showing modification and the percentage of survey points where siltation was rated as significant or total.

Table 1

STREAM	#TRANSECTS	STREAM LENGTH*	% MODIFIED	% SIGNF. OR TOTAL SILTATION
CASCADE	3	2.8 miles	0	0
CORTE MADERA	7	4.3 miles	56	57
FAIRFAX	10	5.3 miles	24	40
ROSS	6	1.4 miles	36	50
SAN ANSELMO	15	9.0 miles	29	27
SLEEPY HOLLOW	13	4.2 miles	41	69

* Stream mileage includes the lower, channelized portion of Corte Madera Creek and upper branched stretches of San Anselmo Creek. The Regional Board's survey began above the channelized portion of Corte Madera Creek and did not include every intermittent upper stream branch.

Dredging

Dredging activities are performed at the mouth of the creek primarily to maintain adequate depths for the Golden Gate Ferry operations. Also, a small dredging project has been approved to increase depths within the tidally influenced area of Corte Madera Creek for recreational boating. Both projects should have little or no adverse impacts to biological resources or local hydrology.

The Army Corps of Engineers is currently considering engineered alternatives to protect Corte Madera homeowners living in the former salt marshes against flooding. One of the preferred alternatives includes significant dredging of San Clemente Creek to create a lagoon. San Clemente Creek drains into the remaining portion of the Corte Madera salt marsh. The Corps project is currently in the feasibility planning stage, and the potential impact of the proposed dredging cannot be assessed .

Groundwater

Groundwater quality data for the Corte Madera watershed are limited and largely based on information collected by William C. Ellis and Associates in 1978. The Corte Madera watershed encompasses the Ross Groundwater Basin. The basin has been

identified as having potential beneficial uses for industrial process and service water supply and existing beneficial uses for municipal, domestic, and agricultural water supply. The groundwater analysis showed high mineral content, especially for iron and manganese. The groundwaters were classified as being relatively hard and of the calcium-magnesium/bicarbonate type except in the lower end of the groundwater basin, which was classified as being of the sodium bicarbonate type. In general the 1978 well sampling showed the groundwater quality to be good, although the wells were not tested for volatiles or solvents, constituents of concern in the San Francisco Bay area because of leaking underground tanks. The sites have shown contaminated soils, but the extent of groundwater contamination has not been characterized at any of the locations.

The groundwater in the lower part of the basin is increasingly brackish due to tidal influence. As of 1978, records show around 110 functioning wells in the basin, at least 7 of them public. Many wells are located in the stream corridors and are used for residential irrigation.

Compliance With Recommended Levels

In general the Ross Valley Groundwater Basin seems to be acceptable for municipal, agricultural, and domestic beneficial use. Overall, based on Ellison's 1978 study, the groundwater for the Corte Madera drainage appears to be of usable quality. The study concluded with the recommendation that piezometric levels and water quality should be periodically monitored at the College of Marin Wells Nos. 1 and 2 in connection with possible saltwater intrusion. Both of these wells showed chloride levels above 2000 mg/1, exceeding water quality objectives for municipal and agricultural use. In addition, groundwater samples at the sites of leaking underground gasoline tanks show benzene exceeding the allowable limit for groundwater. Soil samples at some of the historical underground fuel tank sites have shown unacceptable levels of gasoline, oil, and grease. The groundwater may also be impacted at these sites, but the site investigations haven't fully characterized the groundwater quality (RWQCB, Leaking Underground Fuel Tank Database; pers. comm., John Jang).

Geomorphology and Soils

The morphology of the Corte Madera watershed is typical of the California Coastal Geomorphic Province. The landscape pattern is dominated by fault-influenced northwest-southeast trending mountain ranges that sub-parallel the coastline. The landscape consists of rugged coastal peaks with steep, narrow canyons and linear drainage patterns, which give way to the flatland of the historical floodplains and wetlands. The lower flat reaches are densely urbanized. Houses and the towns' commercial centers flank the stream edges. The upper, steeper stream reaches are progressively less populated, and the upper drainage of the Corte Madera watershed consists mainly of oak woodland open space.

Much of the developed corridor of the creek system consists of earth fill. This soil has been mechanically moved and mixed. Some of the fill may contain varying amounts of concrete, rock, asphalt, and other materials. The soil is loamy and, depending on the percentage of components, can exhibit a wide range of drainage capabilities.
Intermixed with the urban fill are areas of soil derived from sandstone formations in the area. This Tocaloma-McMullin-Urban soil is underlain by sandstone and shale. Slopes range from 15 to 75 percent and are subject to high erosion (Kashiwagi, 1985). The Soil Conservation Service recommends careful erosion control and attention to vegetative cover on the native soil in the Corte Madera watershed. Visual observation during the recent field assessment showed that the streams are actively working towards achieving dynamic equilibrium. Changing drainage patterns, soil permeability, plant cover, and surface water hydrodynamics coupled with the region 's geology are the driving forces in the watershed's geomorphology.

Biotic Resources

Corte Madera watershed is a highly complex system consisting of tidal and non-tidal reaches, influenced strongly by a clearly differentiated wet and dry seasonal climate. The watershed supports a diverse and valuable complex of habitats due to its variety of soils, topography, and microclimate. Twelve distinctive botanical associations have been identified in Marin County alone. These include redwood forests, tanbark oak- madrone woodlands, oak-buckeye woodlands, Douglas fir forests, bishop pine forests, chaparral, coastal brush, grassland, streambank and lakeshore groves, freshwater marsh, saltwater marsh, and dunes. The dominant habitat at the mouth of the creek is saltwater marsh, while the habitat along the creek is riparian woodland/forest.

The types of fish found within the Corte Madera watershed reflect a wide range of habitats from euryhaline to anadromous to completely freshwater. Leidy (1984) reported that 13 fish species have been collected from Corte Madera watershed streams. These include: Sacramento squawfish, California roach, Sacramento sucker, rainwater killifish, mosquitofish, three-spined stickleback, prickly sculpin, riffle sculpin, staghorn sculpin, tule perch, longjaw mudsucker, tidewater goby, and steelhead trout. Additional studies reported the presence of nine additional species including brown trout, Chinook salmon, carp, black crappie, shiner perch, top smelt, Sacramento perch, and starry flounder. Stream surveys performed by California Department of Fish and Game from 1960 through 1980 show five dominant species present in the creek (sucker, roach, stickleback, sculpin, and steelhead), with an occasional coho salmon sighting.

The Regional Board staff conducted field surveys during the summer of 1992 using both visual observation and seine nets and found the five dominant species present. The three that occurred most often were California roach (*Hesperoleucus symmetricus*), Sacramento sucker (*Catostomus occidentalis*), and three-spined stickleback (*Gasterosteus aculeatus*). Given the number of successive drought years and the timing of our sample July), we did not expect to find many salmonids. However, we collected 11 steelhead

trout (*Oncorhynchus mykiss*) and positively identified many others. All steelhead were found in deep shaded pools under overhangs, log debris, and bridges. All steelhead were collected or visually identified in the lower end of the Creek. However, the range of our samples was not large enough to be conclusive. Riffle sculpin (*Cottus asper*) were only found in the one riffle sample. Complete fisheries survey data are available upon request from the Regional Board.

A comparison of historical data to current fish surveys shows a decrease in the species diversity and population numbers in the lower stream reaches. Declines in the steelhead trout population could be attributed to inadequate fish passage structures, reductions of spawning and nursery areas due to the concrete channel, siltation of potential spawning sites upstream of the channel, unregulated diversions of creek flow by landowners, and illegal discharges of chlorinated swimming pool water into the creek.

The primary species found in the tidal reaches of the watershed include: bay goby, speckled sanddab, northern anchovy, striped bass, staghorn sculpin, plainfin midshipman, shiner surfperch, bay pipefish, and longjaw mudsucker. In 1991, the Romberg Tiburon Center's study netted a bigmouth sole (*Hippoglossina stomata*) in the tidal area of Corte Madera Creek, the first such documentation of this fish in the San Francisco Bay. Prior to the find, the northern-most portion of this species' range was believed to be Monterey Bay. Rays, skates, and sand sharks may also be found at the mouth of the creek.

Invertebrates

Detailed information regarding the aquatic invertebrate populations tends to be limited to the middle, lower, and tidally influenced portions of the watershed. The lower portion of the watershed around the Ross area supports a diverse aquatic insect population (USACOE EIS, 1987). Insect orders are represented by water striders, water scorpions, giant water bugs, water boatmen, water bugs *(Naucoridae* and *Dytiscidae),* diving beetles, whirligigs, Dobson fly larvae, caddisfly larvae, damselfly nymphs, dragonfly nymphs, mayfly nymphs, stonefly nymphs, mosquitoes, gnats, and black flies.

Benthic sampling (USACOE EIS, 1987) indicated that dipteran (fly) larvae were numerically dominant. Only a few reaches supported the generally herbaceous mayfly larvae. Omnivorous coroxid beetles were also noted. Pulmonate snails tend to dominate the benthic biomass. These invertebrates tend to be moderately tolerant of pollution. The larvae and emergent adult insects are particularly important food sources for young steelhead trout.

All of the species found in the tidal areas of the watershed are typically found throughout the San Francisco Bay. The two most dominate benthic species found in Corte Madera tidal areas are the gem clam *(Gemma gemma)* and the amphipod *Ampclisca abdita,* which are also the dominate communities throughout the Bay. Other species

found in Corte Madera Creek were the clam (*Chane gracilis),* the Asian clam *(Potamocorbula amurensis),* Sipunculid worms, and the small mussel *(Musculus senhousia).*

Another important invertebrate found within the tidal areas of the Creek is *Crangon franciscorum* or crangon shrimp. In a recent study, 3,650 crangon shrimp were collected in five otter trawl tows (Romberg Tiburon Center, 1991). The shrimp are reported to be most abundant in the outer portion of the creek, which is consistent with studies in other portions of the Bay. In addition to crangon shrimp, other common invertebrates are crabs (spider, mud, Oregon, cancer, and Dungeness), nudibranchs, and cnidarians.

Wildlife

Common amphibians in the upper and middle portions of the watershed are frogs, toads, and salamanders (California newt and California slender salamanders). Garter snakes are also common reptiles in the area (USACOE EIS, 1987).

Resident birds of the study area include California quail, California jay, various hummingbirds, finches, mockingbirds, blackbirds, and robins. Migratory birds are represented by mourning doves, bandtail pigeons, cedar waxwings, warblers, and others. Insectivorous birds specifically attracted to riparian corridors include Wilson's and yellow warblers, yellow breasted chats, Bewick's and house wrens, downy woodpeckers, flickers, vireos, and gnatcatchers. Seed-eaters in this environment include goldfinches, song sparrows, black-headed and blue grosbeaks, towhees, Bullock's and hooded orioles, and lazuli buntings (USACOE EIS, 1987).

Squirrels represent the most common diurnal mammal species. Other rodents include Norway rats, wood rats, and deer mice. Deer, raccoons, rabbits, and vagrant shrews are also present along reaches of the watershed. The trees and associated understory along the creeks provide food, shelter, and excellent travel corridors for mammals. Bobcats, the introduced red fox, and other wildlife are found in the upper part of the watershed.

The Marin Audubon Society lists the following species as being present in the lower portion of the watershed: swallows (cliff, violet green, barn, and rough-winged), raptors (American kestrel, white-tailed kite, red-tailed hawk, short eared owl, burrowing owl), egrets (great and snowy), herons (great blue and night crowned), diving ducks (western grebes, loons, mergansers, cinnamon teals), and shorebirds (northern phalaropes, least sandpipers, western sandpipers, marbled godwit, long- billed curlew, avocets, willets, and killdeer). Other wildlife species in the tidal areas include the gopher snake, black-tailed hare, the meadow mouse, Beechy ground squirrel, California vole, muskrats, and the endangered salt marsh harvest mouse.

Vegetation

The U.S. Army Corps of Engineers Final Supplemental EIS for the Corte Madera Creek Flood Control Project No. **4** (1987) has an extensive list of the types of vegetation found along the riparian corridor of the watershed. The dominant riparian trees in the middle

to lower reaches of the watershed are arroyo willow, big-leaf maple, and California box elder. Other riparian species include Oregon ash, red alder, sycamore, and creek dogwood. The understory associated with the woodland includes California blackberry, red elderberry, and coyote bush.

Several different species of terrestrial trees and shrubs also occur in the study area. These include: American elm, coastal redwood, coast live oak, acacia, California buckeye, and eucalyptus. Dominant shrubs include spice bush, blackberry, and snowberry. The umbrella sedge, horsetail, and water smartweed comprise the dominant freshwater marsh plants along the creek. The principal aquatic plants are duckweed and filamentous green algae.

The riparian woodland community performs several significant functions important to the stream ecosystem. Riparian timber provides nutrients in the form of fallen leaves, twigs, and insects. These coarse nutrient sources are broken down by aquatic invertebrates into particulate and dissolved nutrients available to many other stream inhabitants. Riparian timber moderates water temperature and reduces daily temperature changes by reducing light penetration to the water surface. Tall trees with pronounced canopy development are especially effective because their height provides prolonged "shadowing" during periods of low sun angles in the morning and late afternoon. Horizontal canopy development provides effective overhead shading as the sun approaches its zenith. Shading caused by the riparian trees also limits primary productivity and balances the abundance and diversity of aquatic macrophytes against noxious algal blooms. The canopy is more extensive during mid-spring to late-fall seasons when deciduous trees are in full leaf. This affords resident stream populations the greatest protection from insolation during the hot, low-flow summer seasons when water temperatures may stress inhabitants.

The riparian and terrestrial vegetation in the watershed also supplies nesting, perching, roosting, and feeding habitat for birds and food and cover sources for other wildlife. Much of the area with previous flood control work in the lower portion of the watershed has been replanted with conifers and Lombardy poplars. These species provide substantial shadowing due to their heights, but their limited horizontal branching provides little overhead cover for the streams.

Fallen riparian timber influences the stream system in many ways. First, by altering the hydraulic processes, fallen timber increases the diversity of the aquatic habitat by providing scour holes, undercut banks, and fast and slack water zones. Second, the presence of suitable substrates promotes the increase in abundance and diversity of aquatic invertebrates. Finally, fallen timber, root wads, and scour holes resulting from downed timber provide refuge for stream inhabitants, including anadromous fish.
Some of the trees along many of the unstable bank reaches in the watershed can and do fall into the streams due to flooding and bank erosion, which can lead to problems for homeowners along the streams.

Historic native riparian communities in the Corte Madera watershed were dominantly the Central Coast Live Oak Riparian Forests and the North Coast Alluvial Redwood Forests (Holland, 1986). The dominant and co-dominant plant communities were noted in each of the 54 stream assessment sites. Much of the native vegetation has been replaced by urban forest consisting of non-native species ruderal vegetation. Ruderal vegetative growth is considered to be a sign of disturbed areas. Although the character of the buffer zone has changed, the field work performed during the summer of 1993 showed a relatively high percentage of canopy cover throughout the drainage. Percentage of canopy was measured every 1500 feet along each stream segment using a spherical densiometer. A desirable percent of canopy is generally considered to be 80 percent.

Visual observation during the field assessment showed very little fallen timber or root wads. Much of the urbanized reaches of the stream system exhibited channel modification to repair or to prevent erosion (see Table 2). The bank armouring removes much of the immediate riparian corridor and serves to decrease the natural timber cycle of a riparian corridor.

Table 2

Stream	# Collection Points	% Riparian Canopy	% Urban Forest
CORTE MADERA	7	74	43
FAIRFAX	10	80	30
ROSS	6	79	17
SAN ANSELMO	15	65	20
SLEEPY HOLLOW	13	82	7

The dominant vegetation in the tidal reaches of the watershed includes: cordgrass, pickleweed, salt grass, salt bush, and alkali heath. The lagoons also support cattails, tule, willows, and other shrubby riparian vegetation.

Wetlands and Marshes

The tidal reaches of Corte Madera creek are comprised of six habitat types according to the U.S. Fish and Wildlife Service wetland classification system, developed by Cowardin (1979). The largest in terms of area is the estuarine intertidal emergent marsh, which is regularly flooded. This type of habitat covers 152 acres at the lower end of the Corte Madera watershed. This habitat is typically bordered by cordgrass (*Spartina foliosa*) from mean seal level to mean high water. Above the cordgrass zone, pickleweed (Salicornia virginica) can be found. In the higher marsh, halophytes such as salt grass (*Distichlis spicata*), salt bush (*Atriplex patula*), and alkali heath (*Frankenia grandifolia*) are intermixed with the dominant pickleweed. Organisms that find this habitat suitable include endangered species such as the salt marsh harvest mouse and the California clapper rail. A large number of invertebrates such as crabs and clams also utilize this habitat.

Open water habitat at low tide consists of 126 acres and is classified as estuarine subtidal habitat with unconsolidated mud bottom. This habitat supports fish species and waterfowl. The unconsolidated bottom allows for soft-bodied burrowing invertebrates such as polychaete worms, which are filter feeders and/or deposit feeders.

Another type .of wetland habitat is characterized as intertidal estuarine emergent marsh, which is regularly flooded. These areas are inundated by only the highest tides. Corte Madera tidal reaches have 13 acres of this habitat type.

Similar to the intertidal emergent marsh but higher in elevation, these marshes support the same types of flora and fauna.

Intertidal mudflats border the creek in some areas and total 20 acres . Mudflat vegetation is limited to benthic macroalgae/microalgae and phytoplankton. Filter feeders, deposit feeders, and grazers all exploit this food source. Mudflats also provide food for foraging shorebirds .

Impounded or brackish water habitats also occur around the creek. One such habitat type is an open water lagoon. This lagoon has an unconsolidated bottom, is impounded, and is permanently flooded. It is flushed by tidal waters on an infrequent basis. A second type of brackish lagoon along the upper portion of the tidal reaches is surrounded by scrub-shrub riparian vegetation, is also impounded but is temporarily flooded. The lagoons support cattails (*Typha spp*.), tule (Scirpus robustus), willows (*Salix spp*.), and shrubby riparian vegetation. Fish, shorebirds and waterfowl all benefit from the lagoons.

Each of the wetland habitats within the Corte Madera tidal areas has characteristic sets of plants and animals. Flora and fauna within these areas exhibit introduced as well as native species. Some animal species are resident and some are seasonal visitors. Seasonal visitors include migrating birds, which appear during fall and spring, while others are anadromous fish, which use areas like the tidal areas as nurseries and feeding areas before migrating to the ocean.

Current and Planned Land Use

The middle and lower portions of Corte Madera watershed are densely urbanized, consisting of single family residences, small businesses and industry, some cluster housing, and schools. The lower reaches of the watershed also have the most transportation corridors. The upper portions of the watershed consist of light residential housing and open space areas.

The upper portion of the watershed, with its large areas of open space and parks, reduces runoff through root percolation, and increases water seepage into groundwater tables. Current zoning does not allow for large amounts of additional development in the upper watershed.

The Corte Madera watershed encompasses the cities of Corte Madera, San Anselmo, Larkspur, Kentfield, Fairfax, and Ross. The majority of these cities and the surrounding areas are relatively upper-income housing. Many of the high value homes sit on or near the creeks. The creeks provide an aesthetic quality which equates to economic value to the landowners.

The land use immediately adjacent to the creek is predominately housing, which has impacted the amount of riparian habitat. Most of the housing immediately adjacent to the creek is single family structures in the lower end of the watershed. The central portion of the creek is a mix of apartment complexes, condominiums, and single family homes. Other urban uses include shopping areas, recreational areas, and municipal service facilities. The tidal margins of Corte Madera Creek are surrounded by approximately 69 percent urban land and 31 percent emergent marsh.

The Corte Madera Ecological Reserve is also located at the mouth of Corte Madera Creek. This area, which contains endangered species, is also utilized for recreational purposes (hiking, birdwatching, etc.). However, some of the recreational purposes are not consistent with the intended uses of the land, and problems have arisen . Dogs and other domestic animals have been observed roaming unrestrained in the Reserve and· other sensitive wildlife areas, which can harm wildlife populations. Unintentional destruction of habitat either by foot or bike can also negatively impact the habitat.

Currently, a housing development (Baywood Canyon) is under construction in the upper portion of Fairfax Creek on lands that have primarily been used for stabling horses. The final environmental impact report for Baywood Canyon summarizes a history of water quality problems due to horse manure. The project design recognizes the historical problem and includes remediating measures.

Board staff, during the 1993 field survey, noted stable manure illegally placed in streambeds. In addition, new construction projects have encroached on required streamside setbacks or threatened water quality because the vegetation has been stripped within riparian corridors.

Water Quality

Objectives, Standards, and Plans

The Regional Water Quality Control Board (Regional Board) has adopted a Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan). The Plan lists the present and potential future beneficial uses of surface waters that the Regional Board must protect. A total of 13 beneficial uses have been designated for principal water bodies within the Corte Madera watershed. For those tributary waterbodies that are not listed, the beneficial uses can be inferred from those of the main waterbody.

The Regional Board has established water quality objectives that enumerate concentrations of various pollutants that must not be exceeded in order to assure the

protection of beneficial uses. The Basin Plan also includes general water quality objectives for parameters such as suspended material, sediment, and toxicity, and states that waters shall not contain concentrations or levels of any substance which may "cause nuisance or adversely affect beneficial uses." For some parameters, such as dissolved oxygen and coliform bacteria, there are numerical objectives established to protect aquatic life or human health, respectively.

Surface Water Quality

Water quality in the Corte Madera watershed can be characterized as good despite intensive urban development. The streams in the upper and middle portions of the watershed continue to support small annual runs of steelhead trout, which require reasonably good water quality.

Field studies performed by classes at the College of Marin in the mid-1970's indicated that the creek water was relatively clear and cool with high levels of dissolved oxygen n. Concentrations of nitrates (NO_2) were within acceptable limits for domestic water supplies, and phosphate concentrations (PO_4) were below the levels necessary to cause· eutrophication. These levels were also within acceptable limits for salmonid growth and reproduction. Corte Madera creek receives a high percentage of urban runoff from the lower paved urban areas. This runoff includes non-point source pollutants inherent in any urban area, such as heavy metals, petroleum hydrocarbons, pesticides, and sediments.

In December 1992 and January 1993, Corte Madera Creek was tested by the Sanitary District Number One and the Central Marin Sanitation Agency (CMSA) for coliform bacteria to determine water quality. The test results exceeded acceptable objectives under the Basin Plan for non-contact water areas. Tests in the creek performed over the last few years have shown increases in the levels of coliform. The results have also shown fluctuations of the e levels which occur seasonally. Street and land water runoff results in the highest coliform levels during the wet season and the lowest levels during the dry season. Possible causes for the high coliform are the drought, population increases, animal life, street runoff, and breaks in old sewage pipes. Detection of sewage leaks may be quite difficult due to the large number of older residential homes that border the creek.

Additional problems have been documented in the watershed. Constituents such as nitrates and phosphates; originating from creekside landscaping and homes, may cause stream degradation. The draining of swimming pools into the creeks can also harm water quality by introducing pool chemicals into the water columns, which is known to impact aquatic species. Water diversions can also impact water quality by lowering water levels, thus decreasing dilution abilities. There are no large-scale dairy operations along the stream corridor. However, improper storage and/or disposal of manure generated by private horse ownership can lead to water quality degradation.

Water quality samples were taken by the Regional Board in June of 1992 and February of 1993. The goal of the sampling was to get an overall view of the health of the watershed, for future monitoring and enhancement projects. Therefore, specific areas of concern were not tested at the time. Instead, water and sediment samples were taken below every incoming segment of the stream system to highlight any noticeable changes between the various branches. Water samples were analyzed for dissolved oxygen, pH, temperature and conductivity, total suspended solids, phosphorous (total and ortho), nitrogen series (including total kjeldahl nitrogen), and chlorophyll a. Sediment samples were also taken and analyzed for silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium, zinc, polynuclear aromatic hydrocarbons (PAHs, EPA method 610/8100), and chlorinated herbicides (EPA method 615/8150). Additionally, three sets of fish tissue, California roaches (Lavinia symmetricus) from two sampling areas and Sacramento sucker (*Catostomus occidentalis*) from one area, were analyzed for lipid content, the metal series, chlorinated herbicides and organophosphorus pesticides.

In general the sampling showed good water quality. Dissolved oxygen, pH, and temperature results were all within acceptable limits. Sampling did highlight several areas with marginal sustaining levels of dissolved oxygen.

The water and soil samples did contain metals found in areas with urban runoff. However, even waters in the relatively undeveloped areas of the watershed showed dissolved metals, probably due to background sources from the local geology. Fish samples showed some metal constituents in the fatty tissue of the fish.

Due to the surrounding groomed landscape, fertilizers, pesticides, and herbicides were a possible constituent of concern in the watershed's drainages. None of the fish tissue, water or soil samples showed excessive amounts of organophosphorus pesticides or chlorinated herbicides

Chlorophyll a was detected at concentrations that .are above the recommended levels for the Corte Madera drainage system. Chlorophyll a is considered an indicator of the biomass of minute floating aquatic plants (phytoplankton). Excessive chlorophyll production could lead to potential water quality degradation. The amounts detected during water quality sampling warrant the need for further investigation.

In addition, the wet weather sampling in Februc1:ry 1993 showed much higher levels of phosphates than detected during the dry weather sampling the previous June. The levels did show some correlation of high and low phosphate values among different stream segments. The preliminary data highlight the need for more extensive sampling to begin to characterize the point and nonpoint sources of runoff to the Corte Madera watershed.

Summary of Present and Potential Sources of Pollution and Impacts

Upstream of the flood control channel, soil erosion caused by the natural widening of the creek during storm events and the loss of stream banks and riparian corridors from housing increases the threat of erosion.

The dumping of animal wastes from horse stables along with disposal of lawn and tree cuttings in the creek has increased the nutrient loading in the water and decreased water quality.

Factors in the decline in the steelhead trout populations include reductions of spawning and nursery areas within the concrete channel, sedimentation of potential spawning sites upstream of the channel, unregulated diversions of creek flow by landowners, and discharges of chlorinated swimming pool water into the creek.

The draining of swimming pools into the creek can also harm water quality by introducing pool chemicals into the water column, which is known to impact aquatic species.

Some of the recreational activities in sensitive habitat areas are not consistent with the intended uses of the land, and problems have arisen. The impacts of dogs and other domestic animals, as well as human bicycle and foot traffic, can negatively impact the habitat and harm wildlife populations.

Coliform bacteria levels which exceed objectives contained within the Basin Plan have been detected during some winter months .

Organic constituents, such as nitrates and phosphates originating from creekside landscaping and home units, may cause stream degradation.

Water diversions are a factor in degrading water quality and lowering water flow in the creek, which reduces vital habitat for aquatic species.

Data Gaps

The San Francisco Bay Regional Water Quality Control Board has identified the following additional information needs for the Corte Madera Creek watershed:

- **determination of the causes of high coliform bacteria in Corte Madera Creek;**
- **identification of all the beneficial uses of Corte Madera Creek;**
- **quantitative impacts of nonpoint source pollutants;**
- **status of fishery stocks, especially salmonids, effects of sedimentation and pollutants on spawning beds, and identification of barriers to migration;**

- **extent of and factors causing erosion;**
- **aggregate amounts of regulated and unregulated water diversions and their effect on seasonal instream flows and groundwater recharge;**
- **effects of runoff from landscaping, road surfaces, and pools on aquatic organisms;**
- **determination of the source(s) of excessive biostimulatory substances.**

The Regional Water Board will attempt, in coordination with local agencies and non-profit groups, to obtain additional data to better understand the current health of the watershed and develop methods to improve the existing conditions, as warranted .

PART TWO: WATERSHED PLANNING, MANAGEMENT, AND COMMUNITY INVOLVEMENT

Management and Regulatory Framework: Agency Jurisdictions and Responsibilities

The primary agencies that are involved or potentially could be involved in Corte Madera watershed protection activities are discussed. The discussion considers only agency functions that are related to watershed protection or enhancement. Agencies have been grouped under four general categories: local, regional, state, and federal.

Local Agencies

Broad general powers were granted to cities and counties by the Legislature through the State of California's Planning and Zoning Law. Cities and counties guide the physical development of their land resources through their General Plans and carry out the policies of these plans through their land use regulations, principally zoning.

Special districts are formed to provide some types of community services by taxing or charging fees to the landowners within the boundary of the district. In Marin County and its cities, these services include water supply, sewage treatment, flood control, and maintenance of open space lands .

Cities

Most watershed-related issues for the cities of Corte Madera, San Anselmo, Fairfax, Ross, and Larkspur are handled by the departments of public works and by planning departments. Many of their functions are similar to those described in more detail below for the Marin County departments. The individual cities carry out various creek maintenance activities, including litter and debris removal, in cooperation with volunteer groups. Cleaning of catch basins and storm drains is generally the responsibility of the cities; silt dredging and creek inspections are variously done by the cities or the County Flood Control District. Most cities respond to citizen complaints and do creek inspections as needed. City planning departments may condition use, subdivision, and other permits to protect water quality. Most of the cities have or plan to adopt ordinances that provide for creek setbacks and restriction of development on steep slopes.

Marin County

Marin County's jurisdiction includes all areas of the county not incorporated into a city or town. Departments that deal with watershed-related issues include the Department of Public Works, the Planning Department, the Marin County Department of Environmental Health, and the County Office of Waste Management. The major special districts within the county that deal with watershed-related issues relevant to Corte

Madera Creek include the Marin County Flood Control District, Marin Municipal Water District, the Marin County Open Space District, and the Central Marin Sanitation Agency.

Department of Public Works

The Public Works Department issues grading and building permits, does building inspections, and maintains streets and storm drains in unincorporated areas. The Flood Control District is administered by the Public Works Department and carries out flood control maintenance activities in the Ross Valley zone. The County currently has two fulltime positions devoted to maintaining environmental quality in and along creeks through periodic inspections of all Marin County creeks, noting violations and arranging for cleaning, erosion control, and other maintenance.

Planning Department

The Planning Department develops the Marin Countywide General Plan, evaluates applications for general plan and zoning amendments, reviews development proposals, and issues use permits for residential, commercial, and industrial projects. The Department includes the divisions of Advanced Planning and Current Planning, as well as a Code Enforcement team and an Environmental Coordinator. They are responsible for setting countywide policy on creek setbacks, riparian protection, and conservation zoning through the General Plan. The new Draft Marin Countywide General Plan includes streamside conservation areas extending 100 feet from the banks in rural areas and 50 feet in urban areas; however, these proposed conditions do not apply to existing developments. The Planning Department also prepares environmental assessments required by the California Environmental Quality Act (CEQA). The Planning Division may include conditions in use permits, subdivision maps, and projects requiring CEQA review to protect water quality, including restrictions on stormwater discharge into creeks or wetlands. County jurisdiction in the Corte Madera watershed includes areas of the Greenbrae tidelands, Kentfield, and the upper reaches of the creek tributaries beyond the towns of Fairfax and San Anselmo.

Department of Environmental Health

This department enforces state and local laws related to environmental health and sanitation. Environmental Health inspects water supply systems and waste disposal systems and permits and inspects septic systems through a Memorandum of Understanding with the Regional Water Quality Control Board. The Department responds to reports of spills and illicit discharges to storm drains or creeks, including swimming pool discharges. Environmental Health has also conducted some water sampling in Corte Madera Creek in the past.

Office of Waste Management

This office is responsible for the hazardous materials program countywide. It has developed a household hazardous waste program and curbside collection programs. It also works with the Regional Board in underground storage tank regulation and fuel leaks. A countywide hazardous materials team, comprised primarily of members of the San Rafael Fire Department, was established under a joint-powers authority. This team responds to hazardous materials spills.

Marin County Open Space District

The Marin County Open Space District was approved by the voters in 1972 as a separate, tax-supported agency to acquire and manage open space in the county. Land management responsibilities include erosion control, road grading, drainage and creek maintenance. The District is currently working on a streambank stabilization and erosion control project in Cascade Canyon along San Anselmo Creek, one of the upper tributaries of Corte Madera Creek. The Open Space District currently manages over 10,000 acres in the county, including Cascade Canyon and the Loma Alta Open Space Preserve in the upper reaches of Fairfax Creek.

Marin Municipal Water District (MMWD)

The water district provides drinking water to southern Marin, including all of the areas within the Corte Madera Creek watershed. The upper reaches of Cascade, San Anselmo, and Ross Creeks are within district watershed lands . There are occasional releases of water from Phoenix Lake into Ross Creek to allow for district maintenance activities in the reservoir, as well as overflows from the dam in winter. MMWD also discharges wash water from its Pine Mountain tunnel (a former potable water conveyance tunnel currently used for water storage) into Cascade Creek when the tunnel is cleaned out (currently once every few years, but projected to be yearly due to new Department of Health regulations).

Central Marin Sanitation Agency (CMSA)

CMSA is the agency that treats sewage for the areas included within the Corte Madera watershed. Within the Corte Madera Creek watershed, CMSA's member agencies include the Ross Valley Sanitary District and Corte Madera Sanitary District #2. The member agencies are responsible for the sewage collection systems and pump stations within their jurisdictions; CMSA is responsible for industry inspections and does monitoring for member agencies as needed. CMSA is also implementing a pollution prevention program that will be targeting automotive facilities.

Marin County Baseline Urban Runoff Control Program

Under provisions of the Clean Water Act (see below) the Regional Board has amended its Basin Plan to include requirements for baseline urban runoff control programs that

apply to the four northern Bay Area counties: Marin, Sonoma, Napa, and Solano. (Comprehensive stormwater control programs requiring NPDES permits are in place for the counties of Santa Clara, Alameda, Contra Costa, and San Mateo.) The Baseline Programs require cities and counties to look at a number of elements, including legal authorities, maintenance activities, new development controls, prevention of illicit discharges, and public education. Marin County and its cities have joined together to form the Marin Baseline Urban Runoff Control Program. The Program put together a report assessing the status of all activities related to urban runoff control, including existing activities in creek maintenance and storm drain maintenance. The Program has also completed a two-year action plan that addresses the requirements for preventing increases in storm water pollution. The plan includes a proposal to develop a comprehensive system for tracking Marin County creek conditions; coordinating with agencies, naturalists, and volunteer groups to define a workable approach to habitat identification and documentation; and developing recommendations to implement comprehensive watershed planning efforts.

Regional Agency

Association of Bay Area Governments (ABAG)

ABAG is a council of governments which includes Alameda, Contra Costa, Solano, Sonoma, Marin, San Francisco, San Mateo, Napa, and Santa Clara counties. It is a regional planning body charged with preparing advisory Bay Area regional land use plans. It has no direct control over local land-use decisions, but serves as an advisory policy-making body. ABAG has produced the Manual of Standards for Erosion and Sediment Control Measures, which is used as a standard by most Bay Area municipalities and counties in issuing grading and building permits.

State Agencies

State Water Resources Control Board

The State Water Resources Control (State Board) has authority pursuant to the California Water Code (Porter-Cologne Act) and the Clean Water Act to protect water quality and to issue water rights permits in the state. The State Board oversees the nine Regional Water Quality Control Boards (RWQCBs), including the San Francisco Bay RWQCB, and handles appeals of all regional board decisions.

The State Board, Division of Water Rights, permits or licenses all water allocations statewide. California water rights are of two types: riparian and appropriative.
Riparian rights usually come with owning a parcel of land adjacent to a source of water and entitle the landowner to use the water flowing past his or her property. Such rights require no permits, licenses, or government approval, unless the rights holder wishes to store water from one season to the next. Appropriative rights originated during the California gold rush, when surface water was first transported far from the original

source to work mining claims. The Water Commission Act of 1914 established a permit process for appropriative rights that is now administered by the Division of Water Rights. All use of water must be "reasonable and beneficial." Such uses commonly include municipal and industrial uses, irrigation, livestock watering, and more recently, recreational use, fish and wildlife protection, enhancement, and aesthetic enjoyment.

Landowners are required to file a Riparian Statement of Water Diversion and Use (for a riparian claim) or an Appropriative Water Right Permit (for appropriative use) before they start constructing diversion works or diverting any water. Applications are processed much more rapidly if the landowner obtains clearance and approval from the Department of Fish and Game before applying and the approval is attached to the application (R. Swenerton, State Board Division of Water Rights, pers. comm.).

This "reasonable use" provision also applies to groundwater, but no permits are required for groundwater pumping unless the water underflows a surface stream or flows in a subterranean stream with a known and definite channel. Groundwater may be appropriated, although appropriator's rights are subordinate to those with overlying rights, and no permit process has been established in San Francisco Bay area counties.

Regional Water Quality Control Boards

The San Francisco Bay Regional Water Quality Control Board (Regional Board) administers a water quality regulatory program to protect surface and groundwaters in the San Francisco Bay drainage basin. The Regional Board's authority is based on federal law (the Clean Water Act) and state authority (the Porter-Cologne Water Quality Control Act). Because of their importance to watershed planning and protection, the relevant provisions of these acts are summarized briefly below.

Clean Water Act (CWA): The CWA is the central law in the federal water pollution control program, administered by the Environmental Protection Agency (EPA) (see below). The CWA divides pollution sources into two types: point and nonpoint. Its main thrust is on controlling point source discharges, but urban runoff, formerly considered a nonpoint source, is increasingly being treated as a point source of
pollution . Under the CWA, point source discharge of pollutants to the nation's navigable waters is prohibited unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained. The State and Regional Boards implement this program with oversight from the EPA. The CWA also requires states to include control strategies for nonpoint pollution in their regional management plans (i.e., the San Francisco Bay Basin Water Quality Control Plan). All municipalities must comply with new stormwater runoff control programs for highways, industrial activity, and construction activities. The CWA also requires special permitting for discharging other pollutants into water, such as dredged and fill materials (see below: U.S. Army Corps of Engineers and Environmental Protection Agency).

Porter-Cologne Water Quality Control Act: This act is the major California law governing water pollution. Its water quality goals, policies, and implementation

programs are far more comprehensive than required by the CWA and include jurisdiction over groundwater as well as surface waters. The Porter-Cologne Act is administered by the Regional Board, which conducts water quality planning, permitting, and enforcement activities under State Board guidelines and oversight. The Act authorizes the Regional Board to prohibit or prescribe requirements for the discharge of any waste, whether point or nonpoint, to state waters (both ground and surface waters). The Regional Board may use its discretion to waive discharge requirements if the discharge is effectively controlled at the local level (such as septic system discharges, etc.).

Water Quality Certification: Section 401 of the Clean Water Act gives states the authority to deny or condition all projects involving fill or dredging of wetlands (including riparian) that require permits from the U.S. Army Corps of Engineers. This means in effect that the Regional Board must approve most projects that involve creek bank stabilization, placing of pilings or structures in creeks, or any activities that impact freshwater or tidal wetland areas.

California Department of Fish and Game

The California Department of Fish and Game (CDFG) is authorized by the U.S. Fish and Wildlife Coordination Act, the California Environmental Quality Act (CEQA), and the State Subdivision Map Act to advise local, state, and federal regulatory agencies on the state's viewpoint on fish and wildlife resources. CDFG also carries out provisions of the California Fish and Game Code. All projects that involve diversion or obstruction of the natural flow of a stream or change of its bed, channel, or bank must be reviewed and approved by the Department of Fish and Game. A project will not receive a stream alteration permit if it adversely affects fish and wildlife (Fish and Game Code Sections 1601, 1603). However, streambed alteration projects are generally granted because project sponsors often modify the proposed work to meet the CDFG's concerns. The Fish and Game Code also prohibits the discharge of "any substance or material deleterious to fish, plant life, or bird life" to waters of the State (Section 5650).

The CDFG also reviews local, state, and federal land use proposals, including CEQA documents, as well as water rights applications. They regularly protest appropriative water rights applications on the river and tributaries so that conditions that address adequate bypass flows, fish and wildlife mitigation measures, and soil erosion control measures are included in the water rights permit.

Department of Pesticide Regulation

The Department of Pesticide Regulation implements the state programs for pesticide registration and regulation including a comprehensive regulatory program to address pesticide contamination of groundwater. A key component of this program is the Groundwater Protection List, which specifies pesticides with the potential to pollute groundwater and describes regulations for each material. The Program also designates

Pesticide Management Zones, or areas vulnerable to groundwater pollution, and prescribes chemical uses under various circumstances .

State Lands Commission

The State Lands Commission (SLC) has authority to approve or deny development in tidal and submerged lands and unfilled lands that were formerly tidal and filled. SLC reviews project plans to determine whether there is a state sovereign interest in the project site. If so, any development within the areas of the state's interest must be approved by the SLC.

San Francisco Bay Conservation and Development Commission (BCDC)

The objectives of BCDC are to prevent unnecessary filling of the Bay, to provide water-oriented shoreline development, and to assure maximum public access to the Bay. BCDC has permitting authority over all projects on lands within the first 100 feet inland from the Bay and along certain creeks, including Corte Madera Creek up to the concrete channel built by the U.S. Army Corps of Engineers.

Federal Agencies

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) regulates activities in waters of the United States under the federal Rivers and Harbor Act and the Clean Water Act (CWA). Under Section 10 of the Rivers and Harbor Act, the Corps must issue permits for any work in tidal wetlands and all unfilled areas behind dikes that are below historic mean high water. Under Section 404 of the CWA, the Corps also issues permits for discharges of dredged or fill material into waters of the United States below the high tide line in tidal waters and below the ordinary high water mark in nontidal waters. Its jurisdiction includes wetlands adjacent to waters of the United States and isolated wetlands that have interstate commerce connections. The Corps shares its CWA Section 404 authority with the Environmental Protection Agency (see below).

The Corps also designs and implements flood control projects authorized by the Flood Control Act of 1965, such as the Corte Madera Fl9od Control Channel.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) administers the CWA, much of which is described above (under Regional Water Quality Control Board). It jointly implements the CWA Section 404 with the Corps of Engineers. Under the EPA 404 (b)(1) Guidelines, the Corps cannot issue a Section 404 permit if: 1) the proposed filling is the not the least-damaging practicable alternative (i.e., a feasible upland alternative is available); 2) federally listed rare. or endangered species would be jeopardized; 3) all

state water quality standards would not be complied with; 4) the project would significantly degrade the aquatic environment; or 5) adequate mitigation for unavoidable impacts has not been provided. The EPA reviews Corps permit applications to determine compliance with the Guidelines and has final authority over permit issuance. EPA can also make jurisdictional determinations and enforce Section 404 violations.

The EPA regulates pesticides through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), implements the federal pesticide registration process, and classifies pesticides as restricted or nonrestricted for national use. The EPA has a number of non-regulatory programs that are involved in watershed planning, including the Groundwater Protection Section and the Wetlands and Coastal Planning Sections. The Corte Madera Creek watershed project is being done under a grant from EPA.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) administers the Endangered Species Act and influences decisions on fish and wildlife habitat through its role as a commenting agency on federal and state permit applications. The FWS must be consulted on federally permitted projects involving modification of any body of water in the U.S., as required by the Fish and Wildlife Coordination Act. Listings of endangered, threatened, and proposed candidate species for a given area can be obtained upon request from the FWS.

Any damage to a federally listed endangered species, such as the salt marsh harvest mouse or the California clapper rail, within the watershed from any source is considered a species "take" under the Endangered Species Act. Estimated "take" includes not only the animals actually removed from the habitat, but also the number of animals destroyed or lost. The FWS should be notified of any activity planned in stream channels that contain the California freshwater shrimp (*Syncaris pacifica*), or in any areas that may directly affect those streams. The same considerations apply to the marsh habitats of the clapper rail and salt marsh harvest mouse.

U.S. Department of Agriculture Soil Conservation Service

The U.S. Department of Agriculture Soil Conservation Service's (SCS) mission covers three major areas: soil and water conservation, natural resource surveys, and community resource protection and management. SCS provides both technical and financial assistance primarily on non-federal land to landowners and agencies.

Because the SCS is not a regulatory agency, its role depends on the interest and cooperation of landowners. Possible assistance that the Marin SCS can provide includes evaluating the streambank, assessing erosion and bank protection designs, and conducting demonstration projects on appropriate land management practices and gully erosion control.

Funding Programs For Watershed Protection and Enhancement

The list of programs below includes sources that could potentially be utilized to fund various activities or programs to improve or protect the Corte Madera Creek watershed resources. Some of the funding agencies have not been previously discussed because their primary·relation to Corte Madera Creek is within the framework of funding watershed or water quality protection activities rather than direct jurisdiction over activities within the watershed. The sources listed below include government agencies, non-profit groups, and private foundations. Funding activities range from overall watershed planning projects to various types of hands-on enhancement or restoration activities.

Agency Funding Sources

Federal Funding

Conservation Reserve Program

Dual cost sharing for creating or improving permanent wildlife habitat, shallow water areas for wildlife, vegetative filter strips, or any other practice that benefits fish and wildlife. Cooperators can be paid up to $3,500 or 50 percent of the cost of these practices per year. U.S. Fish and Wildlife Service can also provide up to half the cost of the practices through its Partners for Wildlife program (see below), which may result in little or no cash outlay for cooperators and can provide additional cost shares to cooperators who have reached their Department of Agriculture, Soil Conservation Service $3,500 annual limit. The landowner match for the cost share can be provided in labor, materials, or cash.

Contact: U.S. Department of Agriculture, Soil Conservation Service, Santa Rosa (707) 794-1242

Partners for Wildlife

Provides funds for habitat restoration for wetlands and riparian areas. The main focus of the program is on projects for private landowners, but works with local agencies that have a long-term watershed plan. Cost share up to 50 percent.

Contact: Debra Schlafmann, U.S. Fish and Wildlife Service, Sacramento, (916)978-4420

Clean Water Act Nonpoint (319(h)) Source Grants

The Corte Madera Creek watershed project is currently being funded under this grant. EPA distributes these funds to the State Water Resources Control Board. The State Board must develop a balanced workplan to improve the quality of impaired water bodies by implementing watershed projects and institutionalizing long-term nonpoint

source management programs. To compile this workplan, each Regional Board submits a package of proposed projects to the State Board. The State Board prioritizes projects and submits them to EPA for funding. Grants are awarded for projects that demonstrate new, innovative, or fundamentally different best management practices (BMPs) or other approaches to address nonpoint sources of pollution. At least some projects must be designed to educate individuals on the use and effectiveness of BMPs and technology transfer activities. In 1993 the State Board determined that the highest priority projects would be those that are implementing an existing watershed management plan that has been reviewed by a Regional Water Quality Control Board. Deadline is November 1 for submittal of proposals.

To date, funds under this program have been limited to approximately $1 million annually for the entire state, and matching funds of up to 40 percent may be required.

Contact: Pablo Gutierrez, State Water Board, Nonpoint Source Unit, (916) 657-0793

Clean Water Act 604(b) Funds

The 604(6) State Revolving Loan Funding was established initially as a funding source to replace the Title 2. construction grants for wastewater treatment facilities. The State Board has determined that up to $40 million annually will be available for any project related to nonpoint source pollution reduction. Projects that have been funded recently include municipal stormwater management plans designed to achieve new NPDES permitting requirements (including wetlands systems to reduce stormwater pollution), irrigation district projects to conserve water, and improvements to septic system management. Any California municipality is eligible to receive funding, but individuals are also encouraged to apply for funding for innovative demonstration projects. The interest rate for these loans is half the rate of a State General Obligation Bond. The Regional Board solicits or accepts loan project proposals, which are then submitted to the State Board for prioritization and final approval.

Contact: State Board, Nonpoint Source Unit, Sacramento, (916) 324-5705

State Funding

California Coastal Conservancy Watershed Enhancement Program

The Coastal Conservancy was created to help preserve, restore, and enhance California's coastal resources and to develop creative solutions to difficult land use problems on the coast and around San Francisco Bay. The Conservancy is authorized to acquire land, to restore coastal waterfronts, and to restore wetlands and enhance watersheds. The Conservancy only undertakes creek restoration projects as part of a larger, comprehensive watershed enhancement plan. Funds may be used first to complete an enhancement plan and second to implement actions outlined in the plan, including land acquisition, streambank repair, erosion repair, and restoration. Grants are provided to

local jurisdictions (including special districts) and qualified non-profit groups . The Conservancy has funded several projects in Marin County.

Contact: Reed Holderman, State Coastal Conservancy, Oakland (510) 286-1015

Resources Agency Environmental License Plate Funds

Offers grants to state agencies, local agencies, or private non-profit research organizations to support a variety of projects to help preserve or protect the environment through land acquisition, restoration or enhancement, and development of interpretive facilities. Projects are funded in one-year increments as distinct projects.
Filing date for application is July 15.

Contact: Michele Mercado, Resources Agency, Sacramento, (916) 653-8402

California Department of Water Resources Urban Streams Restoration Program

The Department of Water Resources grants funds for local stream restoration projects. The program aim is to prevent property damage by floods and bank erosion and to restore the natural value of streams. Public agency applicants must be co-sponsored by a private utility or a private citizens group, while private citizen group applicants must be co-sponsored by a local public agency. Grants can fund projects as simple as organizing volunteers to monitor streams, or as complex as completely restoring a stream to its natural state. Funds up to $200,000 may be granted .

Contact: Earle Cummings, DWR Urban Streams Restoration Program, Sacramento, (916) 327-1656

California Department of Water Resources Environmental Water Program

This program was created by the Environmental Water Act of 1988 and has a total of $60 million allocated for enhancement and restoration projects throughout the state. Eligible projects include fisheries, riparian, or wetland habitat restoration and enhancement. Grants must be matched by cash or in-kind services and are for funding actual projects and studies associated with actual projects. Grants are available to all types of public agencies.

Contact: Phil Wendt, Department of Water Resources, Sacramento, (916) 327-1660

California Department of Fish and Game Fishery Restoration Programs

Under various CDFG programs (e.g., the California Wildlife, Coastal and Park Land Conservation Bond Act of 1988, the Cigarette and Tobacco Tax Benefit Fund, the Salmon Stamp Program, and the 1984 Fish and Wildlife Enhancement Bond Act), funds are available for a variety of fish, wildlife, and habitat/waterway restoration projects for species such as salmon, steelhead, and wild trout. The total funds available for these

projects exceeded $4.5 million in 1989. Some funds are available to individuals and some only to public agencies.

Contact: Inland Fisheries Division, CDFG, Sacramento, (916) 653-0861

Department of Forestry and Fire Protection Urban Forestry Grant Program

This program was created by the California Wildlife, Coastal and Park Land Conservation Bond Act of 1988 and allocated $5 million to be used over a five-to-seven year period beginning in 1989. Approximately $633,000 a year is available annually for grants to plant trees along streets, in dedicated open space areas, and in public parking lots and school yards. Funds are available for cities, counties, districts, and non-profit organizations for up to $40,000 for any one project; 90 percent of which must be used for purchasing trees and 10 percent for public awareness and education.

Contact: Rhonda Millwee, California Department of Forestry and Fire Protection, Sacramento, (916) 653-9448

Small Business Administration Tree Planting Program

The California Department of Forestry and Fire Protection is accepting applications from state and local agencies for tree planting funds through a new program sponsored by the U.S. Small Business Administration. Trees can be planted on state or local government-owned land. Trees must be purchased from and planted by small businesses. Cost-sharing for this program is 50 percent.

Contact: Darla Mills, California Department of Forestry and Fire Protection, Sacramento, (916) 653-9509

California Department of Parks and Recreation Land and Water Conservation Fund Program

This program has funds available for acquisition or development of neighborhood, community, or regional parks or outdoor recreation facilities . Applicants may include counties, cities, park and recreation districts, or special park districts . The applicant is expected to fund the entire program and will be reimbursed up to 50 percent of the amount of the project. Application deadline is mid-December.

Contact: Odel King, California Department of Parks and Recreation, Local Assistance Section, Sacramento (916) 653-8758

California Department of Parks and Recreation Habitat Conservation Fund Program

Funds projects for deer and mountain lion habitat; habitat for rare, endangered, threatened, and fully protected species; wildlife corridors and urban trails; wetlands; aquatic habitat for spawning and rearing of anadromous salmon and steelhead; and

riparian habitats. Eligible applicants include counties, cities, and local districts; funds are provided as a 50/50 match, with the matching funds corning from a non-state agency. The program funds up to $2 million in projects annually. Application deadline is March 1.

Contact: Odel King, same phone number as above

Non-Profit Group Funding Sources

Most non-profit organizations are themselves looking for funds to carry out restoration and enhancement projects. However, they can be a good source of volunteer help or act as an umbrella organization to develop a local project. The two organizations listed below are specifically focused on fishery habitat improvements. Other conservation organizations, such as Audubon Society, California Native Plant Society, Sierra Club, Marin Environmental Forum, Marin Conservation League, and a variety of local Marin citizen groups, are valuable resources for information, skilled labor, and community coalition-building.

California Trout

California Trout funds a variety of projects to protect and restore wild trout and native steelhead habitat. These include removal of barriers and installation of fish ladders . It often focuses on large-scale projects at the political level, such as protection of rivers through national legislation, but also works with private non-profit groups, private landowners, etc. It is involved in number of creek restoration projects in the Bay Area.

Contact: California Trout, San Francisco, (415) 392-8887

Trout Unlimited

Trout Unlimited has previously done a great deal of work in the Corte Madera Creek watershed, including monitoring salmonid populations and building fish ladders on Fairfax and Cascade Creeks. It has a large group of skilled volunteers to do creek enhancement work. It does not provide funds directly but looks for grant sources to carry out projects related to improvement of native fish habitat.

Contact: Leo Cronin, Fairfax, (415) 453-5370 or Stan Griffin, Mill Valley, (415)388-1563

Foundations

The foundations listed below have a special interest in funding environmental, educational, or scientific purposes and are included in this section as potential sources for watershed planning or enhancement activities. This list includes only a few of the many California-based foundations that may be available for project funding.

Marin Community Foundation (Buck Fund)

This foundation was not primarily set up to fund environmental projects; however, they have funded Save the Bay projects and other projects related to the environment. Buck Fund money is designated for projects in Marin County only; grants range from $10,000 to $200,000.

Contact: Marin Community Foundation, Larkspur, (415) 461-3333

California Tamarack Foundation

No grants to individuals, on-going funding or debt financing. Prefers to support specific projects only. Grant range: $2,500-$5,000.

Contact: California Tamarack Foundation, Larkspur, (415) 461-3944

Wallace Alexander Gerbode Foundation

Grant range: $500 - $75,000. Does not support direct services, building or equipment funds, general fundraising campaigns, religious purposes, publications, scholarships, or grants to individuals.

Contact: Gerbode Foundation, San Francisco, (415) 391-0911

Foundation Center Library

This is a national service organization providing information on philanthropic giving. It has a number of databases accessible on-line through Dialog. Includes California foundations only.

Contact: Foundation Center, 312 Sutter Street, San Francisco, 94108, (415)397-0902 (general information), 1-800-424-9896 (library)

Suggested Future Watershed Planning Actions

The Regional Board recommends that all interested parties, agencies, and organizations in the watershed collectively agree to form a Task Force to determine: 1) watershed protection goals and objectives; 2) specific measures or tasks needed to accomplish these goals and objectives; 3) prioritization of the identified objectives and tasks; and 4) monitoring and follow-up activities to determine success. A number of interconnected work groups might then be established. These groups might consist of municipal and resource agency personnel, landowners, local schools, and citizens' groups representatives. Membership within each subgroup is not meant to be exclusive, but each subgroup may have a somewhat different focus. For instance, a citizens' group may function more in an advisory capacity to the other task forces and pursue projects more suited to citizen involvement.

A series of general meetings will be needed in order to discuss comments, suggestions, and changes to this report and to establish goals and objectives for the watershed. Final consensus on the content of this report and the development of a watershed management plan will then be needed. Suggestions for discussion topics are outlined below. These suggestions are largely based on input received through personal interviews during the preparation of this report.

Government Agency Topics

1. Establishment of a lead local agency to head the Interagency Task Force and Watershed Management Planning Process. The Regional Board believes that a lead coordinating agency is essential to ultimately producing effective solutions to watershed problems.

2. Establishment of more effective interagency communication and coordination on **watershed issues.** Certainly not all communication problems can be resolved through this process, but perhaps critical problem areas related to watershed management could be addressed through one or several of the following options: 1) establishing a regular forum where issues would be discussed; 2) designating a lead agency to serve as a clearinghouse for certain agency actions; and 3) signing interagency cooperative agreements on the treatment of specific communication issues.

3. Formulation of a consistent means of complying with new stormwater regulations and requirements among county municipalities. The Regional Board recently met with Marin County municipalities to introduce new Regional Board requirements and Clean Water Act regulations related to controlling stormwater runoff and other nonpoint sources of pollution. The need to modify existing regulatory and planning tools to carry out these provisions should be assessed. Agencies should also discuss how they can work together to consistently comply with these requirements, including the initiation of a public education program on preventing stormwater pollution (see Citizens' Group Topics below).

4. Discussion of habitat protection and restoration goals. Because of their importance to watershed protection, the protection of valuable riparian and wetlands areas and the restoration of degraded tributary and wetlands areas might be considered.

5. Directing public monies. Given that funds available for watershed management activities will always be somewhat limited, it is important that all public dollars be spent in an effective manner in order to best meet the goals of watershed management.

Landowner Topics

1. **Establishment of Land Stewardship Groups in Sub-Watersheds**. Land stewardship groups can include landowners and citizens who reside within a watershed or sub- watershed. These groups voluntarily agree to implement practices to protect the resources of their local watershed. The Regional Board believes that widespread land

stewardship planning in the basin could greatly help to control nonpoint source pollution from landowner practices. The Task Force might first prioritize sub- watersheds to be targeted for stewardship. It could also decide how to better publicize the stewardship concept, as well as the many cost-sharing programs that can support environmentally sound management practices.

2. **Development of a means for collectively managing surface water and groundwater resources.** Given that the majority of surface and groundwater in the Corte Madera watershed is used by landowners for domestic purposes, it can be in the best interest of those users to evaluate how best to manage the resource in a sustainable manner. Issues such as water diversions only at high flow times and groundwater usage when the water tables are high could be coordinated among users.

Citizens' Groups Topics

1. **Urban Stream Restoration.** Many local communities and non-profit groups throughout the San Francisco Bay Area have worked with resource agencies to successfully restore their urban streams. Many long-time residents of the Corte Madera watershed have taken an interest in stream protection and restoration. Members of Trout Unlimited, under the guidance of Leo Cronin, have monitored the salmonid resources in the watershed and assisted the Department of Fish and Game with restoration efforts, including the installation of a Denali fish ladder for fisheries migration.

2. **Education and Enhancing Public Awareness**. This may be the single most important resource that the Corte Madera watershed possesses. With over five schools located along Corte Madera Creek and its tributaries, ranging from colleges to elementary schools, the ability to develop long-term habitat assessment data is promising. Many of the local schools currently perform biological studies on the Creek and, on more than one occasional, their data have been cited by resource agencies in preparing biological assessment documents.

Also, public education and participation in watershed protection and management activities are essential if long-term improvements are to be made. A multi-disciplinary resource conservation curriculum could be implemented in local school districts. A number of pilot education programs, such as the Department of Fish and Game's Project Wild, have been initiated throughout the state in-the last few years. Additionally, the San Francisco Estuary Project has materials that can be used to stencil storm drains with symbols to indicate that oil or other pollutants should not be dumped into the drains. Stenciling will require a large volunteer effort and would be a good start at educating the community on nonpoint pollution issues .

3. **Increasing Citizen Involvement.** Government agencies and citizens' groups should work together to discover innovative ways to increase the involvement of citizens in monitoring and protection of the watershed and participation in policy and planning decisions.

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