

6.1 LAKE MERCED

GENERAL DESCRIPTION AND LOCATION

Lake Merced is located in the southwest portion of the City (Figure 1-1) and is bounded by John Muir Drive, Skyline Boulevard, and Lake Merced Boulevard. It is the largest freshwater lake in the City and supports numerous recreational activities, including boating, fishing, golfing, jogging, bicycling, skeet shooting, picnicking, and appreciation of the natural environment. Lake Merced is comprised of four lakes: North, East, South, and Impound (Figure 6.1-1). North and East Lakes are connected directly to each other by a narrow channel below a wooden footbridge south of Sunset Circle. Developed facilities include Harding Park Golf Course, a San Francisco Public Utilities Commission (SFPUC) pump station, the Pacific Rod and Gun Club, the San Francisco Police Department firing range, and several fishing piers. A designated Dog Play Area (DPA) exists on the north side of East Lake in an area informally known as “the Mesa”. The Natural Areas at Lake Merced comprise 395 of the total 614 acres (including the water acreage) and generally encompass the lake, the bordering wetland and upslope vegetation (Figure 6.1-1).

Lake Merced contains the largest expanse of wetland habitat in San Francisco and supports an array of sensitive plant and animal species. In addition, because the lake is the largest freshwater coastal lake and wetland system between the Point Reyes Peninsula in northern Marin County and Pescadero Marsh in southern San Mateo County, it provides valuable refuge for thousands of migratory birds. This combination of extensive native habitat with high wildlife functioning and the presence of numerous rare species make Lake Merced an important ecological resource.

Because Lake Merced is unique among the Natural Areas and subject to such high levels of public use, it is correspondingly an area that has high natural resource and recreational values that include: outstanding lake views; interpretive signs; numerous water-related recreational opportunities including fishing, rowing, and sailing; a popular perimeter trail providing recreational opportunities such as walking, running, biking, and rollerblading; the largest expanse of wetland habitat in the City; important habitat for native plants and populations of sensitive plant and animal species; significant great blue heron (*Ardea herodias*) and double-crested cormorant (*Phalacrocorax auritus*) nesting colonies; significant nesting area for approximately 50 species of resident birds; one of the last populations of western pond turtle (*Clemmys marmorata*) in the City; and important refuge for migratory birds.

Lake Merced is owned by the SFPUC, which is responsible for the lake’s water resources. The San Francisco Recreation and Park Department (SFRPD), under a memorandum of understanding with the SFPUC, manages the recreational and natural resources. Previous studies and reports prepared by the SFRPD, SFPUC, and others were reviewed and incorporated into this plan. Currently there are several studies under way at Lake Merced, including a fish community study and trail plan funded by a grant from the California Coastal Conservancy. The fish community study will provide

recommendations about how to maintain an environmentally sustainable recreational fishery. The trail plan will evaluate the current condition of trails and make recommendations on access improvements. Also, the SFPUC is studying and monitoring the effects of lake level rise, the potential for stormwater diversion via the Vista Grande Canal, and other water- and aquifer-related projects.¹ They are referenced as appropriate in the text that follows.

GEOLOGY, HYDROLOGY, AND TRAILS

Lake Merced formed as a dune lake² and was periodically connected to the Pacific Ocean until a sand bar formed a barrier between the lake and the ocean. The combination of high storm waves and high lake water levels in winter lead to breaching of the sand bar. The sand bar also was breached by an 1852 earthquake. From the 1880s onward, the lake was permanently separated from the ocean (CDM 1998). At approximately the same time (late 1800s), berms were constructed that divided Lake Merced into North and South Lakes. A culvert was installed under the road separating these two water bodies, allowing for the control of water flow between North and South Lakes. North Lake was further divided into North and East Lakes, with a narrow connecting channel. Impound Lake, at the southern end of Lake Merced, was separated from South Lake in the 1950s with the construction of a berm and causeway (CDM 1998). Flow can occur between South and Impound Lakes when water levels are high enough to rise above the berm on which the viaduct causeway was built.

Soils at Lake Merced are mainly composed of cut and fill materials (e.g., the golf course) and Sirdrak sands on 5 to 50 percent slopes (USDA 1991). Surface soils have been altered, removed or covered in the urban areas surrounding Lake Merced, primarily on upland terrace surfaces, and are classified as Urban Land Orthents and Sirdraks (Figure 6.1-2). On the relatively steep side slopes along the lakeshore, little direct modification of the soils has occurred. Exceptions are some compaction along foot trails and the placement of fill material, particularly near the Mesa (a relatively flat area on the north side of East Lake), as part of the construction of Lake Merced Boulevard in the late 1940s (Westfall 1999). Soils on the northern and eastern terrace areas of the park are underlain by bedrock in comparison with the deep sand dune areas to the south and west. However, all of the local soils at Lake Merced have similar sand-textured geologic parent materials, and are susceptible to water and wind erosion when unvegetated (CDM 1998).

The sandy soils comprising the shoreline around Lake Merced are prone to erosional processes. The main erosional features at Lake Merced include: (1) erosion on the cliff face and steep hillside below the Sunset Circle parking lot drain pipe and adjacent to the sidewalk and fence at the northeast corner of the golf course; (2) severe gullies and slope erosion around Impound Lake and causeway, especially at the west end of the causeway, the southeast end of Impound Lake and the west side of Impound Lake; (3) severe erosion on the southwest side of South Lake

¹ San Francisco's Stormwater Management Plan describes stormwater discharge to Lake Merced and programs for treating the runoff before it reaches the lake (SFPUC 2004).

² As defined in Bates and Jackson (1980), a dune lake is a body of water occupying a basin that is formed when sand dunes migrating along the shore block the mouth of a stream.

associated with the overflow of the Vista Grande Canal in 2002 and 2004; and (4) numerous soil erosional features associated with informal trail use around the lake.

Water levels at Lake Merced have fluctuated through time. The SFPUC has concluded that recent lake level declines are a result of alterations to the Lake Merced Watershed such that less water flows to the lake. Historic lake levels recorded between 1935 and 2004 have fluctuated between 21 and 37 feet above mean sea level (msl). Although lake levels have seasonally reached elevations of more than 28 feet above msl in 1998, 1999, 2000, and briefly in 2001, the lake reached a historical minimum of 21 feet above msl. The decline in lake levels raised concerns about the recreational uses of the lake (fishing, boating, etc.), as well as the continued support of vegetation and wildlife communities at Lake Merced that depend on a reliable water supply. Beginning in October 2002, the SFPUC began adding water to Lake Merced. Lake levels have since increased by 3 feet. Water additions currently are on hold pending evaluations of toxic lead shot and associated chemicals in the lake (SFPUC 2005). An interim lake level plan has been prepared that will guide lake levels until 2007. Under this interim plan, lake levels will be maintained between 3 and 5 feet (City datum). During this time, the SFPUC will monitor water quality, wildlife, vegetation, and groundwater.

There is an extensive network of trails at Lake Merced (Figure 6.1-2). Of the different types of trails (paved, primary, secondary, bridges and boardwalks, and roads) the largest category is paved and primary trails, which total over 5,100 linear feet. This includes the only fishing pier within the Natural Areas. When all the other categories are included, existing trails total over 11,100 linear feet at Lake Merced, including approximately 3,300 feet of social trails.

VEGETATION

Vegetation within the Natural Areas at Lake Merced is classified into 44 series (Table 6.1-1). The Natural Areas of Lake Merced include approximately 396 acres, 245 acres (62 percent) of which are open water and 148 acres (38 percent) are vegetated (Figures 6.1-3 to 6.1-7). The vegetation series at Lake Merced are classified as forests (29 percent) and wetlands (29 percent), scrub (26 percent), grassland and other herbaceous (13 percent), and mosaic series (3 percent). Significantly, approximately 58 percent of this vegetation is dominated by native species, comprising 21 vegetation series. Most (76 percent) of this native-dominated vegetation is bulrush marsh and willow scrub, two of the most important habitats for wildlife.

Forest

Of the nine forest series mapped at Lake Merced, only coast live oak (*Quercus agrifolia*) forest is native. One small patch of coast live oak forest occurs just below the southeast end of the Sunset Circle parking area. The remaining forest series are dominated by invasive species including blue gum eucalyptus (*Eucalyptus globulus*), Monterey cypress (*Cupressus macrocarpa*), Monterey pine (*Pinus radiata*), acacia (*Acacia* spp.), blackwood acacia, (*Acacia melanoxydon*), plume acacia (*Albizia lophantha*), and lollypop tree (*Myoporum laetum*). Pine and

cypress predominate around the golf course while eucalyptus predominates along the west shore of South Lake and the north and west shore of North Lake. Many of these invasive forest stands, especially the eucalyptus stands, harbor extensive understories of invasive Cape ivy (*Delairea odorata*) and English ivy (*Hedera helix*). Significantly, the eucalyptus trees on the west shore of North and South Lakes provide nesting habitat for great blue herons and double-crested cormorants (Figure 6.1-8).

Scrub

Eleven scrub series have been mapped at Lake Merced. The most abundant is willow scrub (27.96 acres), which occurs in scattered patches around all lake margins. Some of the largest stands are found on the north and east shore of East Lake, the east shore of South Lake, and throughout Impound Lake. The willow scrub on the south side of the Impound Lake Causeway contains a sizable stand of shining willow (*Salix lucida*), while a stand on the north shore of North Lake contains California wax myrtle (*Myrica californica*). These two species are limited in their distribution in San Francisco and therefore, deserve management attention. Within the willow scrub, native plants account for 23 of the 39 plant species observed and cover approximately 82 percent of the area. Seven of the scrub series are variations of northern Franciscan coastal scrub (Holland 1986). High-quality examples of these scrub series predominate along the shoreline of the Mesa, the south shore of East Lake, and on the east side of South Lake (Figures 6.1-4 and 6.1-7). A small patch of canyon live oak scrub (0.11 acres) occurs on the south shore of East Lake. Two of the 11 scrub series are dominated by invasive species: French broom (*Genista monspessulana*) (0.77 acres) occurs at the east end of East Lake along Lake Merced Boulevard, and Himalayan blackberry (*Rubus discolor*) (0.06 acres) occurs at the Pacific Rod and Gun Club.

Grassland, Herbaceous and Other

Four grassland series were mapped at Lake Merced. The native perennial, purple needlegrass (*Nassella pulchra*) (0.46 acres) occurs on the southwest side of Sunset Circle and is the result of ongoing restoration efforts by SFRPD. This is the only area of native grassland at Lake Merced. The remaining grassland areas are dominated by the invasive annuals ripgut brome (*Bromus diandrus*) (5.77 acres) and slender wild oat (*Avena barbata*) (0.78 acres). Four herbaceous series also were mapped at Lake Merced. The invasive iceplant herbaceous series accounted for almost 59 percent of the total 12.36 acres of herbaceous vegetation. Bare ground and developed areas at Lake Merced totaled 1.61 acres, or less than 1 percent of the total Natural Area.

Wetland

Five wetland series, all dominated by native species, were mapped at Lake Merced. All of these series are significant natural resources and deserve management attention. The bulrush series, dominated by California bulrush (*Scirpus californicus*) (34.89 acres), is the most abundant, bordering almost all of the open water at Lake Merced. Within the bulrush areas native plants

account for only nine of the 16 species observed, but cover 75 percent of the area. The width of this bulrush band has been reported to vary over time with no obvious correlation to lake level. Generally, the increased width is on the upland side, rather than on the lake side (CDM 1998). The broadest expanses of bulrush are found in the northwest and southeast areas of South Lake. Substantial areas also are dominated by swamp knotweed (*Polygonum amphibium* var. *emersum*) (6.93 acres), particularly at Impound Lake, which likely reflects the more gradual shoreline slope. Smaller areas are dominated by giant vetch (*Vicia gigantea*) (1.12 acres), rushes (*Juncus lesueurii*) (0.71 acres), and cattail (*Typha latifolia*, *Typha angustifolia*) (0.03 acres). Lake Merced is the only Natural Area in the City that contains giant vetch and swamp knotweed.

Sensitive Plant Species

Eleven sensitive plant species presently occur at Lake Merced (Table 6.1-2). Among these are San Francisco wallflower (*Erysimum franciscanum*), canyon live oak (*Quercus chrysolepis*), San Francisco spineflower (*Chorizanthe cuspidata* var. *cuspidata*), and California pipe vine (*Aristolochia californica*), Vancouver's ryegrass (*Leymus xvancouverensis*), dune gilia (*Gilia capitata* ssp. *chamissonis*), dune tansy (*Tanacetum camphoratum*), coastal black gooseberry (*Ribes divaricatum*), wild cucumber (*Marah oreganus*), and beach paintbrush (*Castilleja wightii*) (Figure 6.1-8). Several small populations of San Francisco wallflower occur on the steep east shore of South Lake in areas dominated by iceplant (*Carpobrotus edulis*). Wallflower also has been reintroduced at the Mesa and the northeast corner of the Impound Lake as part of the Natural Areas Program's restoration efforts. One small stand of canyon live oak occurs on the steep south shore of East Lake. This is only the second known location of canyon live oak in San Francisco, and the only one within a Natural Area. San Francisco spineflower was recently discovered during restoration activities near Impound Lake. Iceplant removal activities, which disturbed the soils and increased light on the soil surface, appear to have triggered germination of the native spineflower seed bank. This species was last reported from Lake Merced in 1956 (Wood 1996). California pipe vine occurs on the northwest side of the Mesa within California blackberry scrub. Two small populations of Vancouver's ryegrass can be found on the southwestern slopes of the Mesa above East Lake. Two small stands of thimbleberry (*Rubus parviflorus*) can be found on the southern shore of East Lake between the Harding Park Golf Course and the lake. A very small population of dune gilia can be found within the restoration area in the northern corner of the Impound Lake basin. Dune Tansy can be found growing within the grasslands of the Mesa and with dune gilia in the north corner of Impound Lake. Coastal black gooseberry was planted by the Natural Areas Program on the southeast side of Impound Lake. Wild cucumber occurs on the north side of East Lake, paintbrush occurs at the east side of South Lake with San Francisco wallflower and has been planted at the Mesa and the north side of East Lake. Western goldenrod (*Euthamia occidentalis*) was observed in 1999 on the north slopes of South Lake, but has not been observed recently. Other species reported by Howell et al. (1958) include California croton (*Croton californicus*), Curly-leaved monardella (*Monardella undulata*), and San Francisco champion (*Silene verecunda* ssp. *verecunda*) from Lake Merced; however none of these have been recently observed and are assumed extirpated.

Invasive Plant Species

Numerous invasive plant species occur at Lake Merced. High-priority pest plants include eucalyptus, iceplant, poison hemlock (*Conium maculatum*), pampas grass (*Cortaderia seloana*), Cape ivy, ehrharta grass (*Ehrharta erecta*), sweet fennel (*Foeniculum vulgare*), French broom, English ivy, Bermuda buttercup (*Oxalis pes-caprae*), wild radish (*Raphanus sativus*), Himalayan blackberry, and sheep sorrel (*Rumex acetosella*) (Section 4). Of these, eucalyptus, Cape ivy, English ivy, and iceplant are the dominant pest species.

WILDLIFE

Birds

The complex mosaic of open water, freshwater marsh, riparian, and upland habitats creates diverse natural communities that are heavily used by a diversity of bird species. Another factor favoring relatively high levels of bird species richness and abundance is the location of Lake Merced on the coastal edge of the San Francisco Peninsula in an area that is otherwise highly urbanized. This location, combined with nearby Fort Funston, provides an important resting habitat for migrating birds. Almost 70 species of birds have been documented nesting within the Lake Merced area (Murphy 1999). Several of these species are of special concern, locally rare, or neotropical migrants.³

Sensitive Bird Species and Important Bird Habitat

Thirty species of bird considered sensitive for this project have been reported from Lake Merced (Table 6.1-2). Of these, 14 species are reported as occurring, 12 have been documented to breed at the lake, and three are winter residents. The California Natural Diversity Data Base (CNDDDB) reports that California black rail (*Laterallus jamaicensis coturniculus*) occurred at Lake Merced in 1937 (CNDDDB 2005). This species, now listed as threatened by the State of California, has not been recently reported at Lake Merced. Gadwall (*Anas strepera*) nested at Lake Merced according to historic records, but are now present only during the winter. Other winter resident birds include red crossbill (*Loxia curvirostra*) and red-breasted nuthatch (*Sitta canadensis*).

Perhaps the most conspicuous nesting birds include the double-crested cormorants that have nested in eucalyptus groves on the western side of South Lake (near the San Francisco Police Department firing range) and on the northwest edge of North Lake since at least 1997 (Murphy 1999; EIP 2000). In the 2000 breeding season, the nesting colony in South Lake consisted of approximately 40 nests. Two great blue heron nests were also present. The colony on North Lake had only between six and 10 nests and one great blue heron nest (EIP 2000). Recently, cormorants were observed nesting on the north shore of East Lake in the eucalyptus grove below the Mesa. The California Department of Fish and Game (CDFG) considers nesting double-crested cormorants as a species of special concern (CDFG 2004).

³ Species that breed in the area and spend the winters in the tropics.

Common yellowthroats (*Geothlypis trichas*), also a CDFG species of special concern (CDFG 2004). Common yellowthroats have been observed feeding young and singing at several locations throughout the Lake Merced area (CNDDDB 2005; Murphy 1999; EIP 2000).

Other species considered locally sensitive have been documented at Lake Merced. American goldfinch (*Carduelis tristis*), Clark's grebe (*Aechmophorus clarkii*), barn swallow (*Hirundo rustica*), Bewick's wren (*Thryomanes bewickii*), cliff swallow (*Petrochelidon pyrrhonota*), hooded oriole (*Icterus cucullatus*), olive-sided flycatcher (*Contopus cooperi*), pied-billed grebe (*Podilymbus podiceps*), purple finch (*Carpodacus purpureus*), and Wilson's warbler (*Wilsonia pusilla*) have all been observed nesting at Lake Merced.

Lake Merced is an important area for resident and migratory birds. Important bird habitat designated for this project at Lake Merced falls into five major groupings (Figure 6.1-8). The first of these is the extensive stands of willows that can be found at the borders of Lake Merced. Willow thickets provide important nesting habitat for many resident and neotropical migrant species. Willows are also important sheltering and foraging habitat for migratory birds. The tules that border the lakes are the second area of important bird habitat. These bands of marsh vegetation provide nesting habitat for marsh wrens (*Cistothorus palustris*) and common yellowthroats amongst other species. Rails and herons also forage within this habitat. The open water attracts migrating ducks and grebes, some of which spend the winter on Lake Merced. In 2005, duckweed (*Lemna* spp.) became a significant element of the shallow water ecosystem (Murphy 2005). The coves of Lake Merced provide shelter for wintering birds such as gadwall, greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), and resident species such as ruddy duck (*Oxyura jamaicensis*) and Clark's and western grebes (*Aechmophorus occidentalis*). The willows growing within the lake at Impound Lake provide important roosting habitat for black-crowned night herons (*Nycticorax nycticorax*), a locally uncommon species that may breed at this location. Upland habitats on the Mesa and around Impound Lake provide habitat for California quail (*Callipepla californica*) and white-crowned sparrow (*Zonotrichia leucophrys*). White-crown sparrow breed in scrub on the Mesa.

Mammals

Small mammal trapping surveys have been conducted in Impound Lake and the Mesa area in 2000 (Paquin and Reading 2000). Habitats sampled in these efforts were semi-aquatic vegetation in Impound Lake and coastal scrub on the Mesa. Given the high density of vegetation surrounding Impound Lake, sampling was limited to moderate-sized clearings in the eastern edge of the shore. Traps were set in two arrays of 20 traps each at Impound Lake and the Mesa and operated for four nights (total 80 trap nights per array). A second effort was made at the Mesa with an array of 40 traps operated for four nights (160 trap nights) (Paquin and Reading 2000). The only species collected were California meadow vole (*Microtus californicus*) and house mice (*Mus musculus*) (Appendix C). However, surveys of both Impound Lake and the Mesa may have been affected by vegetation management activities. Vegetation removal conducted before and

during the trapping may have caused rodents to move to areas of lesser disturbance. Overall mammal species richness biodiversity of this area may be greater than trapping results indicate. Other species observed at Lake Merced include muskrat (*Ondatra zibethicus*), striped skunk (*Mephitis mephitis*), and Virginia opossum (*Didelphis virginiana*) (*Didelphis virginiana*). Other mammals found in the Lake Merced area are typical of urbanized parks in general (Appendix C). Free-roaming cats are relatively common and likely the most significant threat to wildlife. As of 2005, there are two cat feeding stations on the north side of the lake. No special-status species of mammals have been reported from the Lake Merced area.

Reptiles/Amphibians

Common species of reptiles and amphibians use Lake Merced. Survey work that focused on reptiles and amphibians at Lake Merced conducted in 2000 included 20 site visits that focused on reptiles and amphibians. During these surveys seven species were observed including: skilton skink (*Eumeces skiltonianus*), San Francisco alligator lizard (*Elgaria coerulea coerulea*), red-ear slider (*Trachemys scripta*), soft-shell turtles (*Apalone* spp.), California slender salamander (*Batrachoseps attenuatus*), western pond turtle, and California red-legged frog (*Rana aurora draytonii*) (Paquin and Reading 2000). The western pond turtle and red-legged frog are sensitive species and discussed in more detail in the following section.

Sensitive Reptile/Amphibian Species

Historically, California red-legged frog is documented in the Lake Merced area. The CNDDDB contains seven records of California red-legged frogs for the City of San Francisco, but only one record from Lake Merced (CNDDDB 2005). This record is based on two literature references between 1966 and 1972 and a single pre-1966 specimen. Anecdotal reports indicate that red-legged frogs were common at Lake Merced in the 1950s and often were observed through the 1970s (Ely 2000). California red-legged frog was observed on the eastern shore of Impound Lake on March 25, 2000, by a biologist from San Francisco State University. Bullfrogs (*Rana catesbeiana*) were first apparent in the lakes in the early 1970s and are presumed to still exist there.

To assess the status of any red-legged frogs within Lake Merced, EIP conducted surveys in the spring of 2000 (EIP 2000). All surveys were conducted according to U.S. Fish and Wildlife Service (USFWS) protocol for California red-legged frog surveys either by boat on North and South lakes or by foot or kayak on Impound Lake (USFWS 1997). No red-legged frogs were observed during the protocol surveys, but adult bullfrogs were observed in each of the lakes. The survey results were submitted to the USFWS as required in November 2000 and no comment was received. The lack of red-legged frog observations during protocol surveys is not an unexpected result given that the window for protocol surveys, May 1 through October 31, is very late in the red-legged frog breeding season and adults are typically not calling anymore by this time. In spring of 2000, the red-legged frogs that breed in the Strybing Arboretum in Golden Gate Park had not been heard calling since late February 2000 (Mahone 2000).

Several factors suggest that the population of red-legged frogs has been locally extirpated from Impound Lake. First, continuing vegetation management work by the Natural Areas staff within the Impound Lake sub-basin has not resulted in observations of any red-legged frogs. This work is conducted throughout the year and it seems likely that if a population of frogs remained in Impound Lake, they would have been observed at some point.⁴ Another reason that the red-legged frogs may not exist in Impound Lake is the presence of predators. Bullfrogs were noted during field surveys. This species is a voracious predator and will easily consume red-legged frog eggs, juveniles, and small adults (USFWS 2002). Also the water level in South Lake has recently been raised. This has resulted in an intermittent connection between South Lake and Impound Lake below the existing causeway. Although this link is likely relatively shallow, largemouth bass (*Micropterus salmoides*) would have been able to enter Impound Lake from South Lake. Largemouth bass would prey on any amphibians within Impound Lake. Watershed alteration and other habitat changes caused by urbanization over the years had likely reduced this population of red-legged frogs to a relatively small number by 2000. At this point it is assumed that the California red-legged frog is no longer present in Impound Lake or at other locations within the Lake Merced Natural Area.

San Francisco garter snakes (*Thamnophis sirtalis tetrataenia*) are listed as endangered under both the State and Federal Endangered Species Acts (ESA) (CDFG 2005). While habitat may be present, San Francisco garter snakes have never been reported at or near Lake Merced. The northernmost population of this species is near Sharp Park in Pacifica (Section 6.4). Also, San Francisco garter snakes are a specialized predator whose preferred prey is frogs (McGinnis 1998). The small frog populations limit potential foraging habitat for San Francisco garter snakes at Lake Merced area. This species is not presumed to occur at Lake Merced.

Western pond turtles, a species of management concern, were observed in East Lake (EIP 2000). The breeding status of this population is unknown, but there appears to be sufficient upland habitat and numbers of individuals to be a viable population. There are anecdotal reports of Pacific chorus frog (*Pseudacris (Hyla) regilla*) from Lake Merced, but none were observed during surveys.

Invasive Reptile/Amphibian Species

Large water bodies in urban environments often are used by the public as release sites for unwanted pets. Red-ear sliders and soft-shell turtles may have been introduced to the lake in this way. Both of these species could be influencing adversely the reproductive success of native reptiles and amphibians through competition for resources and direct predation.

⁴ Natural Areas staff monitor the population of red-legged frogs at Sharp Park (Section 6.4) and would be able to identify this species if it was observed.

Fish

As discussed earlier in this section, the water supply levels for Lake Merced have fluctuated over the course of history, directly affecting the fish species in the lake. Historically, creeks flowed into Lake Merced from the surrounding hills, creating conditions that may have supported freshwater fishes. Until the 1880s, the lake was separated from the ocean by a sand bar that periodically breached. This would have offered an opportunity for marine fish tolerant of fresh or slightly brackish water to colonize the lake.

Since the late 1800s, the fish populations of Lake Merced have undergone dramatic changes that reflect changes in the physical condition and management goals of the lake (i.e., recreational fishing). Historic management practices included the repeated application of fish-specific toxins to North, South, and Impound Lakes between 1949 and 1968 (Singer 2000). This work was conducted in an effort to improve conditions within the lakes for production of game fish. Over time, the lakes have been stocked with a variety of species with the intention of enhancing the sport-fishing experience. Records show that at least 11 species have been introduced since 1893 (Appendix C) (Singer 2000).

The studies of fish populations at Lake Merced have used a wide variety of techniques and vary in their accuracy. However, they do provide a qualitative overview of fish species present in the Lake Merced system (Appendix C).

The preliminary results of the fish study indicate that Lake Merced provides habitat for, and has, several native and non-native fish species (McGowan 2005). Native species such as tule perch (*Hyserocarpus traski*), prickly sculpin (*Cottus asper*), and small native minnows such as hitch and roach, appear to be successfully reproducing in the lake. Also, several species of non-native recreational fish, such as largemouth bass, common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*) and Sacramento blackfish (*Orthodon microlepidotus*), have self-sustaining populations that reproduce naturally in the lake. There is no spawning habitat for trout in the lake, so they cannot reproduce. Maintaining that fishery will require on-going stocking.

Sensitive Fish Species

Historically, tidewater gobies (*Eucyclogobius newberryi*), a small estuarine fish species, now federally endangered and a CDFG species of concern, was found in Lake Merced. It has not been collected there since 1895, despite multiple sampling and poisoning events, and are assumed to be no longer present in Lake Merced (CNDDDB 2005).

Invasive Fish Species

At this time, the lakes support a wide variety of species, most of which have been intentionally introduced (Singer 2000). While many of these species are predatory (largemouth bass, rainbow trout (*Onchorynchus mykiss*)), others are primarily herbivores (common carp (*Cyprinus carpio*),

goldfish (*Carassius auratus*), etc.). Some non-native species can prey upon native species; however, the native tule perch and other small species in Lake Merced may be able to persist in the presence of largemouth bass. More detailed population studies should occur before the population of largemouth bass is enhanced in order to ensure that native species will be protected from over predation by the bass (McGowen 2005).

Invertebrates

Common butterflies, dragonflies, and other insects are assumed to occur at Lake Merced. Recent sampling of the terrestrial invertebrates at Lake Merced has focused on predaceous ground beetles (*Coleoptera: Carabidae*) as an indicator group (Low and Conser 2000). Carabids are the third largest family of beetles in North America and have been used by other researchers as an indicator of habitat quality because they are top predators, have a complex life history, and are sensitive to environmental fluctuations. Sites of higher quality habitat are expected to support higher densities and larger diversity of insects. Preliminary results indicate that species diversity varies amongst the sites sampled (Appendix C) (Low and Conser 2000).

Sensitive Invertebrate Species

Tomales isopod (*Caecidotea tomalensis*) was collected in 1984 in North Lake and is a federal species of concern (CNDDDB 2005). The current status of this species is unknown and further evaluation may be required. No special-status species have been identified in the terrestrial invertebrate sampling conducted at Lake Merced to date (Low and Conser 2000).

MANAGEMENT AREAS

Management Areas (MAs) at Lake Merced fall into three general categories: the open water of Lake Merced, the freshwater marsh that borders the immediate edge of the lake, and the upland habitats between the marsh edge and the Natural Areas boundary (Figure 6.1-9). The water of East Lake is considered an MA-2a area because western pond turtles live within this lake. North and South lakes are considered MA-3a areas. The tule marsh that forms a narrow border around East, North, and South lakes is considered MA-1a. Three MA-1b areas have been designated within these lakes that include the double-crested cormorant rookeries. A small portion of the Mesa is designated MA-1c in an area that supports sensitive plant species. The habitat between the marsh edge and the Natural Area boundary generally falls into the MA-2 category. The urban forests found within a narrow band of land around Lake Merced are generally categorized as MA-3. Impound Lake itself and the associated wetlands are designated MA-1f to MA-1h because this area supports sensitive habitat and species. The following text presents issues and recommended management actions by Management Area.

ISSUES AND RECOMMENDATIONS

Several conservation and recreation-related issues have been identified for Lake Merced. Recommendations developed for each of these issues will guide restoration, enhancement, and maintenance work. In the following discussion, system-wide issues and recommendations (GR-1 for example; see Chapter 5) that apply to the entire Natural Area at Lake Merced are presented first within each topical area, followed by site-specific issues and recommendations. Site-specific recommendations are keyed to the Management Area in which they should occur.

Site Improvements – Implementation of management recommendations at Lake Merced would not change significantly the overall look of the park and would result in:

- improved public access on designated trails;
- improved access to lake edge on the east and west sides of the Impound causeway for fishing and other recreational activities;
- enhanced biodiversity;
- increased and more sustainable populations of rare and sensitive plant species;
- improved quality and patch size of willows and coastal scrub to provide better bird habitat;
- formalization of informal trails away from the wetland vegetation into less sensitive terrestrial habitats;
- beautification of some park entry points with designed native plant gardens;
- improved wildlife habitat;
- creation of more open grassland habitat;
- improved habitat for Western pond turtles;
- no change to existing DPA unless use patterns change; and
- improved access to Sunset Circle beach, the northwest beach, and Haas pier.

Overall, implementation of the following recommendations could lead to the creation of highly productive freshwater marsh and upland grassland habitats at Lake Merced. Protection of existing marsh habitats could lead to increased populations of sensitive species including western pond turtles. Management of upland areas could create improved habitat for sensitive plants as well as resident and migratory birds. In the long term, Lake Merced may be viewed as a very productive functional ecosystem similar to that found at Rodeo Lagoon in the Golden Gate National Recreation Area.

Vegetation

Issues relating to vegetation management at Lake Merced revolve around the protection of sensitive species and habitats, typically through the control of invasive plants (GR-1) and management of sensitive species and vegetation series of limited distribution (GR-2). Issues

relating to the general safety of visitors and surrounding homes and illicit activities must be considered during management of the Natural Areas (GR-13). Management of the urban forest within MA-3b and MA-3c shall follow the recommendations in GR-15. In addition to these general recommendations, the following site-specific issues should be addressed.

Issue LM-1: Lake Merced supports a variety of sensitive elements that are not found at other places within the Natural Areas, including rare dune plants (e.g., San Francisco spineflower) and wetland series (bulrush marsh, swamp knotweed marsh, and rush meadow, and giant vetch marsh) and other plants (Vancouver's ryegrass, canyon live oak, and thimbleberry). Habitat loss and invasive species within the Lake Merced Natural Area threaten the continued existence of these species and habitats.

Recommendation LM-1a: To protect existing habitats from invasive species and enhance these areas, SFRPD shall contain and reduce herbaceous and woody weeds such as Cape ivy, English ivy, poison hemlock, Bermuda buttercup, wild radish, sheep sorrel, iceplant, European grasses, and mustard, within all Management Areas. Native species shall be planted to approximate the diversity, cover, and density (generated from relative importance values) of adjacent habitat or reference plots in similar habitats at other parks (Appendix B).

Recommendation LM-1b: To maintain and enhance native habitats, it is necessary to selectively remove some trees. Approximately 134 trees (or less than 2%) of a total estimated 12,000 trees would be removed at Lake Merced. Trees shall be removed in the following locations:

- 3 small trees from MA-1d;
- 6 trees on the slope below golf course and cypress at the toe of the slope in MA-1e;
- approximately 10 trees from within MA-2b, allowing approximately 20 to remain;
- approximately 10 trees on steep slopes within MA-2c;
- approximately 5 trees from within MA-2d;
- approximately 100 trees that are on the slopes and encroaching into wetlands that surround North, South, and East lakes (MA-2e); and
- no tree removal shall occur in MA-1a-c, MA-1f-h, MA-2a, MA-2f, MA-2g, MA-3a, and MA-3c.

Recommendation LM-1c: To help maintain and enhance coastal wetland scrub, grassland and oak habitat, prevent the establishment of invasive tree species (MA-1a, MA-1c-e, MA-1g, MA-1h, MA-2a-b, MA-2d-g). Within MA-2c, some cypress recruitment shall be allowed, but eucalyptus shall be prevented from establishing. Because trees can block public views, tree planting and natural recruitment shall be prevented in public view corridors.

Recommendation LM-1d: Lake Merced supports a variety of sensitive habitats, some of which are of very limited distribution (e.g., Vancouver's ryegrass prairie, swamp knotweed marsh, or rush meadow) within the Natural Areas system. Therefore, SFRPD shall maintain and enhance the following habitats:

- bulrush marsh and other wetland vegetation (MA-1a);
- dune scrub with open sand areas for plant recruitment (MA-1c, MA-1d, MA-1e, MA-1g, MA-2b);
- willow scrub (MA-1h, MA-2e);
- oak woodland at edge of road in MA-2b;
- mixed forest of cypress, oak, toyon, and native scrub (MA-2c, MA-2e);
- oak woodland at upper edge of slopes, as pines and cypress die, replace with oaks, toyon (*Heteromeles arbutifolia*), silk tassel bush (*Garrya elliptica*) and California lilac (*Ceanothus thyrsiflorus*) (MA-2e);
- coastal scrub with open dune gaps to allow for plant recruitment (MA-2d);
- dense coastal scrub (MA-2f); and
- mixed forest and grassland community (MA-3c).

Issue LM-2: Populations of rare plants including San Francisco wallflower, canyon live oak, San Francisco spineflower, and California pipe vine exist at Lake Merced. However, the populations of these species are small and are susceptible to decline or localized extinction if they are not actively managed.

Recommendation LM-2a: To maintain these species and increase chances of survival, consider augmenting existing sensitive plants such as San Francisco wallflower (MA-1b, MA-1e, MA-2b, and MA-2e), California pipe vine (MA-1a, MA-1h, and MA-2d-f), dune tansy (MA-1a, MA-2b, and MA-2e), paintbrush (MA-1b, MA-1e, MA-2b, and MA-2d-f), San Francisco spineflower (MA-1d, MA-1g, and MA-2g), wild cucumber (MA-2b-f), canyon live oak (MA-2c and MA-2e), coastal black gooseberry (MA-2c and MA-2e), thimbleberry (MA-2c and MA-2e), and Vancouver's ryegrass (MA-2e and MA-2f).

Recommendation LM-2b: In addition to augmenting the populations of the species discussed above, SFRPD shall consider reintroduction of species such as California croton (MA-1e and MA-2d), western goldenrod (MA-1e, MA-2d, and MA-2f), Canadian toad-flax (*Linaria canadensis*) (MA-1g), California goosefoot (*Chenopodium californicum*) (MA-2b and MA-2f), Nuttall's milkvetch (*Astragalus nuttallii* var. *virgatus*) (MA-2b and MA-2f), leafy daisy (*Erigeron foliosus*) (MA-2b), silk tassel bush (*Garrya elliptica*) (MA-2b-e), western choke cherry (*Prunus virginiana*) (MA-2c and MA-2e), wood rose (*Rosa gymnocarpa*) (MA-2c and MA-2e), giant chain fern (*Woodwardia fimbriata*) (MA-2e), and Lake Merced manzanita (*Arctostaphylos tomentosa* ssp. *rosei*) and brittleleaf manzanita (*Arctostaphylos tomentosa* ssp. *crustacea*) on the south side of north lake) (MA-2e and MA-2f). Reintroduction of these species to

Lake Merced would create additional populations in San Francisco and help prevent countywide extinctions of these species.

Wildlife

Wildlife issues at Lake Merced focus on three main topics: available habitat, food sources, and shelter. Vegetation management during the breeding season can impact nesting birds (GR-4), however, vegetation management also can provide materials to create artificial habitat for ground-dwelling birds, small mammals, and reptiles (GR-9). Artificial nesting structures may benefit some species, especially cavity nesters such as wood ducks, chickadees, and woodpeckers (GR-6). Reduction in predation pressures will benefit all animals within the Natural Area (GR-7). Finally, measures to educate park users and reduce feeding of animals will enhance wildlife habitat (GR-14). In addition to these general recommendations, the following site-specific issues should be addressed.

Birds

Issue LM-3: Nesting double-crested cormorants are a species of special concern that nests at Lake Merced; often great blue herons can be found nesting in the same rookery. Red-shouldered (*Buteo lineatus*) and red-tailed hawks (*Buteo jamaicensis*) also nest at Lake Merced. The hawks change nest sites every two to three years, while the cormorants and herons remain in generally the same locations from year to year. Common yellowthroats are believed to nest in the tule marsh vegetation around the edges of the lakes. Recreational use and vegetation and tree management activities could impact these species if these activities are performed in proximity to nests or during the wrong season.

Recommendation LM-3a: Coordinate any tree removal activities at Lake Merced to avoid removing trees used by these raptors, cormorants, or herons (MA-1b and MA-2e). Do not conduct tree removal activities within 500 feet of nests when they are in use. Trees on the upslope side of these nesting colonies shall be retained to provide nesting habitat if the trees in which the cormorants currently nest in die as a result of rising lake levels.

Recommendation LM-3b: To reduce the potential impact of recreational use on nesting birds in tule marsh, consider the closure of social trails near cormorant nesting colonies or hawk nests if it appears that trail use is disruptive to nesting (MA-1b and MA-2e). Signage shall be installed at all boat rental and launching locations that explains the potential for recreational boat use to disturb birds nesting in the marsh vegetation around the edges of Lake Merced. This signage shall request that boaters remain a minimum of 30 feet from the edge of the marsh to help avoid disturbance of nesting birds between February 1 and August 31 (MA-2a and MA-3a).

Recommendation LM-3c: Perform removal of invasive understory vegetation when the nests are not active (MA-1b, MA-2e, MA-2f, MA-1h, and MA-1g). Conduct specific surveys to evaluate nesting status as required prior to vegetation management.

Recommendation LM-3d: Raptor nests within all Management Areas shall be located and mapped by SFRPD staff each year and avoided while active.

Issue LM-4: Habitats important to many bird species are limited in distribution and complexity at Lake Merced. Examples of this include the willow riparian and especially coastal scrub habitats.

Recommendation LM-4a: As discussed in recommendations associated with Issue LM-1, maintain and enhance these habitats that provide important nesting and foraging habitat for birds. Specific enhancement measures include actions such as removing invasive species that border these areas and allowing natural recruitment into the newly opened areas (MA-1h, and MA-2b to MA-2e) thereby increasing the patch size of willows and coastal scrub. Larger habitat units would create interior habitats that are more sheltered from outside disturbance. Planting species such as twinberry or elderberry within the willow patches would enhance structural complexity and provide additional food sources.

Issue LM-5: Open grasslands and grassland-scrub mosaic provide important foraging habitat for raptors and ground-dwelling birds. These habitats at Lake Merced need to be protected and enhanced.

Recommendation LM-5a: Create more open grassland habitat at Lake Merced through vegetation management and control of invasive plants in coordination with other restoration activities. Existing grasslands are all on the Mesa within MA-1c and MA-2b.

Recommendation LM-5b: Remove iceplant to create openings where native grasslands and grassland/scrub mosaics could be created. Vegetation removal and revegetation activities are discussed in Recommendation LM-1 and GR-1. Creation of brush piles as described in General Recommendation GR-9 would create complex, high-quality native habitats for ground-dwelling birds (especially California quail) and foraging habitat for raptors.

Reptiles/Amphibians

Issue LM-6: Western pond turtles can be found within East Lake. Western pond turtle is a species of special concern whose populations have been declining throughout California. Maintenance of suitable aquatic and terrestrial habitat is especially important for the survival of this species at Lake Merced. Because management of Lake Merced could affect their reproductive success and survival, implement the following recommendations in MA-2a to help ensure the survival of this species.

Recommendation LM-6a: Remove invasive vegetation and enhance native scrub and grassland species in upland areas of sandy soils adjacent to East Lake to allow for nesting. Logs or rock piles shall be installed at various locations through the lakes to increase and improve basking habitat. Perform routine vegetation maintenance to ensure these features remain in contact with the water and are exposed to the sun.

Recommendation LM-6b: To reduce competition and direct predation, SFRPD shall conduct periodic trapping and removal of non-native turtle species. Trapping and removal shall focus on North and East lakes (MA-3a and MA-2a). If possible, captured turtles should be relocated to educational facilities for non-lethal classroom purposes. In addition to the trapping and removal program, SFRPD shall develop educational materials and signage to educate the public about the damage caused by the release of non-native reptiles and amphibians (see Impacts of Non-Native Turtle Control discussion at the end of this section).

Recommendation LM-6c: To prevent native turtles from being disturbed during breeding season, restrict public access to the waters and shoreline of East lake between April 1 and August 31. It may be possible to achieve these access restrictions through signage. If not, temporary barriers that would prevent boat access to East Lakes could be installed. This barrier could be as simple as a floating log boom that would prevent boat access to East Lake, yet allow water flow and fish movement between the lakes (MA-2a).

Aquatic Resources

The aquatic resources at Lake Merced provide important ecosystem functions and habitat for sensitive species such as double-crested cormorants and western pond turtles, as well as socioeconomic values to the people of San Francisco who recreate at the lake. Currently, water is being added to the lake in an effort to improve water quality and restore recreational uses. Many of the recommendations made in the Public Draft (EIP 2002) are part of ongoing studies being conducted by SFPUC at Lake Merced. Because these studies are ongoing, making recommendations relating to the management of aquatic resources at the lake is premature. Therefore, instead of making recommendations, the Natural Areas Program should continue to coordinate with SFPUC and other organizations as required to ensure that Natural Areas and sensitive species are protected. Implementation of any future recommendations resulting from these studies would be subject to approval by the Commission and involve a public process (See Section 1.7).

Soils, Erosion, and Public Use

The erosion and public use issues at Lake Merced relate to surface runoff and use of trails and existing facilities. Designated (7,787 feet) and social trails subject to closure (approximately 3,300 feet) occur throughout Lake Merced (Figure 6.2-2). The issue of erosion and habitat impacts related to social trails is addressed through implementation of GR-11 and GR-12.

Issue LM-7: The existing off-leash DPA at the Mesa (MA-1c and MA-2b) is located in a restored dune habitat that supports nesting white-crowned sparrow, which is declining in number in San Francisco, sensitive plant species and some of the only raptor foraging habitat at Lake Merced. The remainder of Lake Merced is an on-leash park and Natural Area. This off-leash DPA currently experiences low use levels, perhaps due to lack of parking and abundant foxtails.⁵ Off-leash dog use, and its associated impacts, may increase at the mesa if Fort Funston is closed to off-leash dogs. Under current conditions, impacts to breeding white-crowned sparrows are limited. However, it is possible, with increased use of this DPA, that off-leash dogs could have significant negative effects on breeding birds. Independent scientific review indicated, however, that this DPA should be relocated to a less-sensitive location (Huntsinger and Bartolome, 2005).

Recommendation LM-7a: The SFRPD and the Dog Advisory Committee should consider relocating the DPA to a different location. In the meantime, this DPA can remain open, but impacts should be monitored. If use levels increase during this time such that impacts to breeding bird habitat are detected, signs and other mitigations should be implemented.

Issue LM-8: There is little public awareness about the lake ecosystem and its importance in supporting healthy populations of native species. However, because of the wealth of resources, ease of access, and central location, Lake Merced provides tremendous ecological educational opportunities. It is important to encourage research and education on the ecology of the lake and its environs.

Recommendation LM-8a: Implement General Recommendation GR-14 (Section 5).

Recommendation LM-8b: Consider participating in the development of an environmental education center as described in the Recreation and Nature reports of the Lake Merced Task Force's Stewardship Plan (LMTF 2001). This facility could include educational displays, classroom and lab space, docent-led tours and research facilities.

Recommendation LM-8c: Maintain existing interpretive signs at key locations.

Issue LM-9: Surface runoff is draining across established roads, trails, and parking areas throughout Lake Merced. In many of these areas, this runoff is eroding the slopes as it flows towards the lake. These areas range in size from less than 1 cubic yard to over 10 cubic yards.

Recommendation LM-9a: Small scale erosion gullies shall be treated with measures such as gully plugs, brush boxes, energy dissipaters, and water bars (see Section 5.4). Additionally, these areas shall be planted with the appropriate native vegetation to prevent soil erosion (Appendix B).

⁵ Foxtails (*Hordeum murinum*), which can become imbedded in dogs' ears, nose or eyes and cause infection, represent a serious hazard to dogs.

Recommendation LM-9b: Large erosion gullies will require engineered, specifically bio-engineered, solutions to solve. This type of solution, which could include vegetated gabions or other soft engineering solutions, will require capital plans and funds that are beyond the scope of this plan and the resources of the Natural Areas Program. The San Francisco Department of Public Works has initiated efforts to repair the slope failure caused by the Vista Grande overflow. The SFRPD shall continue to coordinate with this and other agencies to ensure that Natural Areas and sensitive species are protected.

Issue LM-10: Because Harding Park Golf Course borders on Lake Merced, sensitive species may be disturbed by golf course operations and use, especially during large tournaments.

Recommendation LM-10a: Create an educational program for all golf course staff. Items to discuss could include identification of species, their preferred habitats, and measures to protect them.

Recommendation LM-10b: Post informational and interpretive signs adjacent to Lake Merced along the periphery of the golf course indicating that the area is sensitive wildlife habitat (MA-2d to MA-2f). Install temporary barriers to sensitive areas during large tournaments. These measures will require coordination with the SFRPD Golf Division.

IMPACTS OF NON-NATIVE TURTLE CONTROL

The periodic trapping and removal of non-native turtles would have a beneficial effect on the aquatic ecosystem of Lake Merced. Removal of non-native turtles from Lake Merced, especially North and East lakes, would occur only if it was shown that there was a breeding population of western pond turtles. Turtles such as red-ear sliders and soft-shell turtles are both aggressive predators that consume other young turtles, juvenile amphibians (including egg masses), and fish. Unfortunately, these turtles have become common in the lakes throughout San Francisco, probably from the release of unwanted pets. Should a breeding population of western pond turtles be present, they would compete with these non-native turtles for food. Therefore, removal of non-native turtles would benefit the western pond turtle as prey would become more abundant. Although trapping and removal programs may result in euthanasia of the captured animals, it is also possible to humanely relocate these animals to education facilities that could use turtles for non-lethal classroom purposes. To the extent possible, SFRPD should pursue relocation and humane treatment of these animals.

Table 6.1-1. Vegetation series mapped within Natural Areas at Lake Merced.

	Vegetation Series	Total Acreage
Forest	acacia forest	3.96
	blue gum forest	14.73
	coast live oak forest*	0.13
	cypress forest	7.68
	Eucalyptus forest	0.09
	mixed exotic forest	12.01
	pine forest	3.55
	plume acacia forest	1.12
	Prunus forest	0.11
	Subtotal	43.38
Scrub	California blackberry scrub*	5.02
	California sagebrush scrub*	0.65
	canyon live oak scrub*	0.11
	coyote brush scrub*	1.47
	French broom scrub	0.77
	Himalayan blackberry scrub	0.06
	lizard-tail scrub*	0.41
	poison oak scrub*	1.15
	twinberry scrub*	0.08
	willow scrub*	27.96
	yellow bush lupine scrub*	0.20
Subtotal	37.89	
Mosaic	bee plant/California blackberry mosaic*	0.21
	bee plant/coyote brush mosaic*	0.33
	giant vetch/California blackberry mosaic*	0.73
	iceplant/coffeeberry mosaic	0.10
	iceplant/coyote brush mosaic	2.69
Subtotal	4.06	
Grassland	purple needlegrass prairie*	0.46
	ripgut brome grassland	5.77
	hybrid ryegrass prairie*	0.02
	wild oat grassland	0.78
Subtotal	7.02	
Other Herbaceous	bee plant herbaceous*	0.44
	cape ivy	1.36
	iceplant herbaceous	7.27
	mixed exotic herbaceous	2.91
	nasturtium	0.02
	pampas grass	0.03
	poison hemlock	0.33
Subtotal	12.36	
Wetland	bulrush marsh*	34.89
	cattail marsh*	0.03
	giant vetch marsh*	1.12
	rush meadow*	0.71
	swamp knotweed marsh*	6.93
Subtotal	43.68	
Other	bare ground	0.44
	developed	1.17
	open water	244.89
	Subtotal	246.50
Grand Total	394.88	

* Indicates vegetation type is dominated by native species.

Table 6.1-2. Sensitive species presently and historically known to occur at Lake Merced.

Species	Common Name	Status Federal, State, CNPS	Occurrence Status
ANIMALS			
<i>Caecuditea tomalensis</i>	Tomales Isopod	FSC	Collected in 1984 (CNDDDB 2005)
<i>Eucyclogobius newberryi</i>	Tidewater Goby	FPD (FE), CSC	Historically collected (1895), not recently observed
<i>Rana aurora draytonii</i>	California Red-legged Frog	FT	Last observed in 2000
<i>Clemmys marmorata</i>	Western Pond Turtle	CSC	Presently occurs
<i>Carduelis tristis</i>	American Goldfinch	LS	Presently breeds
<i>Falco sparverius</i>	American Kestrel	LS	Presently occurs
<i>Riparia riparia</i>	Bank Swallow	ST	Currently nest at Fort Funston and forage over Lake Merced
<i>Tyto alba</i>	Barn Owl	LS	Presently occurs
<i>Hirundo rustica</i>	Barn Swallow	LS	Presently breeds
<i>Thryomanes bewickii</i>	Bewick's Wren	LS	Presently breeds
<i>Laterallus jamaicensis coturniculus</i>	Black Rail	ST	Historically reported, not recently observed
<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	-	Locally uncommon, may breed.
<i>Aechmophorus clarkii</i>	Clark's Grebe	LS	Presently breeds
<i>Hirundo pyrrhonota</i>	Cliff Swallow	LS	Presently breeds
<i>Geothlypis trichas</i>	Common Yellowthroat	CSC	Presently occurs
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	CSC (rookeries)	Presently breeds
<i>Anas strepera</i>	Gadwall	LS	Historically bred within San Francisco. Now a winter resident.
<i>Ardea herodias</i>	Great Blue Heron	Sens	Presently breeds
<i>Bubo virginianus</i>	Great Horned Owl	LS	Presently occurs
<i>Butorides striatus</i>	Green Heron	LS	Presently occurs
<i>Icterus cucullatus</i>	Hooded Oriole	LS	Presently breeds
<i>Contopus borealis</i>	Olive-sided Flycatcher	LS	Presently breeds
<i>Vermivora celata</i>	Orange-crowned Warbler	LS	Presently occurs, likely breeds
<i>Pandion haliaetus</i>	Osprey	LS	Presently occurs
<i>Podilymbus podiceps</i>	Pied-billed Grebe	LS	Presently breeds
<i>Carpodacus purpureus</i>	Purple Finch	LS	Presently breeds
<i>Sitta pygmaea</i>	Pygmy Nuthatch	LS	Presently occurs
<i>Loxia curvirostra</i>	Red Crossbill	LS	Winter resident.
<i>Sitta canadensis</i>	Red-breasted Nuthatch	LS	Winter resident.

Table 6.1-2. Sensitive species presently and historically known to occur at Lake Merced.

<i>Buteo lineatus</i>	Red-shouldered Hawk	LS	Presently occurs
<i>Porzana carolina</i>	Sora	LS	Presently occurs
<i>Rallus limicola</i>	Virginia Rail	LS	Presently occurs
<i>Wilsonia pusilla</i>	Wilson's Warbler	LS	Presently breeds
<i>Dendroica petechia</i>	Yellow Warbler	CSC (nesting)	Observed at Lake Merced in spring 2000, breeding undocumented
PLANTS			
<i>Aristolochia californica</i>	California pipevine	-	Presently occurs
<i>Castilleja wightii</i>	Beach Paintbrush	LS	Presently occurs
<i>Chorizanthe cuspidata</i> var. <i>cuspidata</i>	San Francisco spineflower	FSC, CNPS List 1B	Presently occurs
<i>Croton californica</i>	California croton	-	Historically documented (Howell et al. 1958), not recently observed
<i>Euthamia occidentalis</i>	Western Goldenrod	LS	Presently Occurs
<i>Erysimum franciscanum</i>	San Francisco wallflower	FSC, CNPS List 4	Presently occurs
<i>Gilia capitata</i> ssp. <i>chamissonis</i>	Dune gilia	CNPS List 1B	Presently occurs
<i>Leymus x vancouverensis</i>	Vancouver's Ryegrass	LS	Presently occurs
<i>Marah oreganus</i>	Wild Cucumber, Man-root	LS	Presently occurs
<i>Monardella undulata</i>	Curly-leaved monardella	CNPS List 4	Historically documented (Howell et al. 1958), not recently observed
<i>Quercus chrysolepis</i>	Canyon live oak	LS	Presently occurs
<i>Ribes divaricatum</i>	Coastal Black Gooseberry	LS	Presently occurs
<i>Rubus parviflorus</i>	Thimbleberry	LS	Presently occurs
<i>Silene verecunda</i> ssp. <i>verecunda</i>	San Francisco campion	FSC, CNPS List 1B	Historically documented (Howell et al. 1958), not recently observed
<i>Tanacetum camphoratum</i>	Dune Tansy	-	Presently occurs

Status Key:

Federal Status

- FE* Endangered. Species in danger of extinction throughout all or significant portion of its range.
- FT* Threatened. Species likely to become endangered within foreseeable future throughout all or a significant portion of its range.
- FPE* Proposed for listing as endangered.
- FC* Candidate for listing as endangered. Candidate information now available indicates that listing may be appropriate with supporting data currently on file.
- FSC* Species of Concern. Former Category 2 Candidate for listing as endangered.
- FPD* Proposed de-listing.

Table 6.1-2. Sensitive species presently and historically known to occur at Lake Merced.

California State Status

- SE* Endangered. Species whose continued existence in California is jeopardized.
- ST* Threatened. Species, although not presently threatened with extinction, that is likely to become endangered in the foreseeable future.
- SSC* Species of Concern.
- SFP* State Fully Protected under Sections 3511 and 4700 of the Fish and Game Code.
- Sens* Considered a sensitive species by the California Department of Forestry.

California Native Plant Society

- 1A* Plants presumed extinct in California
- 1B* Plants that are rare or endangered in California and elsewhere.
- 2* Plants that are endangered in California, but more common elsewhere.
- 3* Plants about which more information is needed.
- 4* Plants of limited distribution (a watch list).
- LS* Locally Significant.

Golden Gate Audubon Society

- LS* Locally Significant.



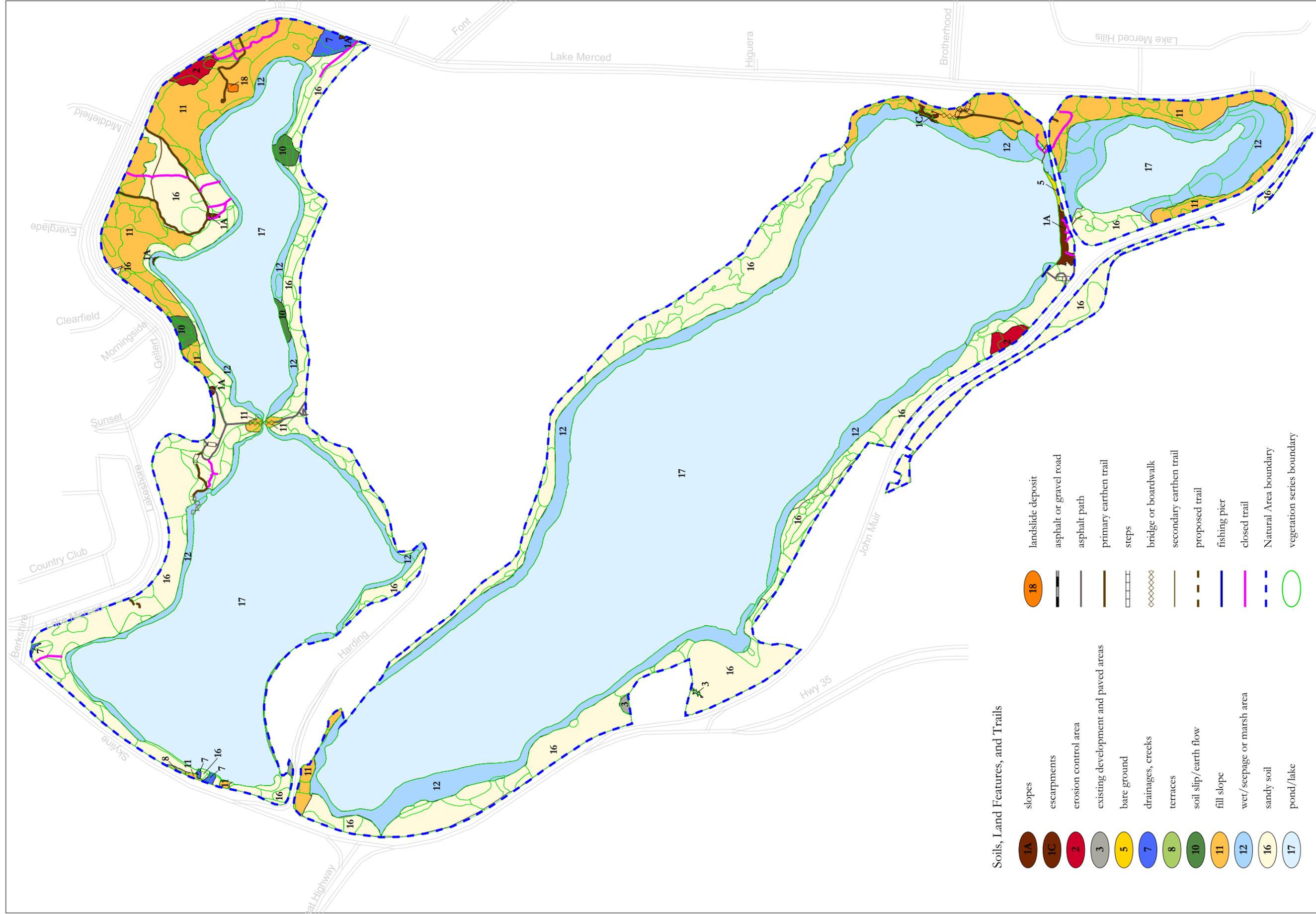
-  Natural Area Boundary
-  Natural Area Boundary and SFRPD Jurisdiction (SF City Property)
-  SFRPD Jurisdiction (SF City Property)
-  10-Foot contour line

Source: Aerial photography San Francisco Department of Public Works, 2002, Orthophoto -San Francisco - 1-foot resolution, 2001; property boundary data derived by San Francisco Recreation and Park Department (RPD) 2005 from data provided by San Francisco Department of Telecommunications and Information Services, 2002; natural area boundary data created by San Francisco State University Institute for GISc from information provided by RPD's Natural Areas Program (NAP), 2005; contour lines provided by San Francisco Department of Conservation; all data are California State Plane Zone III, NAD 83.

Created by Debra Dwyer, San Francisco State University Institute for GISc, May 5, 2002, revised June 7, 2005.

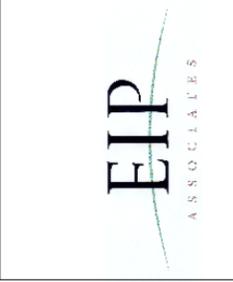


FIGURE 6.1 - 1
AERIAL PHOTOGRAPH, PROPERTY BOUNDARIES, AND NATURAL AREAS
 Lake Merced
 Significant Natural Resource Areas
 Management Plan
 San Francisco, California



Soils, Land Features, and Trails

- | | | | |
|----|--------------------------------------|----------------------------|-------------------------|
| 1A | slopes | 18 | landslide deposit |
| 1C | escarpments | asphalt or gravel road | asphalt path |
| 2 | erosion control area | primary earthen trail | steps |
| 3 | existing development and paved areas | bridge or boardwalk | secondary earthen trail |
| 5 | bare ground | proposed trail | fishing pier |
| 7 | drainages, creeks | closed trail | Natural Area boundary |
| 8 | terraces | vegetation series boundary | |
| 10 | soil slip/earth flow | | |
| 11 | fill slope | | |
| 12 | wet/seepage or marsh area | | |
| 16 | sandy soil | | |
| 17 | pond/lake | | |



Source: Vegetation data collected by San Francisco Department of Recreation and Parks Significant Natural Areas Program (SNAP), San Francisco State University Biology Department, and EIP Associates, 1999-2000; soil and land features data collected by EIP Associates, 1999-2002; trails data collected by NAP, 2005; data layers digitized by Geotopo, Inc., 1999-2000; edited and corrected by San Francisco State University Institute for GISc (SFSUGIS), 2000, 2005; trails data digitized by SFSUGIS, 2005; natural area boundary created by SFSUGIS from data determined by NAP, 2005; streets data excerpted from ArcView StreetMap 2000 Data, copyright 1998-2000, Environmental Systems Research Institute, Inc. (ESRI).

Created by Debra Dwyer, San Francisco State University Institute for GISc, March 16, 2002, revised December 11, 2005.

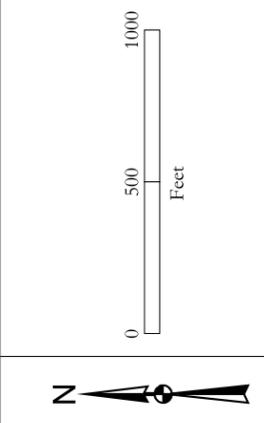


FIGURE 6.1 - 2
SOILS, LAND FEATURES, AND TRAILS
Lake Merced
 Significant Natural Resource Areas Management Plan
 San Francisco, California

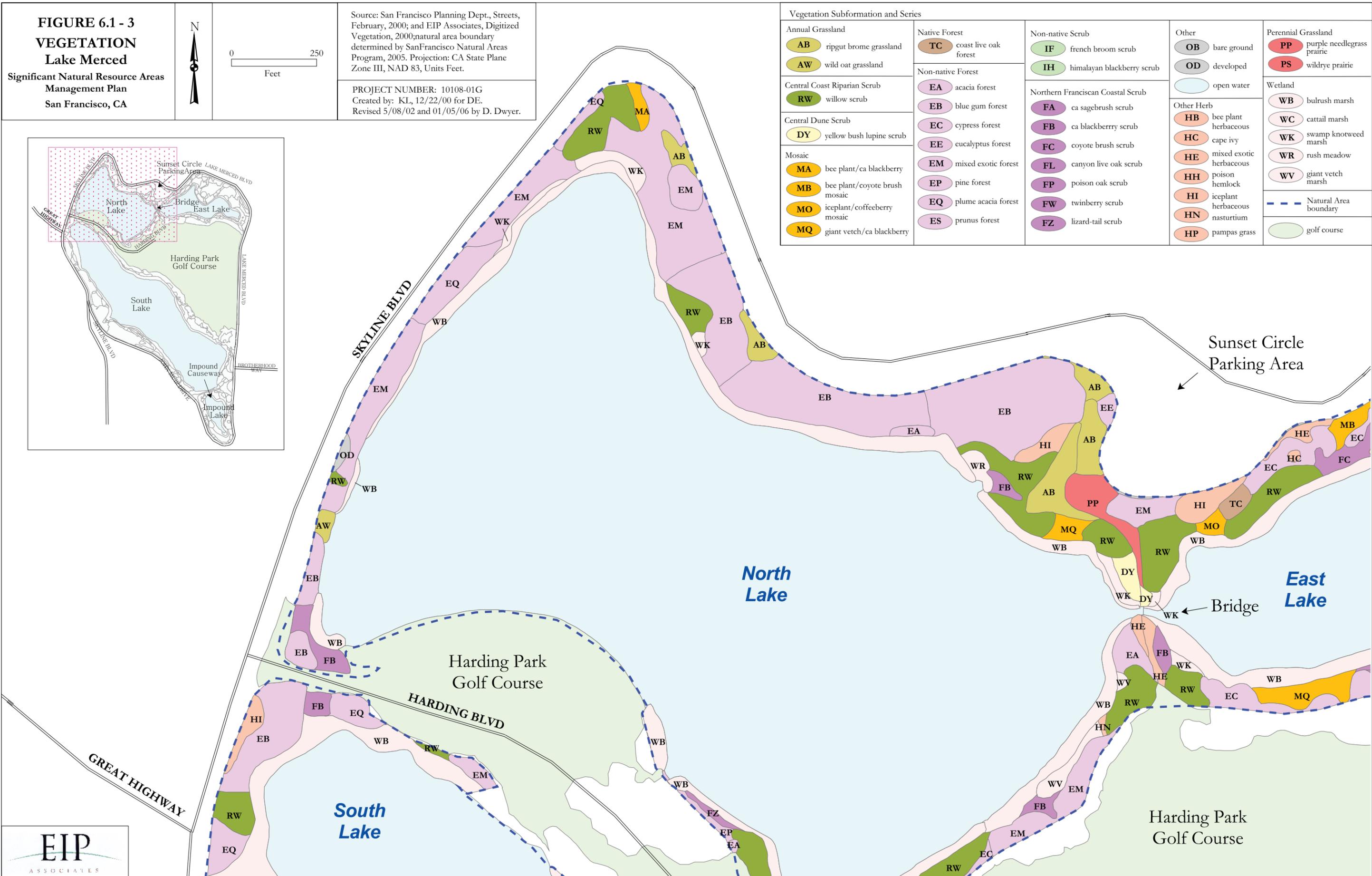
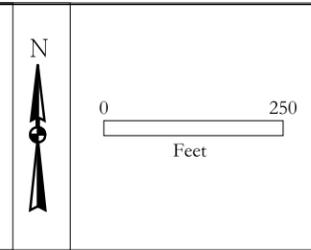


FIGURE 6.1 - 4
VEGETATION
Lake Merced
Significant Natural Resource Areas
Management Plan
San Francisco, CA



Source: San Francisco Planning Dept., Streets, February, 2000; and EIP Associates, Digitized Vegetation, 2000; natural area boundary determined by San Francisco Natural Areas Program, 2005. Projection: CA State Plane Zone III, NAD 83, Units Feet.

PROJECT NUMBER: 10108-01G
 Created by: KL, 12/22/00 for DE.
 Revised 5/08/02 and 6/10/05 by D. Dwyer.

Vegetation Subformation and Series				
Annual Grassland	Native Forest	Non-native Scrub	Other	Perennial Grassland
AB ripgut brome grassland	TC coast live oak forest	IF french broom scrub	OB bare ground	PP purple needlegrass prairie
AW wild oat grassland	Non-native Forest	IH himalayan blackberry scrub	OD developed	PS wildrye prairie
Central Coast Riparian Scrub	EA acacia forest	Northern Franciscan Coastal Scrub	open water	Wetland
RW willow scrub	EB blue gum forest	FA ca sagebrush scrub	Other Herb	WB bulrush marsh
Central Dune Scrub	EC cypress forest	FB ca blackberry scrub	HB bee plant herbaceous	WC cattail marsh
DY yellow bush lupine scrub	EC eucalyptus forest	FC coyote brush scrub	HC cape ivy	WK swamp knotweed marsh
Mosaic	EM mixed exotic forest	FL canyon live oak scrub	HE mixed exotic herbaceous	WR rush meadow
MA bee plant/ca blackberry	EP pine forest	FP poison oak scrub	HH poison hemlock	WV giant vetch marsh
MB bee plant/coyote brush mosaic	EQ plume acacia forest	FW twinberry scrub	HI iceplant herbaceous	Natural Area boundary
MO iceplant/coffeeberry mosaic	ES prunus forest	FZ lizard-tail scrub	HN nasturtium	golf course
MQ giant vetch/ca blackberry			HP pampas grass	

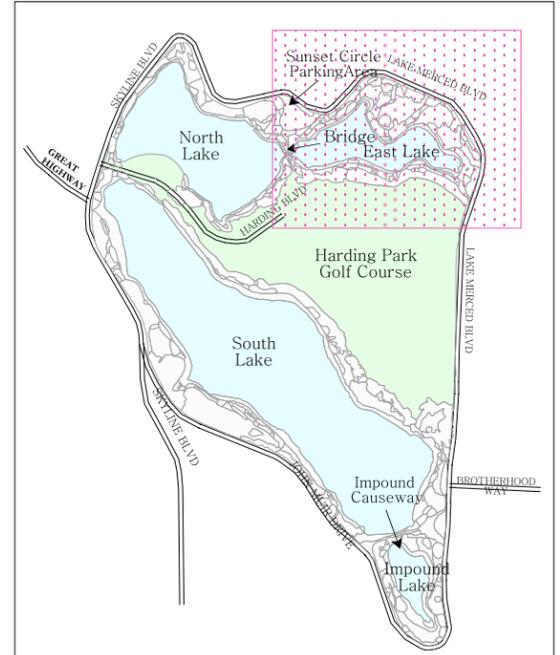
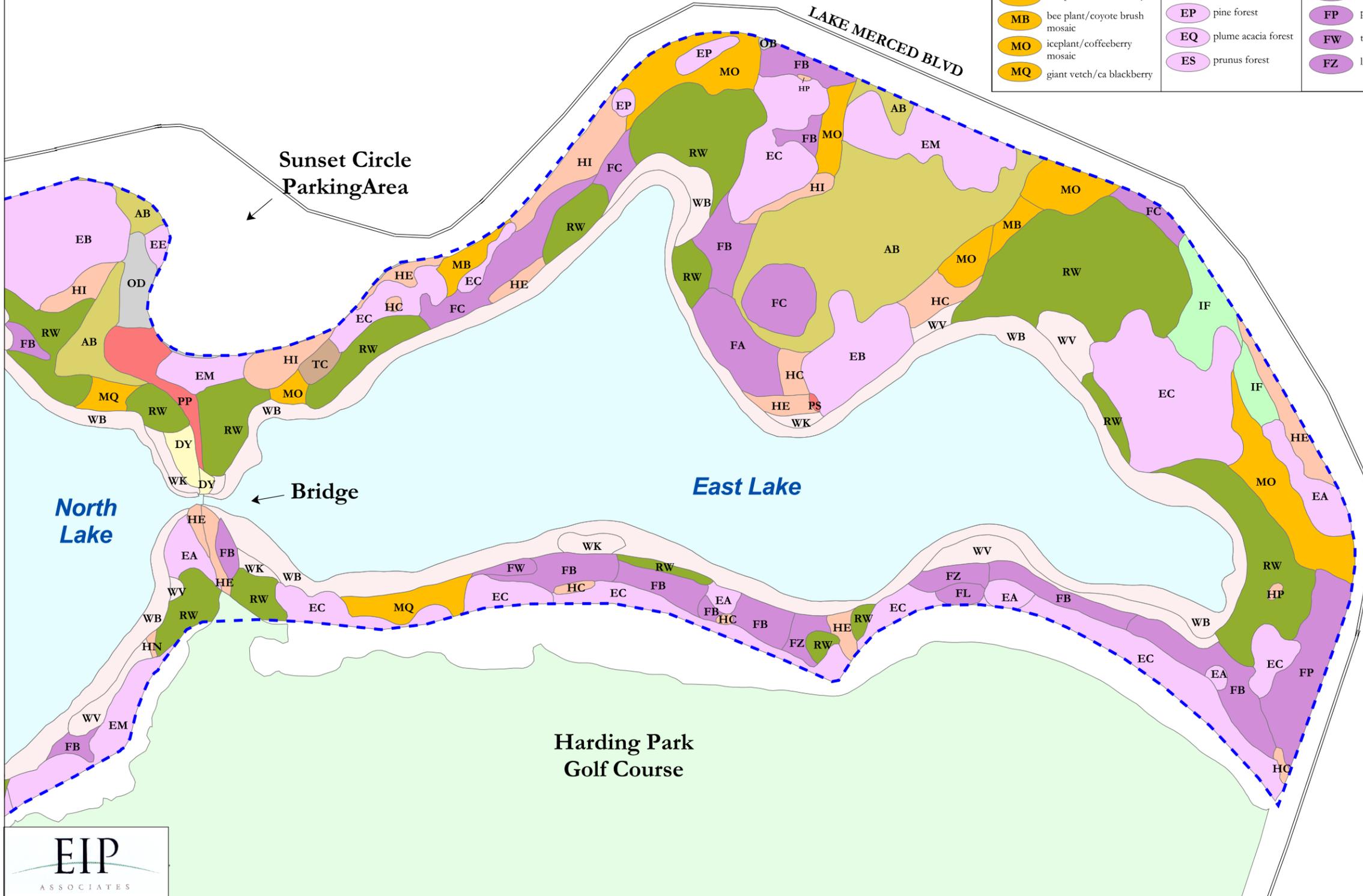
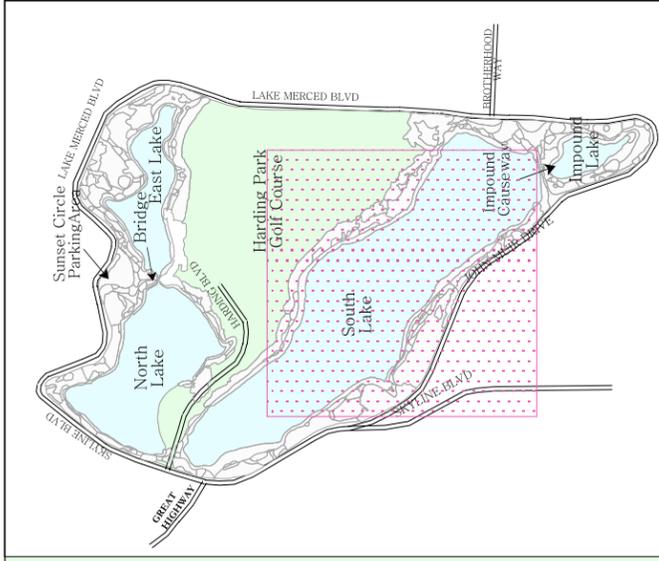
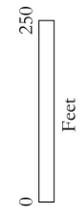
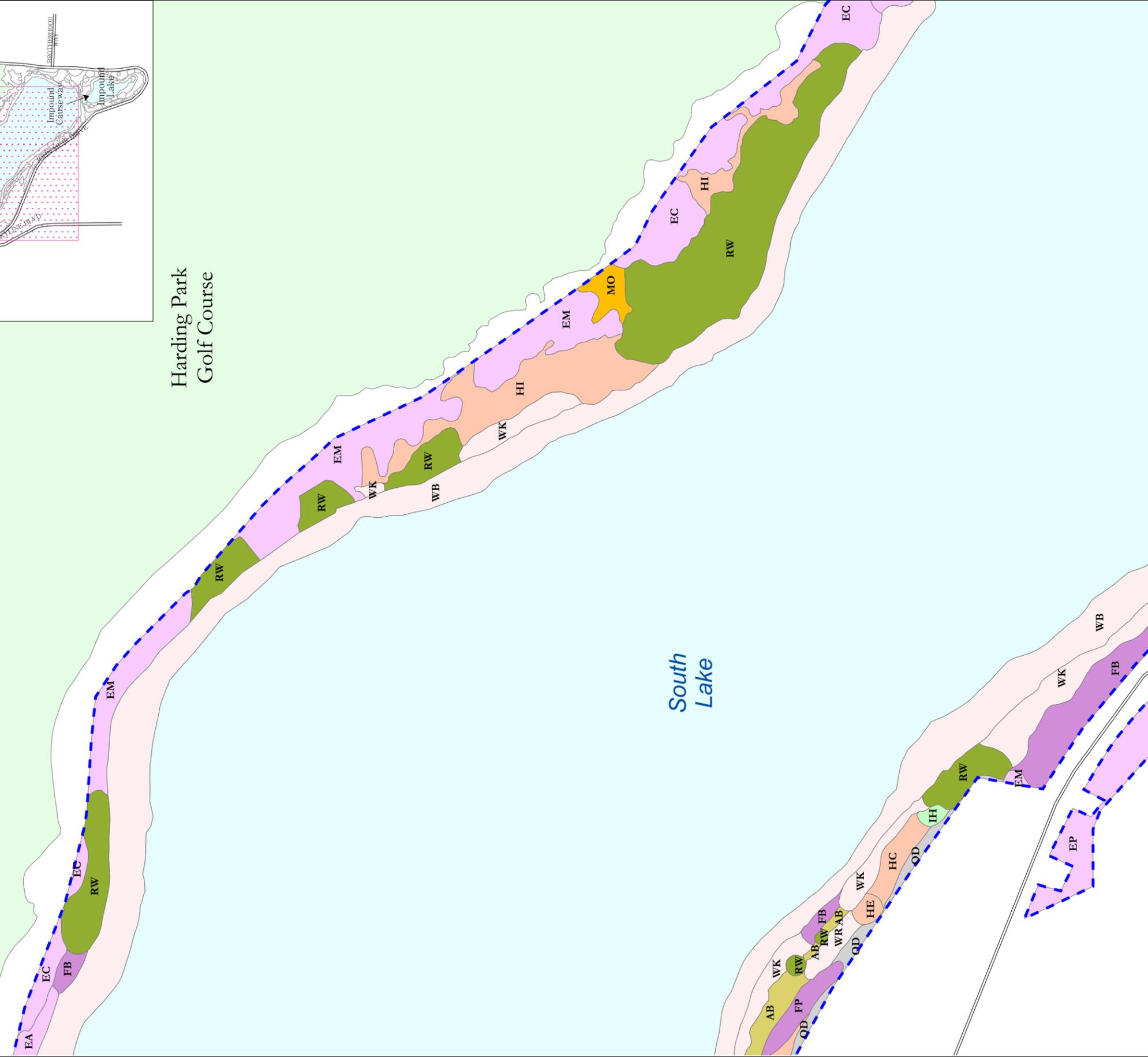


FIGURE 6.1 - 6
VEGETATION
Lake Merced
Significant Natural Resource Areas
Management Plan
 San Francisco, CA

Source: San Francisco Planning Dept., Streets, February, 2000; and EIP Associates, Digitized Vegetation, 2000; natural area boundary determined by San Francisco Natural Areas Program, 2005. Projection: CA State Plane Zone III, NAD 83, Units Feet.
 PROJECT NUMBER: 10108-01G
 Created by: KL, 12/22/00 for DE.
 Revised 5/08/02 and 6/10/05 by D. Dwyer.



Harding Park Golf Course



Vegetation Subformation and Series

Annual Grassland	Native Forest	Non-native Scrub	Other	Perennial Grassland
AB ripgut bromo grassland	TC coast live oak forest	IF french broom scrub	OB bare ground	PP purple needlegrass prairie
AW wild oat grassland	Non-native Forest	IH himalayan blackberry scrub	OD developed	PS wildtyle prairie
Central Coast Riparian Scrub	EA acacia forest	Northern Franciscan Coastal Scrub	open water	Wetland
RW willow scrub	EB blue gum forest	FA ca sagebrush scrub	Other Herb	WB bulrush marsh
Central Dune Scrub	EC cypress forest	FB ca blackberry scrub	HB bee plant herbaceous	WC cattail marsh
DY yellow bush lupine scrub	EC eucalyptus forest	FC coyote brush scrub	HC cape ivy	WK swamp knotweed marsh
Mosaic	EM mixed exotic forest	FL canyon live oak scrub	HE mixed exotic herbaceous	WR rush meadow
MA bee plant/ca blackberry	EP pine forest	FP poison oak scrub	HH poison hemlock	WV giant vetch marsh
MB bee plant/coyote brush mosaic	EQ plume acacia forest	FW twinberry scrub	HI iceplant herbaceous	--- Natural Area boundary
MO iceplant/coffeeberry mosaic	ES prunus forest	FZ lizard-tail scrub	HN herbaceous nasturtium	○ golf course
MQ giant vetch/ca blackberry			HP pampas grass	

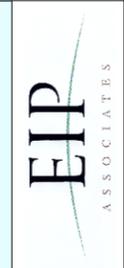
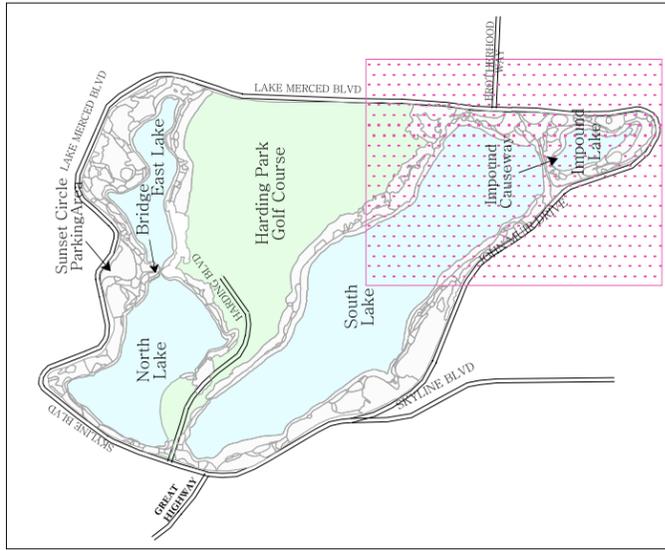
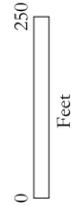


FIGURE 6.1 - 7
VEGETATION
Lake Merced
Management Plan
San Francisco, CA

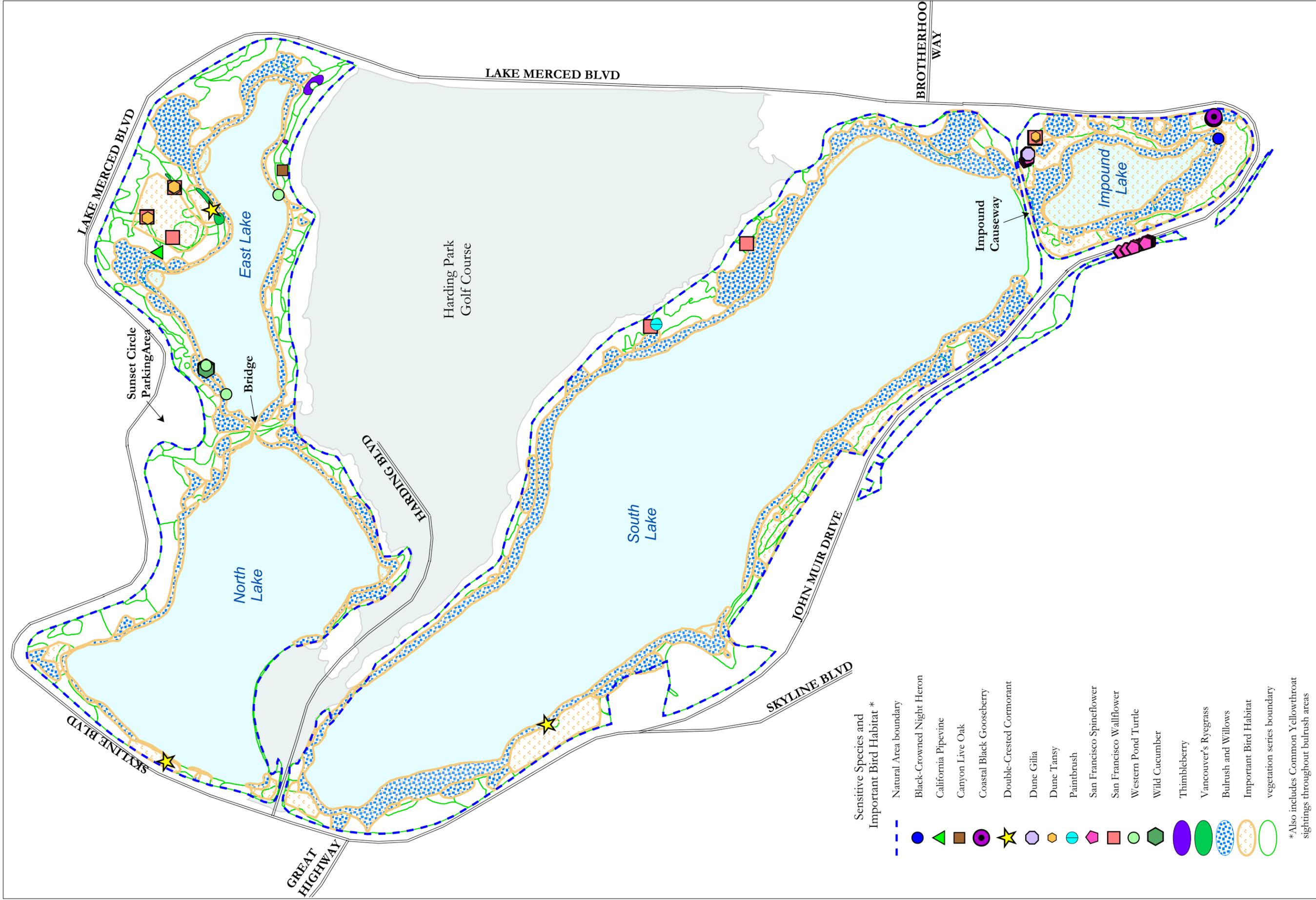
Source: San Francisco Planning Dept., Streets, February, 2000; and EIP Associates, Digitized Vegetation, 2000; natural area boundary determined by San Francisco Natural Areas Program, 2005. Projection: CA State Plane Zone III, NAD 83, Units Feet.
 PROJECT NUMBER: 10108-01G
 Created by: KL, 12/22/00 for DE.
 Revised 5/08/02 and 6/10/05 by D. Dwyer.



Vegetation Subformation and Series

Annual Grassland	Native Forest	Non-native Scrub	Other	Perennial Grassland
AB ripgut brome grassland	TC coast live oak forest	IF french broom scrub	OB bare ground	PP purple needlegrass prairie
AW wild oat grassland	Non-native Forest	IH himalayan blackberry scrub	OD developed	PS wildrye prairie
Central Coast Riparian Scrub	EA acacia forest	Northern Franciscan Coastal Scrub	open water	Wetland
RW willow scrub	EB blue gum forest	FA ca sagebrush scrub	Other Herb	WB bulrush marsh
Central Dune Scrub	EC cypress forest	FB ca blackberry scrub	HB bee plant herbaceous	WC cattail marsh
DY yellow bush lupine scrub	EC eucalyptus forest	FC coyote brush scrub	HC cape ivy	WK swamp knotweed marsh
Mosaic	EM mixed exotic forest	FL canyon live oak scrub	HE mixed exotic herbaceous	WR rush meadow
MA bee plant/ca blackberry mosaic	EP pine forest	FP poison oak scrub	HH poison hemlock	WV giant vetch marsh
MB bee plant/coyote brush mosaic	EQ plume acacia forest	FW twinberry scrub	HI iceplant herbaceous	— Natural Area boundary
MO iceplant/coffeeberry mosaic	ES prunus forest	FZ lizard-tail scrub	HN herbaceous nasturtium	— golf course
MQ giant vetch/ca blackberry			HP pampas grass	





Source: Census Tiger Database, Streets, June 30, 1997; and EIP Associates, Sensitive Species, and Vegetation, and GIS Program, November 28, 2000; natural area boundary and additional sensitive species data collected by San Francisco Recreation and Park Department Natural Areas Program, 2001 and 2005.

Created by: KL at EIP 2000; revised by D. Dwyer, San Francisco State University Institute for GISc, October 13, 2005.

FIGURE 6.1 - 8

SENSITIVE SPECIES AND IMPORTANT BIRD HABITAT

Lake Merced

Significant Natural Resource Areas Management Plan
San Francisco, CA



Mgmt Area	Action
MA-1a	• Maintain tule marsh wetland
MA-1b	• Maintain trees for cormorant colony and heron nesting
MA-1c	• Maintain dune scrub with open sand
MA-1d	• Augment sensitive plant populations
MA-1e	• Relocate DPA, keep open and monitor in interim
MA-1f	• Remove 3 small invasive trees
MA-1g	• Maintain open dune scrub with open sand
MA-1h	• Augment sensitive plant populations
MA-1i	• Remove 6 invasive trees
MA-1j	• Maintain dune scrub with open sand
MA-1k	• Augment sensitive plant populations
MA-1l	• Relocate DPA, keep open and monitor in interim
MA-1m	• Maintain tule marsh wetland
MA-1n	• Maintain sparse dune scrub with open sand
MA-1o	• Augment sensitive plant populations
MA-1p	• Reinroduce sensitive plants
MA-1q	• Maintain willow scrub
MA-1r	• Augment sensitive plant populations
MA-1s	• Maintain and enhance western pond turtle habitat
MA-1t	• Consider short-term restrictions during western pond turtle breeding
MA-1u	• Remove approximately 10 invasive trees
MA-1v	• Maintain and enhance oak woodland habitat
MA-1w	• Maintain and enhance diverse coastal scrub with grassland and open dune gaps
MA-1x	• Augment sensitive plant populations
MA-1y	• Reinroduce sensitive plants
MA-1z	• Relocate DPA, keep open and monitor in interim
MA-2a	• Remove approximately 10 invasive trees on steep slopes
MA-2b	• Maintain and enhance a mixed forest (cypress, oak, toyon) and native scrub
MA-2c	• Allow for cypress recruitment
MA-2d	• Augment sensitive plant populations
MA-2e	• Reinroduce sensitive plants
MA-2f	• Consider development of an lake overlook

Mgmt Area	Action
MA-2a	• Remove approximately 5 invasive trees
MA-2b	• Maintain and enhance open dune scrub with open sand
MA-2c	• Augment sensitive plant populations
MA-2d	• Reinroduce sensitive plants
MA-2e	• Remove approximately 100 invasive trees on slopes and in wetlands
MA-2f	• Maintain and enhance mixed forest and oak woodland
MA-2g	• Maintain views
MA-2h	• Augment sensitive plant populations
MA-2i	• Reinroduce sensitive plants
MA-2j	• Consider development of new trail
MA-2k	• Maintain and enhance coastal scrub
MA-2l	• Augment sensitive plant populations
MA-2m	• Reinroduce sensitive plants
MA-2n	• Maintain and enhance grassland with open sand
MA-2o	• Augment sensitive plant populations
MA-2p	• Install signs requesting boaters keep 30 ft from wetlands
MA-2q	• Maintain and enhance urban forest
MA-2r	• Allow for recruitment of invasive trees
MA-2s	• Maintain and enhance mixed forest-grassland mosaic
MA-2t	• Allow for recruitment of invasive trees

Natural Area Wide Management Actions

- Reduce and contain herbaceous and woody weeds
- No invasive tree removal unless specified above
- Prevent recruitment of invasive trees unless specified above
- Total trails to remain (including possible new trails): 8,152 linear-feet
- Provide access on designated trails only
- Social trails subject to closure
- Total invasive trees to remove: 134; total invasive trees to remain: 11,866
- Implement erosion control as require (GR-12)
- Implement wildlife enhancements as appropriate
- Discourage animal feeding (GR-14c)

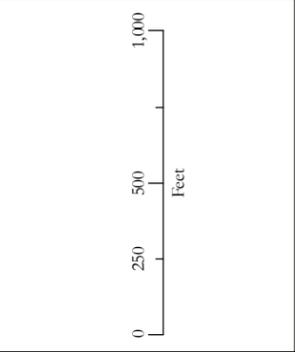
Management Areas

- management area 1
- management area 2
- management area 3

Trails

- primary
- secondary
- proposed

FIGURE 6.1 - 9
MANAGEMENT AREAS
AND TRAIL PLAN
Lake Merced
 Significant Natural Resource Areas
 Management Plan
 San Francisco, California



Source: Management areas and trails data collected by San Francisco Department of Recreation and Park Natural Areas Program (NAP), 2005; trails data digitized by San Francisco State University Institute for GISc (SFSU IGIS), 2005; streets data excerpted from Environmental Systems Research Institute (ESRI), Inc.'s StreetMap 2000 data copyright ESRI 1998-2001; aerial photography San Francisco Department of Public Works, 2002, Orthophoto - San Francisco - 1-foot resolution - 2001; all data are in California State Plane Zone III projection, NAD 1983; map produced using ArcGIS 9.0 software by ESRI.

Map created May 30, 2005 by Debra Dwyer, San Francisco State University, Institute for Geographic Information Science; revised October 13, 2005.

