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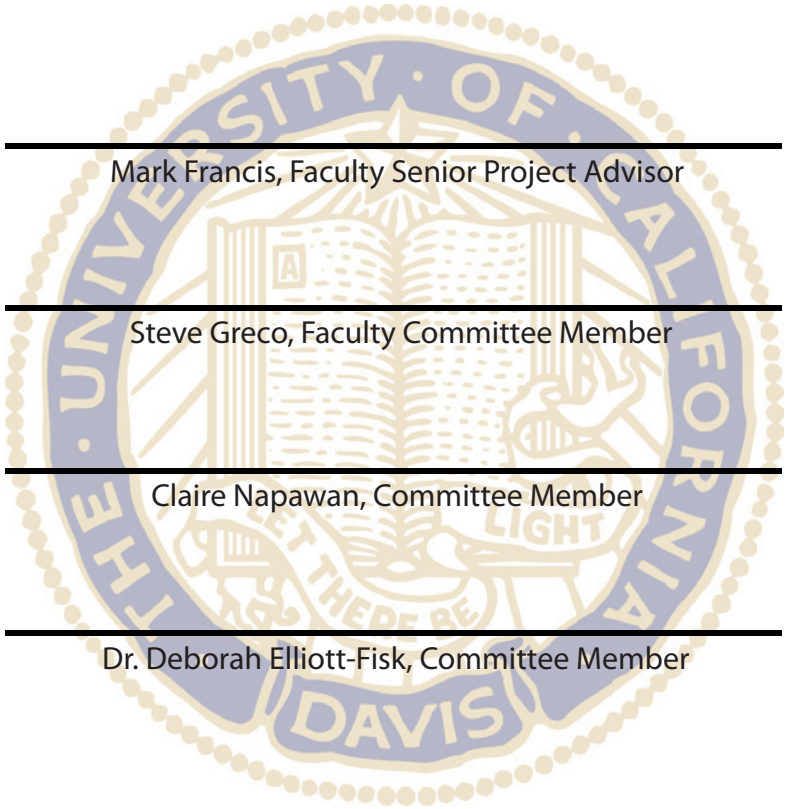
A Senior Project Presented to the
Faculty of the Landscape Architecture Department
of the University of California, Davis
in partial fulfillment of the requirement for the
Degree of Bachelors of Science in Landscape Architecture

Accepted and Approved by



Mark Francis, Faculty Senior Project Advisor

Steve Greco, Faculty Committee Member

Claire Napawan, Committee Member

Dr. Deborah Elliott-Fisk, Committee Member

The last mark I hope to make in our Landscape Architecture program is to show that a natural environment can co-exist in a reputably urbanized region. Southern California, specifically Orange County, is where I grew up and throughout the years, I have witnessed concrete lots and open spaces transform into shopping malls, car dealerships, housing tracts and small parks throughout the county. To visitors and those not native to Orange County, the notion that a natural environment still exists is very unlikely.

However, when I was in third grade, I had the unique opportunity to visit an estuary called the Upper Newport Back Bay Nature Reserve located in Newport Beach. I learned the importance of tide habitats for plants and animals, how humans created endangered species, and several ways we could help save the Earth. It was a memorable field trip because it was my first hands-on experience in a delicate habitat, and even in my third grade mindset, I began to be more aware of how human actions affect the Earth. It was from that field trip that I learned to be more conscious of my surroundings.

Fourteen years later, with the knowledge that I have gained through education and from the landscape architecture program, I am given a chance to make a difference. This project is important because I want to demonstrate how humans can affect delicate habitats and those who inhabit them. The Upper Newport Bay Nature Reserve and Ecological Reserve is only of the few remaining coastal habitats in Southern California, and while it does receive attention from visitors and the community many are not aware of the negative impacts they bring to the estuary.

For this project, my goal is to design a boardwalk for one of the most visited and heavily impacted areas located in the northeastern portion of the estuary, the West Bay. Throughout the boardwalk educational boards will explain the effects of human activity with before and after photographs and facts about the plant and animal species that inhabit the estuary. From my boardwalk design, my goal is to create a sense of importance and caution that visitors and the community should take when entering the estuary.

edicati n

This project is dedicated to my parents *for their relentless support in my education, career path and sometimes even my "dangerous" hobbies. I would also like to thank them for never limiting my talents, for allowing my spirit to thrive, and* ***for giving me the ability to see beauty in ordinary things.***

ckn wled e ent

I would like to sincerely give thanks to…

FACULTY & COMMITTEE MEMBERS

Mark Francis for listening and helping with my early dilemmas, looking over my draft report, and for giving the seniors a chance to show everyone their creativity and professionalism through this final project.

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Matt Yurko, California Coastal Commission Restoration Education Project Coordinator from Upper Newport Bay, for giving me a thorough tour of the West Bay, answering all of my questions and giving me helpful information.

Sue Stoffel, OC Parks North Coastal Operations Resource Specialist, for providing with an incredibly detailed aerial photography and for always being super smiley.

SUPPORT CREW

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Leo Aquino for giving me super helpful Photoshop tips, keeping me sane and on track for the past seven months and ten days, and for the love and laughter.

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List of Figures cont.

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The conservation and rehabilitation of natural habitats is crucial in maintaining *a steady rhythm of life for all species of animals and plants. With increasing urbanization and a rising population count, habitats that were once home to species are now endangered or nearing extinction.*

Upper Newport Bay is an estuary environment where salt water and fresh water meet, creating a unique environment for species of animals and vegetation, and is also an important winter stopover for migratory birds. (Newport Bay Naturalists and Friends)

Since the estuary is surrounded by urban development, the conditions of the site have gradually worsened over the past few decades. Its prime location serves as a popular recreation spot, home to activities such as hiking, cycling, canoeing, kayaking and fishing. However, due to the integration of human activities in such a delicate natural environment, the structure and function of the estuary has taken a toll. The area suffers from high runoff from storm water, soil compaction from visitors, and heavy erosion from silt settlements and heavy foot traffic. Habitats are in danger of being disturbed or destroyed due to unprotected and unmarked territories where animal species take refuge. The effects of these problems threaten to alter the structure and functions of the site into a marshland in the future if restoration and conservation projects are not put into place soon. (Newport Bay Naturalists and Friends)

One of the most prominent problems that is directly affecting the West Bay is the inappropriate public use of the bluffs. Visitors often wander away from established trails and create unauthorized trails of their own on steep slopes and along sensitive wetland habitats (Newport Bay Naturalists and Friends). Since there is so system of trails directly leading to the wetlands visitors are often found running at the wetland's edge or allowing their dogs to run free without a leash. Without knowing these trails created by visitors erode the steep slopes and destroy the system of wetlands and habitats, and further affect the status of endangered species that dwell in the reserve.

The focus of this project will be combating the problems surrounding the West Bay with a board-walk design along the wetland's edge. The boardwalk and trails will be strategically planned and designed to minimize the amount of harmful effects towards the habitats, while also providing visitors the chance to view nature one on one.

"In the name of the people of the State of California, so that this and future generations may continue to have, to use and enjoy the priceless heritage of the wildlife resources, the Upper Newport Bay Ecological Reserve is hereby dedicated."

Ecological Reserve State Dedication
California Department of Fish and Game,
April 11, 1975

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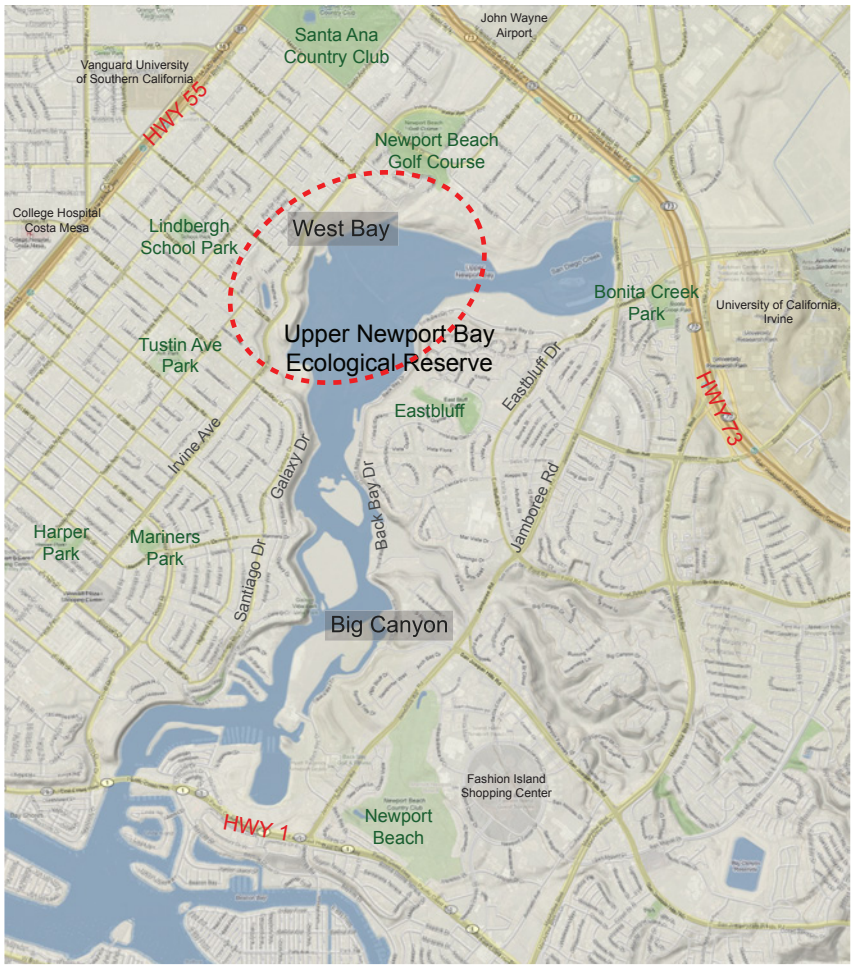
The Upper Newport Bay Nature Preserve and Ecological Reserve is located in the city of Newport Beach, Orange County in Southern California. Comprised of 900 acres, it is adjacent to the Pacific Ocean and numerous freshwater sources. The reserve is completely enclosed by major highways such Highway 1, Highway 55 and Highway 73. There are also several parks in nearby neighborhoods as well two golf courses, both of which are less than five miles away. Other public facilties include John Wayne Airport less than 5 miles north of the reserve, as well as UC Irvine, Vanguard University, the College Hospital of Costa Mesa and the Fashion Island Shopping Center. The reserve is completely bordered by streets such as Irvine Avenue, Back Bay Drive, and Galaxy Drive. From the figure 1.1, one can easily conclude that the reserve is heavily surrounded by urban development.

The focus area of the project, the West Bay is located in the northwestern region of the reserve where a heavy amount of the marshland habitats are located. It is also very close in proximity to the golf course which releases heavy amount of pollutants from its turf.



Site Context:
transportation circulation, green space, public facilities

Figure 1.1

Site Context

Figure 1.2. Site Context
Photo credit: Bruce Perry, Department of Geological Sciences, CSU Long

Site Context

Figure 1.3. Site Context
Photo credit: Bruce Perry, Department of Geological Sciences, CSU Long

Upper Newport Bay has a long history of early settlers and land entitlements. The earliest inhabitants of the bay were Gabrielinos, also known as the Tongva, a group of Mission Indians formed under the influence of Spanish colonization about two thousand years ago. They occupied lands surrounding Los Angeles County, Northern Orange County, and the islands of San Clemente and Santa Catalina. As the wealthiest and most advanced Indians in the Southern California region, they had great influence over neighboring tribes in terms of religion and trade. (Smith, 1998)

Figure 1.4. Picture credit: Friends of Ballona Wetlands

The earliest European explorer was Juan Rodriquez Cabrillo, a Portuguese explorer from Spain, credited with exploring the California coast in 1542. Cabrillo's expedition was followed by notable explorers Francis Drake in 1579 and Sebastian Vizcaino in 1602. During the age of exploration, Newport Bay was geographically open to the ocean which allowed for deeper depths and sandy ocean floors in the bay. The land surrounding the bay was comprised of marsh and swamp lands. (Smith, 1998)

During the 1700s, Spanish missionaries were established throughout California, spreading Christianity to Indians and other settlers. Findings of evidence in a village called Genga, where the baptism of Indians took place, show that Bolsa de Gengara was the first and earliest recorded name for the bay. During the 1800s, land around the bay was used by the missions and ranchos for grazing livestock. However, from 1823 to 1825, heavy floods carried sediments created from cattle grazing towards the coastline creating a sand bar that ultimately blocked the mouth of bay from

the ocean during low tides. Another major flood in 1862 brought heavy amounts of sediments that formed a sand pit now known as the Balboa Peninsula. The sand pit cut off the bay from the open ocean and allowed the accumulation of mud and sediments to form islands and marshlands. (Smith, 1998)

In the 1830s, the Mexican government transferred ownership of the ranchlands to private citizens and secularized the missions. In 1843, the parcel around the bay, known as Bolsa de San Joaquin was transferred to Don Jose Andres Sepulveda, who constructed a hacienda on the current Rancho San Joaquin Golf Course located northeast of the reserve. After facing land title defeats and the end of the Rancho Era, Rancho San Joaquin was sold to James Irvine and his partners for 37 cents an acre in 1876. (Smith, 1998)

The future formation of the Upper Newport Bay began when James Irvine bought out Rancho San Joaquin from his partners and surrounding lands, thereby owning the most amount of land-100,000 acres- in the region by 1876. In 1901, the Irvine Company obtained state patents to the north portions of the bay, and by the 1960s, plans were in progress for a massive residential and commercial marina along the upper bluffs and wetlands, though tidelands that were considered under public ownership are by natural law, common to all. After legislation set aside the tidelands under private ownership in 1957, the Irvine Company held their persistence for its development proposals, while the public faced the possibility of losing coastline access. To combat the Irvine Company's development plans, surrounding communities formed the Orange County Tidelands Association and the Orange County Foundation for the Preservation of Public Property. In 1969, these organizations along with the newly formed Friends of the Newport Bay, and a lawsuit filed by County Auditors, Fran and Frank Robinson in 1969, prevented the exchange of property between the Irvine Company and the County of Orange. The exchange would have resulted in loss of tide-lands and public beach access. Finally, on April 11, 1975, the State of California purchased the land from the Irvine Company, forming the Upper Newport Bay Natural Preserve and Ecological Reserve. (Smith, 1998)

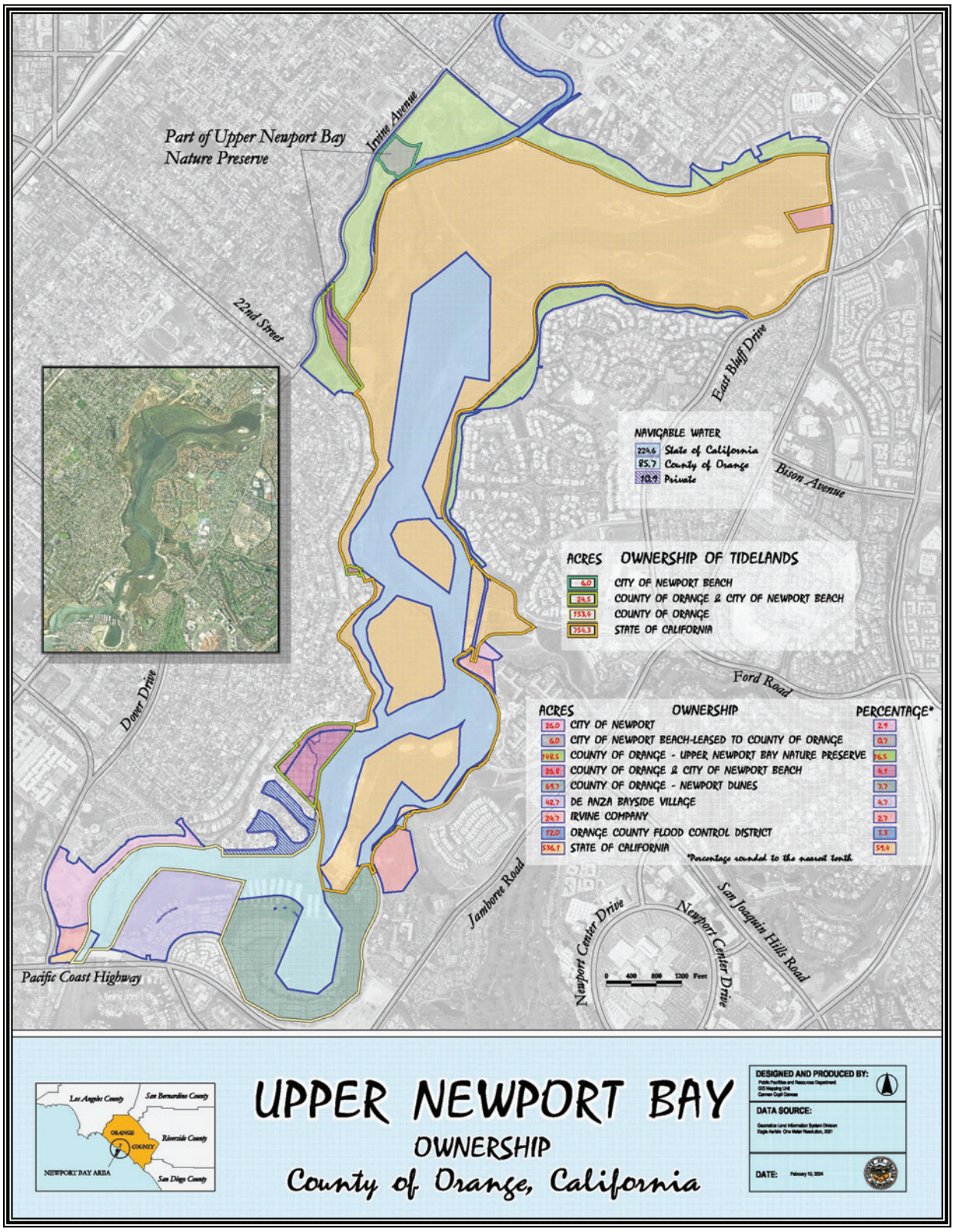


Figure 1.5. Ownership Map
Credit: County of Orange

ppe Newp t Bay Owne hip c nt.

Upper Newport Bay is owned by many agencies and organizations. Ownership is split between available water, tidelands and land acreage. The main owners of the lands comprised in the Upper Newport Bay are the California Department of Fish and Game, the County of Orange and the City of Newport Beach.

The California Department of Fish and Game owns about 536 acres of the 900 acres of Upper Newport Bay. This includes the bodies of water found in Upper Newport Bay and all of the tidelands, the land below the bluffs. Therefore, all of the ecological reserve is managed and belongs to the State of California.

Orange County and the city of Newport Beach owns all of the nature preserve found in the West Bay, East Bay and to the north totaling about 148 acres.

The Irvine Company now owns only 25 acres of the land found in Upper Newport Bay nearest the Newport Dunes.

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The Upper Newport Bay Nature Preserve and Ecological Reserve, comprising over 900 acres (Newport Bay Naturalist and Friends) of land, is home to one of southern California's unique environments. The nature preserve and ecological reserve is an estuary where freshwater from channels into the bay and mixes with saltwater from the ocean. The one-way flow of freshwater meets with the inflowing and outflowing saltwater creating complex currents that vary with the structure of the estuary, season tidal oscillations and winds (Smith & Smith 81). The mixing of these two very different water sources, called the brackish water transition zone, influences the estuary's salinity causing the same/varying levels of salinity vertically and horizontally (Smith & Smith 81). The salinity may be the same from top to bottom or may have layers of freshwater on top and a dense layer of salty water on the bottom (Smith & Smith 81). The least amount of salinity can be found near the mouths of freshwater inflows and the most can be found near coastal openings (Smith & Smith 81).

In an environment that combines both characteristics of freshwater and saltwater, animals and plants have had to adapt to conditions in order to survive. Aquatic organisms evolved physiologically or behaviorally in order to adapt to sudden changes with salinity levels in the estuary. Oceanic species of fish must adapt to tidal movements and during periods of low freshwater and high salinity. Since conditions in the estuary fluctuate on a daily basis, estuarine environments often have a low diversity of organisms despite high productivity. (Smith & Smith 81)

The mixing of freshwater and saltwater gives rise to many habitats in the estuary. As the two water sources meet, the current's velocity drops allowing sediments to deposit around the bay. The buildup of sediments creates alluvial plains that form mudflats, islands and salt marshes that are dominated by grasses and small shrubs that take root in these habitats. The nutrient cycling of these habitats differ from terrestrial, stream and marine habitats because it combines the elements of both freshwater and saltwater. (Smith & Smith 469)

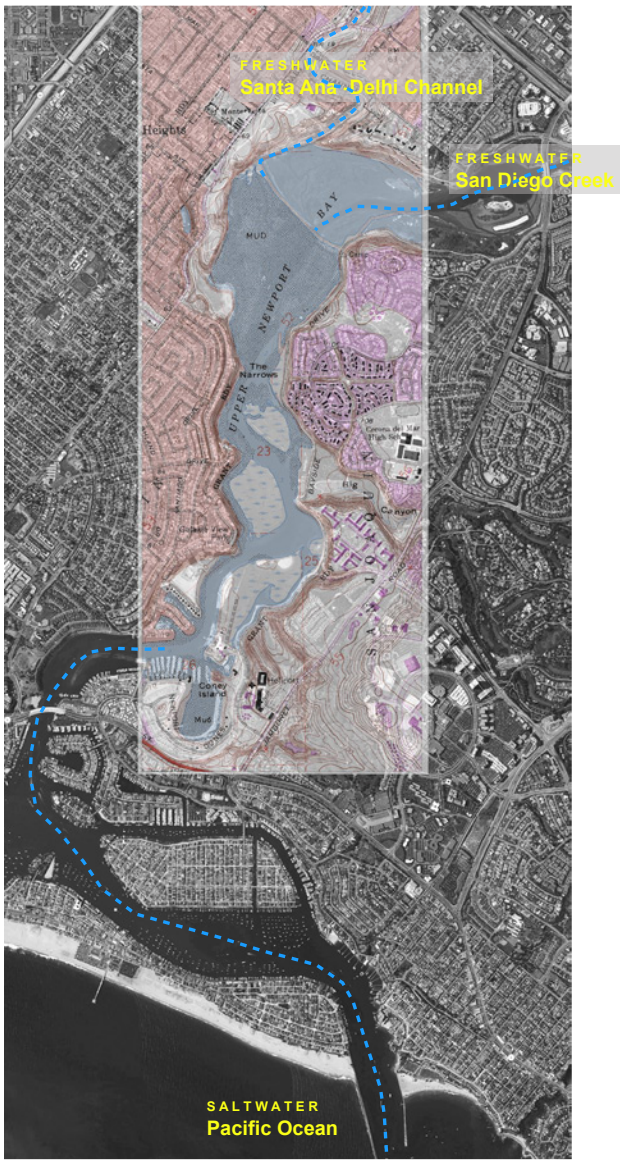


Figure 2.3.
Hydrology Map

Orange County is comprised of 13 watersheds including the San Diego Creek. San Diego Creek drains approximately 112.2 square miles and includes cities such as Costa Mesa, Irvine, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana and Tustin (Orange County Coastkeeper). Urban runoff collected from roads, sidewalks, parking lots, roofs, golf courses, construction sites, toxic wastes, etc get collected in the San Diego Creek and empties in the bay.

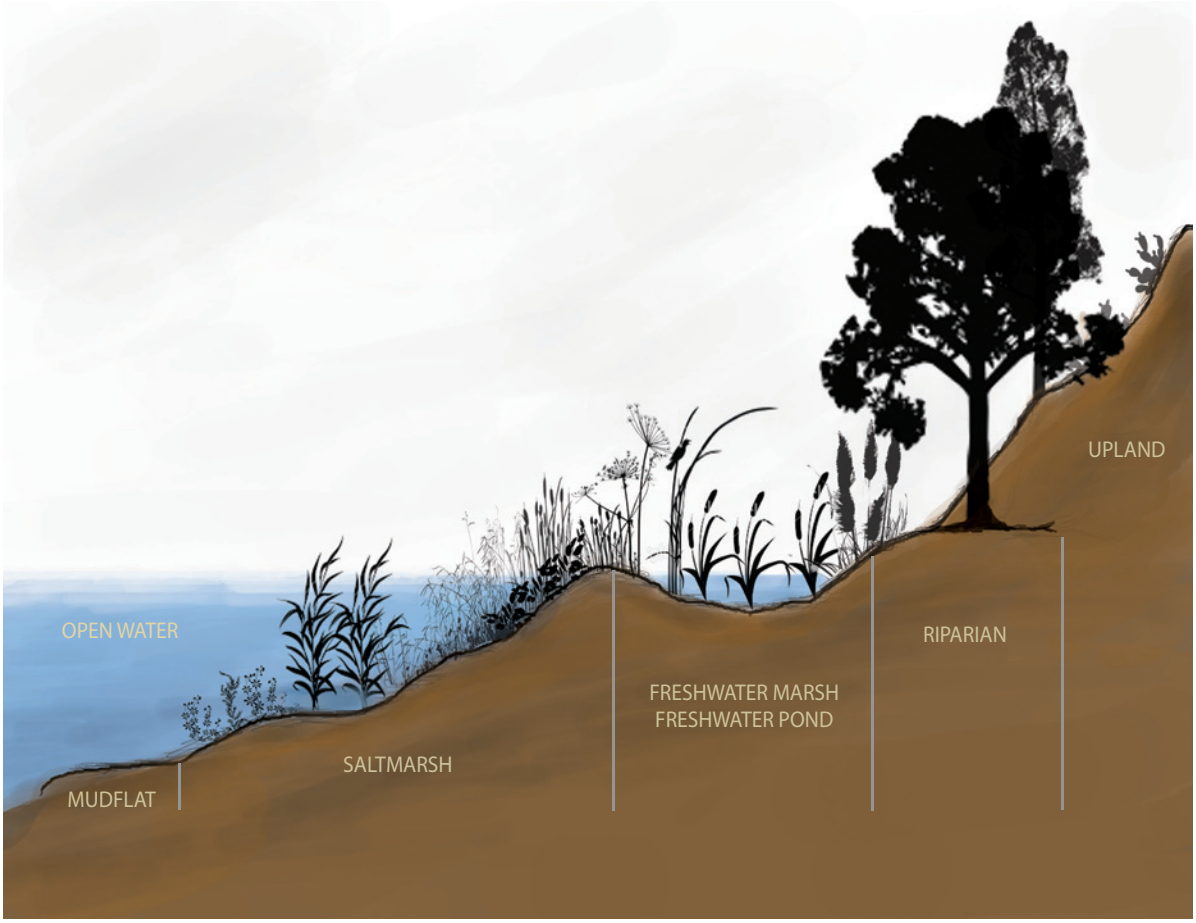
The other freshwater source is the Santa Ana-Delhi Channel, which covers approximately 17 square miles and is an artificial channel that collects water from the city of Santa Ana to Upper Newport Bay (Orange County Public Works).

Freshwater Sources

Figure 2.4. Freshwater Sources;Together, the San Diego Creek watershed brings in 80% and the Santa Ana-Delhi Channel brings in 15% of the freshwater supply into the bay with the remaining 5% from nearby tributaries (Orange County Public Works).
Photo credit: Bruce Perry, Department of Geological Sciences, CSU Long Beach

Saltwater Source

Figure 2.5. Saltwater Source; depicts the saltwater source, the Pacifice Ocean and the direction of travel through Upper Newport Bay.
Photo credit: Bruce Perry, Department of Geological Sciences, CSU Long



Estuary Habitat Succession

Figure 2.1. *above,* Habitat Succession; shows the habitat succession from upland bluffs to the open water channel and the possible types of vegetation. Figure 2.2. *left,* Habitat Aerial Photography; is an aerial photograph showing a portion of the Upper Newport Bay, especially the West Bay. The transition of habitats starting from the upland trails to the marsh, mudflats and open water is clearly visible.

Photo credit: Bruce Perry, Department of Geological Sciences, CSU Long Beach

Habitat cont.

A variety of habitats can be found in Upper Newport Bay. As shown in figure 2.1, a succession of habitats can be found starting from the upland along the bluffs all the way down to open water and marine areas. Each have their own characteristics that support a vast variety of flora, fauna, waterfowl and aquatic animals. They provide food supplies, nest grounds, roosting grounds and shelter for all species of wildlife found in the bay.

UPLAND

The upland habitats include the undeveloped areas, bluffs and cliffs in the bay. These slopes are abundant with the coastal sage and scrub plant communities. Some common plants include cacti, ice plants, bush sunflower, black sage, prickly pear, toyon, native grasses and various species of wildflower, as well as the threatened species of plant known as the Laguna live-forever which is found clinging to steep cliffs. A variety of animals including gopher snakes, lizards, red-tailed hawks, vultures, white-tailed kites and peregrine falcons, California ground squirrel, cottontail rabbit, raccoon, long tailed weasel, skunk, gray fox and on rare occasions, coyotes, are spotted in the upland habitats. (Smith, 1998)

RIPARIAN

The riparian habitat is of great importance to any body of water. It plays an important role in establishing a boundary line between the water's edge and any other disturbance such as urban development, and also acts as an importance corridor of species of animals that are dependent on migration. Riparian habitat brings organic and inorganic nutrients to the bay, and also provides refuge for birds and animals. Strands of large trees such as willows and cottonwoods, as well as mule fat, shrubs and freshwater vegetation are some of the few plants in this habitat. Common wildlife include bushtits, finches, hummingbirds, raccoons, tree frogs, fence lizards, bullfrogs and pacific salamanders. (Smith, 1998)

FRESHWATER MARSH/POND

Freshwater habitats are found in areas furthest away from the ocean. These areas are home to water-loving plants such as cattails, sedges and bulrushes that can tolerate mile to m/oderate salinity. Common birds observed in the freshwater marshes and ponds include cinnamon teal, pintail ducks, great blue herons, mottled plumage, song sparrows, yellowthroats, red-winged blackbirds. The pond turtle is another animal that dwells in the freshwater habitats. The plants found in this habitat provide great refuge for birds from prey and is also an abundant source of food. (Smith, 1998)

SALT MARSH/INTERTIDAL HABITAT

The saltmarsh and intertidal habitats are the areas of the estuary that experiences the most land and water changes. These habitats are areas inbetween mudflats and the high tide line. As high tides emerge along the shoreline, it brings with it killfish, goby, crabs, long-jawed mudsuckers and plankton-rich water. As the tide retreats back into the ocean, shorebirds scurry to take advantage of the food sources the high tides brought. Some species of birds observed includes long billed curlews, godwits, willets, western sandpipers, plovers, and dowitcher. (Smith, 1998)

MUDFLATS

Mudflat habitats get covered by high tides twice a day and dense mats of algae that thrive during the summer season. The algae is home to the polycharte worms, jackknife clams, horse mussels, and horn snails. (Newport Bay Naturalists and Friends)

OPEN WATER/MARINE

Open water habitats are areas of the estuary that contain permanent bodies of water throughout the year. During heavy storm seasons, these habitats are subject to a decrease in salinity due to fresh water runoffs. The saltwater loving creatures observed in these marine habitats include plankton, topsmelt, anchovy, mullets, halibut, croaker, basses, stingrays, bay rays, gray smoothhound shark, California brown pelicans, terns, grebes, commorants, buffleheads, ruddy ducks, pintains and canvas backs. (Smith, 1998)

The impacts of careless human actions, urbanization and global warming *have greatly affected wildlife around the world. Thousands of species are listed as endangered or nearing extinction around the world. The Upper Newport Bay is home to five species of waterfowl that take refuge in the bay that are currently listed as state or federally endangered. The acknowledgement of these species' mortality statuses has initiated efforts to save them from extinction. The endangered species found in Upper Newport Bay are the light-footed clapper rail, California least tern, brown pelican, Belding's savannah sparrow, and the coastal California gnatcatcher.*

Figure 2.6. Photo credit: iStockphotos

LIGHT- FOOTED CLAPPER RAIL

Rallus longirostris levipes

Status: State and Federally Endangered

In 2006, the Upper Newport Bay was home to 38.7% of the total state population of Light-Footed Clapper Rails, making it the prime breeding and nesting grounds for this species (Zembal, Konecny, Hoffman 9). The continued loss and degradation of the southern California and Northern Baja California coastal wetlands and abundance of cordgrass, an important plant used for nest building, continue to threaten the existence of this bird species (Newport Bay Naturalists and Friends). To save the light-footed clapper rail from extinction, several measures have been proposed by the California Department of Fish and Game. They include:

1) habitat restoration,
2) providing nesting site in marshes,
3) study and control predators,
4) develop guideline for captive breeding and segregate smaller populations,
5) reaffirm and improve management strategies of the ecosystem,

Figure 2.7. Credit: lamoustique/flickr

CALIFORNIA LEAST TERN
Sterna antillarum browni
Status: State and Federally Endangered

The California Least Tern's nesting grounds were historically found along the coastline of Southern California, which has been destroyed by beach go-ers who accidentally trample on eggs.The Upper Newport Bay is an important environment for the California Least Tern because many of the sandy islands are refuge for their nesting grounds, safe from the public. (Newport Bay Naturalists and Friends)

To prevent the California Least Tern from further extinction, plans to provide more effective management at existing habitat sites as well as plans to increase suitable nesting sites are proposed by the U.S. Fish and Wildlife Service.

Figure 2.8. Credit: Rodney Cammauf

BROWN PELICAN
Pelecamus occidentalis
Status: State Endangered

The careless use of pesticides contributed to the brown pelican's status as a state and federal endangered species in the 1950's. The effects of pesticides, primarily DDT, affect the pelicans' eggs making the shells too thin to incubate. Since the pelican feeds on aquatic animals, they too were also affected. When DDT was finally banned, the population of brown pelican began to improve and was federally de-listed in 1985. (Newport Bay Naturalists and Friends) However, its status as a California state endangered animal still remains. Efforts to improve the population of the brown pelican in California include maintaining existing populations in Mexico, and to provide undisturbed breeding and roosting areas and food supplies (U.S. Fish and Wildlife Service 74).

Figure 2.9. Credit: JED/Picasa

BELDING'S SAVANNAH SPARROW
Passerculus sandwichensis beldingi
Status: State Endangered

Similar to the light-footed clapper rail, the Belding's savannah sparrow is a year-round resident of salt marshes in southern California. Due to urban development, degradation and fragmentation of coastal salt marshes, the population of this bird species has decreased. Specifically to Upper Newport Bay, human and pet trespassing into marshlands and the lack of predator monitoring have contributed to the decline of the Belding's savannah sparrow. (U.S. Fish and Wildlife Service) Current efforts in the bay include removing invasive plant species, and land planning to control invasive plants are underway. Other recovery plans include dredging, which would result the creation of channels that can sustain salt marshes. (Zembal, Konecny, Hoffman 9)

Figure 2.10. Credit: silverbeam/photobucket

COASTAL CALIFORNIA GNATCATCHER
Polioptila californica californica
Status: Federally Threatened

The habitats of coastal California gnatcatchers are threatened by urban and agricultural development, wildfire and invasive plant species (Newport Bay Naturalists and Friends). Through Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), the U.S. Fish and Wildlife Service and the CA Department of Fish and Game have proposed a goal to increase the population of the gnatcatcher by selecting site for habitat restoration and improvement (U.S. Fish and Wildlife Service).

Though Upper Newport Bay's scientists and other specialists are aware of these species' critical needs, more has to be done to inform the public about how their actions can and will affect the mortality of these endangered species.

Non-native plants, or invasive species, make up 47% of the plants found in Upper Newport Bay (California Coastal Commission). Whether the plants were introduced unintentionally through seeds traveled by air or on visitors' shoes, or intentionally, they compete for the resources that native plants needs to stay healthy. Therefore, the removal of these plants is important in order to retain the plant diversity in the bay.

Figure 2.11.
black mustard
Brassica nigra

Figure 2.12.
yellow star thistle
Centaurea solstitialis

Figure 2.13.
myoporum
Myoporum laetum

Figure 2.14.
giant reed
Arundo donax

Figure 2.15.
ice plant
Delosperma cooperi

Photo Credits: Figure 2.11: Bruce Chambers, Orange County Register; Figure 2.12: USDA; Figure 2.13: PlantRight.com; Figure 2.14-Figure 2.15: Raphael

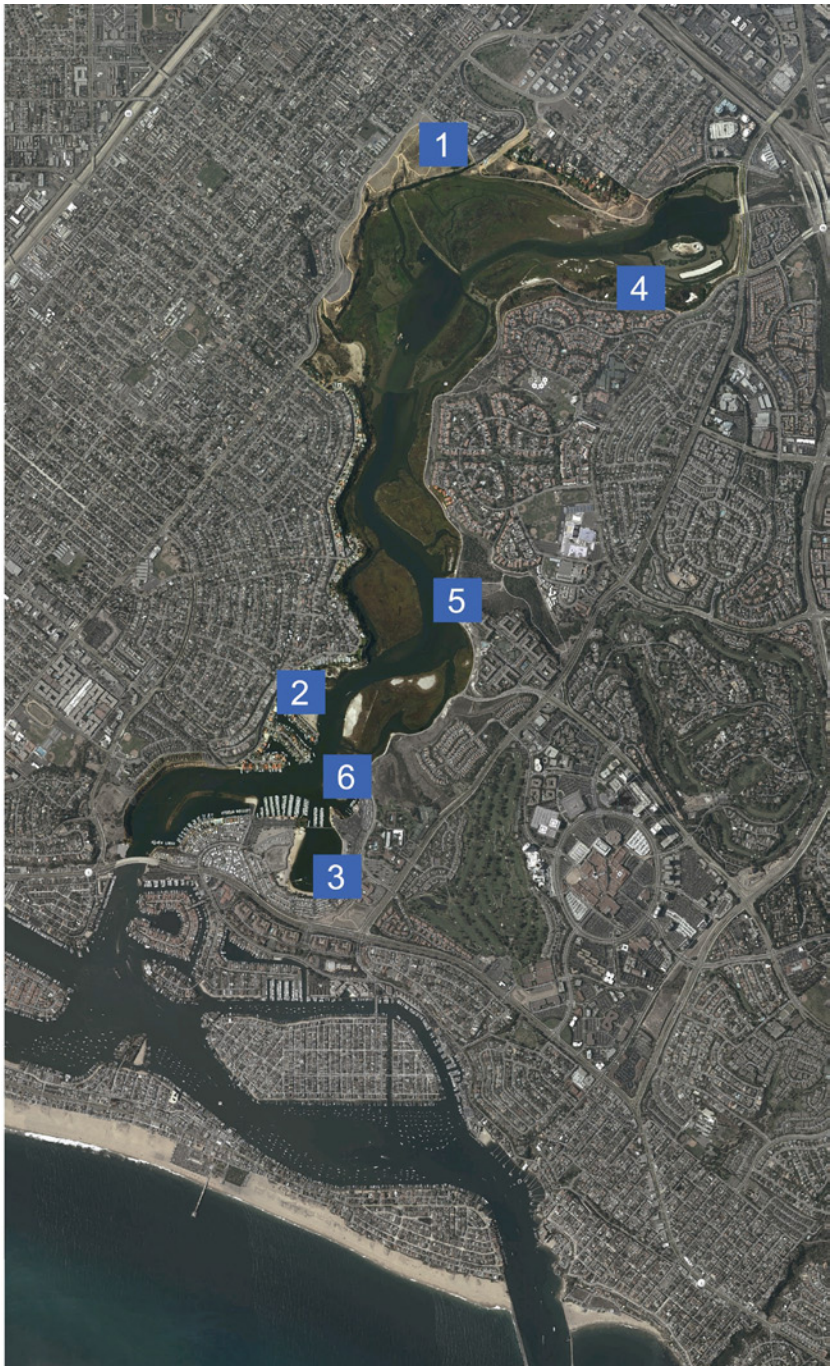


Figure 2.16. Points of Interest

Figure 2.17.

1 Peter and Mary Muth Interpretive Center

PETER & MARY RUTH INTERPRETIVE CENTER

The center aims to "promote and support the protection and preservation of California Coastal Wetlands through environmental education." The center provides visitors information about coastal wetlands and estuaries, and holds a variety of activities that children can enjoy.

The building's construction is made up of renewable materials such as sand, gravel and water obtained from nearby creeks, and 300 tons of 100% recycled steel rebar. The doors and windows are made up of laminated scraps leftover from mahogany and renewable wheat straw, while the carpets were made up of 100% post-consumer plastic containers. The interpretive center not only aims to educate the public about coastal wetlands and the estuary, but is also a role model in environmentally-friendly construction. (Newport Bay Naturalists and Friends)

Figure 2.18.

2 Newport Aquatic Center

NEWPORT AQUATIC CENTER

Founded in 1987, the Newport Aquatic Center is a non-profit corporation that offers a variety of water sports to including outrigger, kayaking, canoeing, rowing and dragonboating. Visitors may also kayak through the reserve with a naturalist. (Newport Aquatic Center)

Figure 2.19.

3 Newport Dunes Resort

NEWPORT DUNES RESORT

The Newport Dunes Resort is comprised of 110 acres of land located at the entrance of the nature reserve nearest the Pacific Ocean. It is home to a RV park, restaurants, camping sites; houses a variety of recreational activities including kayaking, swimming, sailboating and pedal boating; and holds events such as movie nights and holiday celebrations. (Newport Dunes)

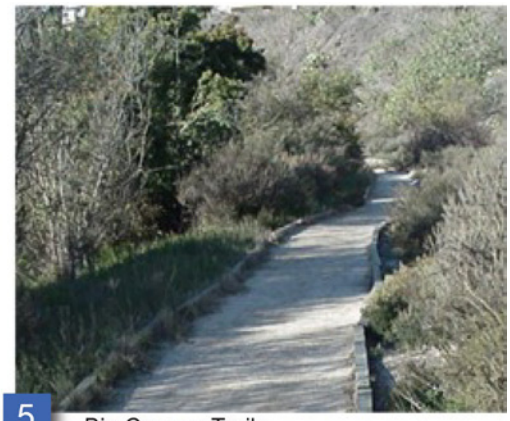
Figure 2.20.

4 Vista Point Friends Tours

VISTA POINT

Vista Point is home to a memorial dedicated to the estuary's local heroes, Frank and Francis Robinson, who were at the forefront of the battle to designate the bay as reserve in 1975. Their success brought more attention to its ecological preservation. A ceremony held on November 2008 was held to present a plaque to commemorate their efforts and success. (Newport Bay Naturalists and Friends)

Figure 2.21.



5 Big Canyon Trail

BIG CANYON TRAIL

Big Canyon Trail is the meeting site of a two-hour guided tour on the half-mile trail through the Big Canyon area of the reserve. On the tour visitors can learn about the plants, wildlife and marine life lead by a naturalist guide. (Newport Bay Naturalists and Friends)

Figure 2.22.

6 Back Bay Science Center

BACK BAY SCIENCE CENTER

The Back Bay Science Center is a state-of-the-art facility that provides students and the public hands-on experience with the bay's ecology, and to promote conservation and stewardship. An on-site water quality lab analyzes bacteria in water samples collected from local beaches and includes a teaching lab for students to work with top scientists. The 13,000 square foot facility was built through a partnership of the University of California Irvine, California Department of Fish and Game, the City of Newport Beach and the Orange County Health Care Agency. (Newport Bay Naturalists and Friends)

Upper Newport Bay Community-Based Restoration and Education Program

In efforts to restore habitat lands within the estuary, the California Coastal Commission's Upper Newport Bay Community-Based Restoration and Education Program works hand-in-hand to engage community involvement. The program works with the California Department of Fish and game; the Newport Bay Naturalists and Friends; and the Orange County Harbors, Beaches and Parks. (California Coastal Commission)

ROOTS

Every fourth Saturday of each month and on Stewards Days every Wednesday, volunteers participate in the ROOTS program which involves the removal of invasive plants which are hauled to a green waste facility. The sites that are eradicated of the invasive species are replaced with plants that are beneficial to the wetland and wildlife. (California Coastal Commission)

Our Wetlands, Our World

This program is part of the California Coastal Commission's high
school level curriculum structured to help teachers with activities that would link science concepts to local resources. By using Upper Newport Bay as an example, students learn about the history and ecology of the estuary as well as the effects of urbanization, loss of biodiversity, and the importance of community-based restoration. (California Coastal Commission)

Upper Newport Bay Estuary Awareness Day

A chance for community to learn the importance of estuaries. Guests have a chance to see sharks and rays found in the bay, visit the native plant nursery, take a guided tour on a boat and on a nature walk, learn about ways to protect estuaries and the environment. (Newport Bay Naturalists and Friends)

Newport Bay Naturalists & Friends Research Workshop

Newport Bay Naturalists & Friends "Fun-Raiser" Barbeque

Newport Bay Naturalists & Friends Movie Night

Newport Bay Naturalists & Friends and the Southern California Plein Air Painters Assoc.

Big Canyon and Back Bay Drive Nature Walks

Tideland Tots

Special Events:
Earth Day, Free Fish Day, Clean-Up Day, Habitat Restoration Days, Arbor Day
(events information source: Newport Bay Naturalists and Friends)

The importance of discussing and laying out these events is to show that the community is heavily involved in the Upper Newport Bay. There are events and activities that not only bring in visitors from surrounding residential neighboorhoods, but also from universities, schools and visitors from other cities. Many of these activities are available because they have an underlying principle that spreads the importance restoration, conservation and preservation. By getting the public involved such activities, more people would be aware of their actions when going about their activities in the bay, and how their actions can affect the well-being of the habitats and the wildlife that depend on them.

EOB E ON N N L

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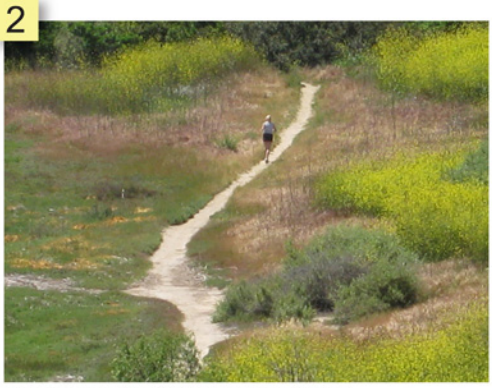
Figure 3.1. Problem Areas

trespassing on wetland habitat
soil compaction

Figure 3.2.



unauthorized trail along wetland edge

Figure 3.3.

unauthorized trail along wetland edge

Figure 3.4.

LACK OF DESIGNATED TRAILS

The main problem affecting the West Bay is the lack of designated public access leading to the wetland water's edge. For visitors who want to get closer to the water and wildlife, trespassing has become the main mode of access. When visitors stray away from established trails and onto unmarked territory, they disturb critical habitat lands by compacting the soil and vegetation, frightening wildlife, and may also carry foreign sediments and possibly invasive species onto the habitat lands. The effects of soil compaction affect the sediment deposition around the habitats and contribute to the erosion of stable soil strata. Also, since there is no system of trails leading to the water, visitors are observed bringing unleashed pets that may hard endangered and threatened species and their habitats.

decomposed granite erosion Figure 3.5.

compaction, crevasses from erosion Figure 3.6.

Figure 3.7

dangerously steep unauthorized trails created

E R O S I O N

A visible problem is the erosion of established and unestablished trails, especially those made up of decomposed granite, along the bluffs and slopes of West Bay. Many of the slopes are too steep and do not have a boundary separating them from habitat lands. During periods of rainfall, the decomposed granite runs down-slope and onto critical habitats which compacts the soil preventing the percolation of water through the soil. This stagnates and prevents further growth of plant species. Also, in some cases, the erosion of decomposed granite on authorized and steep unauthorized trails cause crevasses on the trails and poses as a safety hazard towards visitors.

introduced species of plants that do not belong in riparian habitat: palm trees, Figure 3.8.

vandalized information stand Figure 3.9.

INVASIVE SPECIES & VANDALISM

Other problems affecting an area of the West Bay are invasive species and vandalism. Evidence of the most obvious invasive species can be found near the mouth of the Santa Ana Delhi Channel inlet. As a designated riparian habitat, species of palm trees and other desert-like vegetation can be found thriving where those species normally should not be. It is likely that these species of palms and desert vegetation were thrown away or entered the riparian area through the Delhi Channel. Vandalism is a problem, though difficult to prevent, affecting the bay. Numerous educational signs and caution signs have been graffitied over causing unnecessary money that can be spent for more dire issues to fix the signs.

Figure 3.10. Site Analysis: terrestrial features

PUBLIC ENTRANCES

The West Bay's nature preserve has a total of 10 public entrances along the bluffs from established bike paths, parking lot and the interpretive center. The entrances are marked with yellow circles. These entrances are established by the County of Orange and are the only entrances that visitors are allowed to use to prevent access into lands undergoing restoration.

LOOK-OUT POINTS

Along the designated decomposed granite paths are 5 observed nature-viewing areas complete with wooden or stone seating, information stand and wired fencing to keep visitors from trespassing onto steep slopes and habitat lands. These viewing sites should only be accessible by established trails, though there are several visitor-created trails that run along the very edge of the bluff.

PARKING LOT

There is one parking lot located near the entrance of the interpretive center composed of decomposed granite. It was observed that cement was not used for the parking lot to prevent further runoff onto restored habitat lands and to prevent unnecessary drainage. There are two entrances into the preserve from the parking lot with enough parking spaces to accommodate guests. More parking is available along the street.

COMPACTED SOIL

Two major compacted habitats were observed located along the wetland's water edge. These two areas had visitors trespassing running along the edge of the water and with others allowing their dogs to run around freely without a leash. The compacted areas are noticeable from the bluffs because the green vegetation that should be there have been replaced with white compacted groundcover.

UNAUTHORIZED TRAILS

Many unauthorized trails were observed leading to the water's edge from the bluffs. These trails cut through marshlands, riparian and upland habitats. Visitors were observed running along these trails and walking with unleashed dogs. Some adults were observed with children who touched the water where waterfowl were less than 10 feet away.

C E E

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Upper Newport Bay is one of the few places in Orange County where ecotourism takes place. Ecotourism is tourism that draws attention to natural resources and in turn, aims to protect the attraction (Kusler). In the case of Upper Newport Bay, the natural attractions are the ecological reserve and nature preserve. To ensure the protection of the many habitats found in the bay, it is important that ecotourists are aware of their presence. One important aspect of ecotourism is that it can educate visitors with regards to the functions and values of the estuary.

So, how do you balance ecotourism and protect natural resources? The Upper Newport Bay has many attractions that bring visitors down from the bluffs and near the water's edge. While this may be enjoyable for the visitors, wildlife may be disturbed or have their habitats threatened by the presence of humans.

To combat the issue of visitors destroying delicate habitat lands and administering chaos against wildlife, facilities such as viewing platforms, trails and boardwalks can be implemented. These will provide access and a limit to where humans can physically immerse themselves in the natural environment.

A boardwalk is a structure that is common to wetlands because it provides visitors safer and easier access to the water, plants and wildlife that live there. More importantly, it prevents further harm towards the ecology of the wetland.

The following are three case studies that have influenced the design of my boardwalk system for the West Bay. These were chose because they have integrated human interaction with the envrioronment while meeting the needs of nature. They each have certain elements that make them distinguishable and very viable for public use.

NE REDMOND NEIGHBORHOOD PARK

NE Redmond Neighborhood Park located in Redmond, Washington. This 5-acre park of mostly undeveloped land has the elements that allow the public to gain access to natural areas and interact with the environment. Notable features of the park include main trails and spur trails that lead to a wetland habitat. The park's location along such a habitat provides its users the opportunity to learn more about the wetland, the environment and wildlife. The master plan calls for interpretive displays that contain information about the park's biodiversity and ecological setting, education opportunities that include water exploration and other environmental interaction, a boardwalk leading to the wetland with a viewing deck, and wildlife habitat management plans. (NE Redmond Neighborhood Park)

This park has many elements that inform the design of public access in the West Bay. An important aspect is how to allow the public to interact with the wildlife and habitats without disrupting the circle of life. To address this issue, the use of a boardwalk with a viewing deck allows the public to get close enough to the water without doing too much harm as long as they stay on the boardwalk. In order to make sure the public stays on the designated access trails and the boardwalk system, the use educational displays to inform the users of their negative impacts is a plausible strategy. Also, by using the boardwalk and the wetland as an outdoor classroom, children will be able to learn about the environment and be environmentalists.

CORKSCREW SWAMP SANCTUARY

The Corkscrew Swamp Sanctuary is an 11,000 acre natural system located in Florida and

contains the largest remaining virgin bald cypress forest in North America. To guide visitors around the forest, a 2.25-mile raised boardwalk was constructed through distinct habitats. The boardwalk winds through groves of trees and gradually transitions into different habitat zones such as forests, marshes, prairies and lakes. (Corkscrew Swamp Sanctuary)

The notable feature of the Corkscrew Swamp Sanctuary Boardwalk is that it takes visitors through many different areas to the nature system. In doing so, it gives them a sense of surprise and wonder as the boardwalk turns and goes through groves of trees. The fact that the boardwalk is raised also allows for animal movement underneath and also prevents the visitors from jumping off and wandering about by themselves.

THE HIGH LINE PARK

The High Line Park, located on Manhattan's West Side, is a unique public area suspended above ground. The park rests on abandoned railroad tracks built above ground, and while it features many amenities any ordinary park would have, many elements make it one-of-a kind. The wooden walking decks are structured so that visitors experience something new at each turn and curve. Plants of different varieties and color line the decks in no ordinary fashion adding aesthetic appeal and a sense of softness to the hardscape. Also, there are nine areas of interest that provide visitors new experiences and things to explore. (The High Line Park)

This park provided innovative ideas to the boardwalk design that points out that it does not have to be an ordinary wooden deck lined with handrails. By lining the deck planks in a vertical fashion and in a staggered order, plants can be added in-between the planks to add a sense of softness to the boardwalk. The addition of plants also adds aesthetic appeal, and the boardwalk's sudden turns and curves provides visitors something new to see instead of looking forward to a straight path. These design ideas can be seen in the second boardwalk option.


BO L E GN
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Designing public access in an environment such as Upper Newport Bay, particularly the West Bay, involves a heavy amount of research. The boardwalk would pass through three to four different habitat zones depending where one would be standing. Therefore, prior to the design phase, it is important to take into consideration

1. the structure and function of an estuary;
2. ecological and social significance;
3. the flora and fauna that dominate the site;
4. endangered species and species of concern;
5. current issues facing the site;
6. the relation of the site to the community;
7. different uses; the areas that receive the heaviest foot traffic;
8. how visitors interact within the site, including the negative impacts;
9. environmentally-safe materials and budget;
10. the agencies and groups that own the land.

By taking into consideration these factors, the next step is determining possible entry, viewing points and pathway of the boardwalk. It is important to develop a thorough site analysis in order acknowledge the current uses of the site, the areas negatively impacted by human use, the areas of interest such as water bodies, and habitat areas to avoid.

Safety is a huge concern because very steep bluffs surround the estuary, so determining the areas where the slopes are steep and flat are very crucial.

The design of the public entrances includes two options. The first option is a more standard design with some added features, and the second option is a more innovative approach to a boardwalk design. I only included very conceptual drawings that are not to scale, but purposely show how the boardwalk and viewing platforms would be integrated in the marshland and along

the bluffs. The design follows the curvature of the bluffs so it will minic the non-linear characteristic of the landscape in hopes of connecting it to the environment and provide visitors different sights with each turn.

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The overall process for the boardwalk system includes:

1. Researching the elements of a boardwalk
2. Identifying steep and flat areas for safe entry from top of bluff to marshland
3. Strategizing route and length of boardwalk, and taking into consideration areas of interest and sensitive habitats to avoid.
4. Identifying best scenic viewing areas
5. Identify uses of boardwalk
6. Add amenities and educational displays
7. Create options for materials and provide cost estimates

PURPOSE

- used to educate the public about the fragility and importance habitats
- used to establish support for protection and restoration
- facilitate safe bird watching and ecotourism
- create an outdoor classroom for science education
- prevent unauthorized access into habitats
- prevent disturbance of animal and plant species

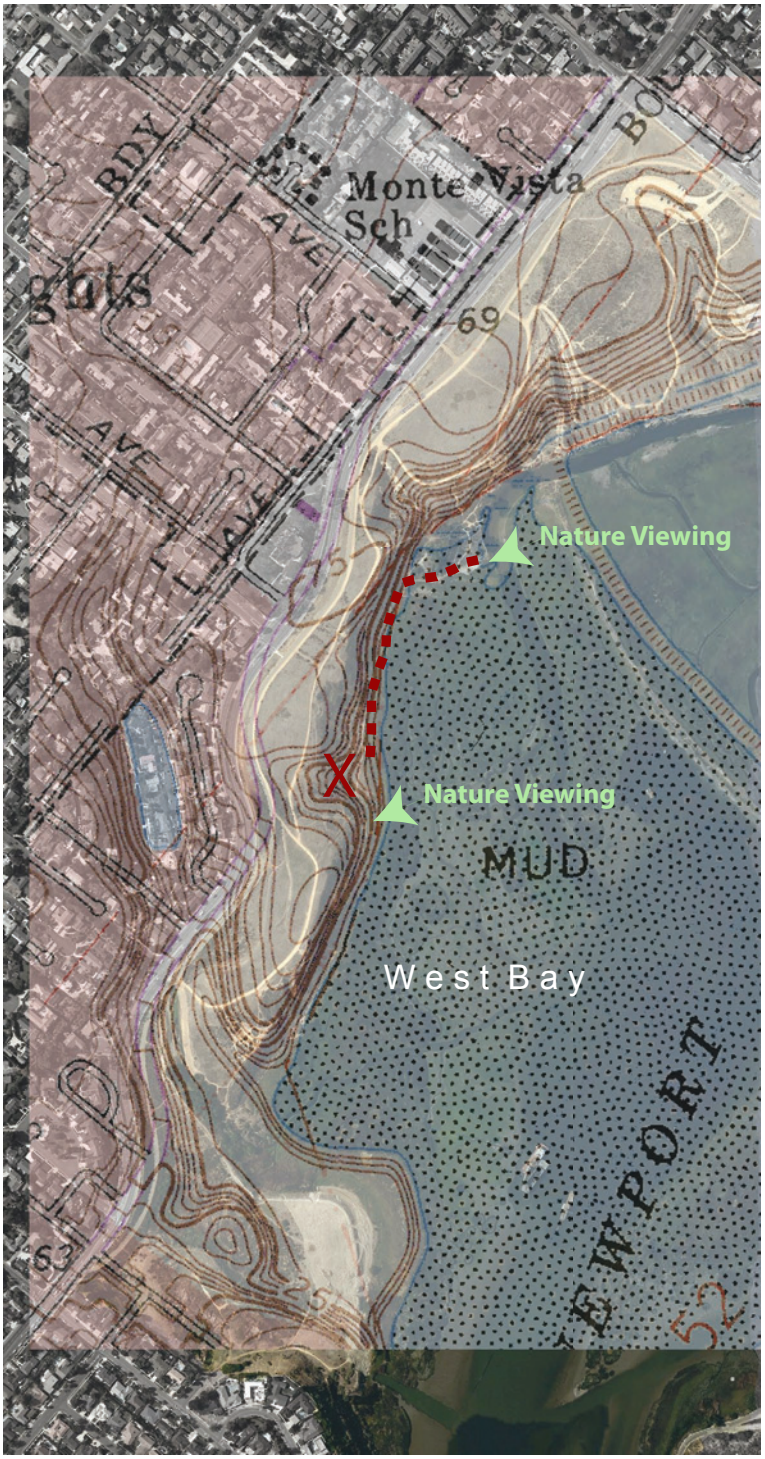
KEY ELEMENTS

- connection to nearby trails or parking
- provide map and explanatory materials
- signage for marking points of interests
- informational brochures
- deck to cover sight of visitors' feet to prevent animal fright

DESIGN CONSIDERATIONS

- the location, length, width and height
- should consider any species conservation plans and design around them
- should bring visitors in contact with interest points and areas that showcase a variety of
- habitats and biodiversity
- strong enough to support the weight of many visitors while anticipating varying loads
- include additional featured such as viewing platforms or observation decks to allow nature watching
- should be made out of material that will not deteriorate and can withstand flooding, wave movement and temperature extremes
- have railings and fences that cover foot traffic to prevent the starling of nearby birds
- incorporate elements that bring surprise such as curves and other architectural interests

* source: Kusler, 1993.



legend

X start / end points

boardwalk

nature viewing platform

Figure 5.1. Boardwalk Location: proposal

Boardwalk Location: Proposal cont.

Figure 5.2 shows the proposed location of the boardwalk in the West Bay. Using a topography map, the areas with the steepest and relatively flattest slopes were identified. For the design it is important to know which areas will be easily accessible by people. Steep slopes would be dangerous for visitors to walk on since the highest elevation along the bluff is about 50 feet above sea level. Each line increment represents a 5-foot difference. From the map, the areas with lines closest together signify a steep slope. Therefore, the area located on the map with an "X" is the ideal entry and exit point for the boardwalk. Gradual slopes bring the possibility of creating a viewing platform that would have a stable foundation and provide safer opportunities for a staircase to lead visitors to the boardwalk.

Figure 5.2. Steep slope

The other areas of the bluff are deemed too steep and incredibly dangerous for visitors to even hike down on. Thus, this would be the argument for why there is only one entrance and exit point for the boardwalk. The slopes opposite from the "X" are not only too steep but are also comprised of coastal sage scrub communities and small riparian habitats. The existence of these habitats combined with steep slopes make it implausible for any construction and would highly refute the reasons behind the boardwalk's purpose.

The red dashed lines represent the length of the boardwalk from the "X" to the water's edge. The path of the boardwalk follows the trails made by visitors who wandered off the trails on the bluffs above. These paths rest adajent to the bottom of the upland and near the riparian zones. and span the length of West Bay's bluff edge.

Figure 5.3. Steep slope

From the "X," the path of the boardwalk eventually ends near the edge of the water channel, Reasoning behind the boardwalk reaching the water's edge comes from observations of visitors often seen trespassing around there. The area closest to the water is also very compacted suggesting that vegetation growth is stunted and that is also receives heavy foot traffic. The extension of the boardwalk to the edge of the water also allows visitors to get close to the channel, but while also elevated enough, prevents them from causing harm to the ecosystem.

Figure 5.4. Steep trail

By looking at the topography map, ADA accessibility is not possible. The trails along the West Bay are constantly changing in elevation and some areas are incredibly steep. Therefore, the boardwalk will not be ADA accessible. In order to make it accessible for the handicap, the entire bluff and upland habitats will need to be heavily re-graded with extensive cut and fill. Doing so would cause unimaginable damage to numerous habitats, create sediment erosion and change the landscape ecology of the West Bay.

Figure 5.5. Ecological features

Figure 5.5. shows the location of the boardwalk's path in relation to the surrouding habitats. The pathway of the boardwalk avoids cutting into precious marshland and mudflats, and hugs along the foot of the bluffs. However, the path of the boardwalk rests near pockets of water in the marshland making it a point of interest. This provides opportunities for the public to learn about the habitats they see in the Upper Newport Bay.

Scenic Views

Figure 5.6

Figure 5.6 depicts the pathway of the boardwalk and the direction of scenic views from different areas. Walking in both directions, views span from the interpretive center and stretches towards the Pacific Ocean and vice versa. From the top of the bluff, panoramic views spanning for miles offer great views of the surrounding cities, public facilities and of Upper Newport Bay. Therefore, no matter where visitors stand on the boardwalk, they will be able to see something interesting and worthwhile, whether it's wildlife, naturalf habitats or scenic beauty.

The following pages will feature descriptions of the educational displays, the master plan and several conceptual perspectives for the boardwalk. As mentioned before, there will be two design options.

Option 1 features a more conventional boardwalk design. It be will integrated with the bluffs and have a pathway that be non-linear to allow visitors to enjoy more of the natural surroundings. A unique bench design will also be featured and will be carefully integrated in the bluff.

Option 2 features a more out-of-the-box boardwalk design. The pathway will also follow the curvatures of the bluffs, but the deckboard's pathway will designate the path. This means that boards will be cut in different lengths and constructed together to create an extremely non-linear pathway throughout the boardwalk. The non-linear formation will allow vegetation to grow around the boardwalk, and holes in the boardwalk will allow vegetation to grow through the boardwalk. This boardwalk concept plays around with the idea that vegetation can play an important role in integrating a man-made structure in a natural setting.

Both boardwalk designs will feature educational displays, binoculars, benches and trash bins. The boardwalk will be used as an outdoor classroom for students and researchers, bird-watching, photography, walking, running, sight-seeing, an escape from the hustle and bustle of everyday life, etc.

Though the boardwalk is meant to provide the public access to the marshland from the top of the bluffs, it is important that visitors also learn about the environment they are stepping into. Strategically laid out along the boardwalk will educational displays that serve the purpose of informing the public the purpose of the boardwalk, providing an introduction to the estuary and its inhabitants, and informing users the effects of human impact in the estuary.

These educational displays are meant to be a self-guided learning tool for an outdoor classroom, the estuary. It is important for visitors to know that they are introducing themselves to the homes of wildlife and that they should more cautious as to not disturb the circle of life when they visit Upper Newport Bay and other ecological settings.

Each board has a different them meant that are meant to explain visitors what they are viewing and also include interactive flip-boards and spinning wheels for children.

The board themes are:

1. Introduction of Boardwalk
2. What is an Estuary?
3. Animals, Birds and Aquatic Species
4. Plants: Native Dwellers, Invasive Trespassers
5. Quiz Yourself: Activity to Review Information
6. Photographs to Highlight Scenic Sights
7. Effects of Human Interaction in Habitats

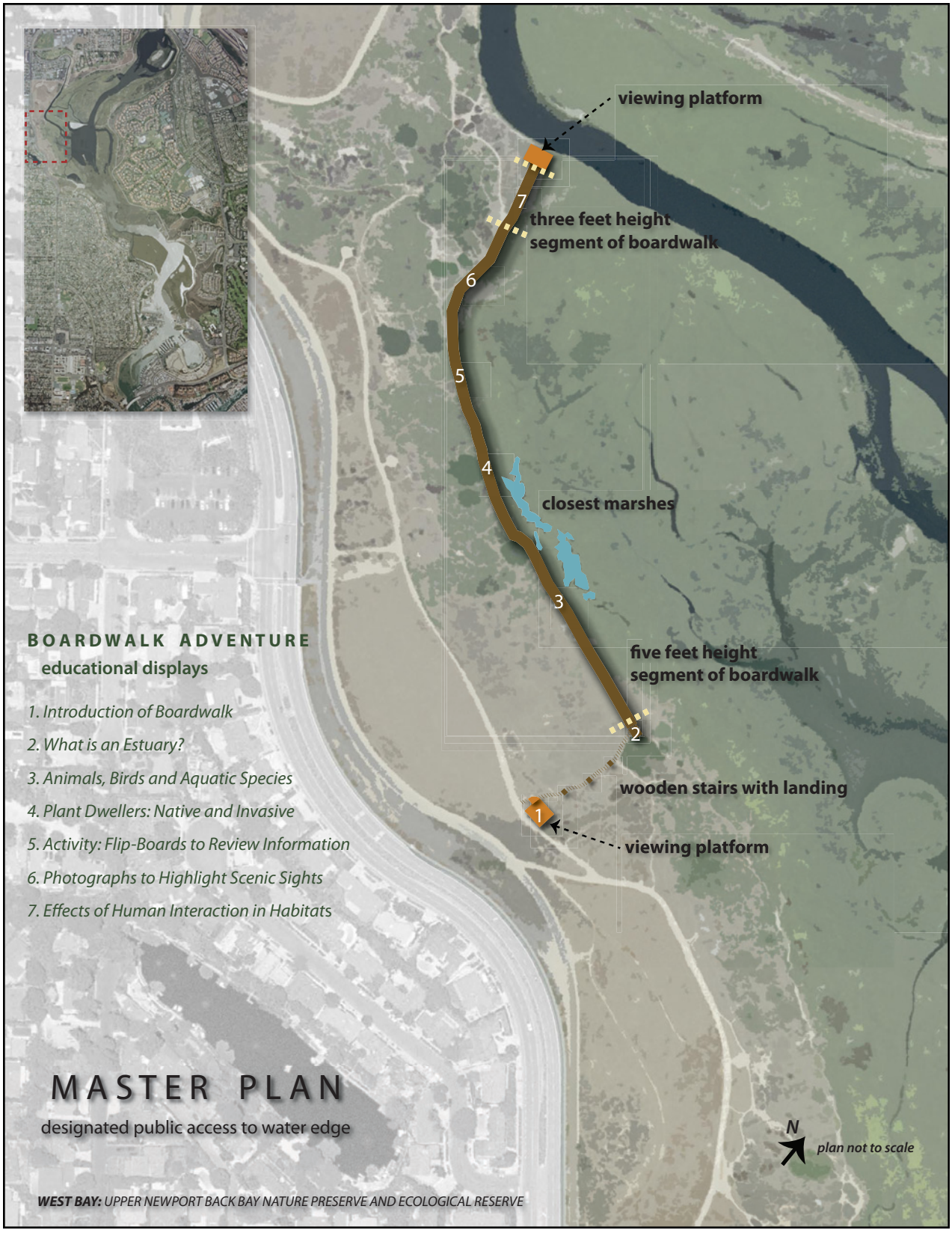


Figure 5.7. Master Plan

Figure 5.8. Viewing platform and stairs

Figure 5.8 is a conceptual sketch of the viewing platform and a stairway leading to the boardwalk. Though the viewing platform is drawn on the part of the bluff shown, the actual location of the platform is on the bluff is closer to the foreground. Since there was no available photograph of the actual location, the viewing platform was drawn for the purposes of showing the connection from the bluff down to the boardwalk. Wooden stairs will be the mode of access to the bottom, while landings will provide stopping points for those wanting to rest or catch a great view of the estuary.

The unique characteristic of the West Bay is that the height of the bluffs provides a huge advantage. It allows for a greater depth of vision from the viewing platform and makes it a journey for visitors whil climbing the stairs to get closer to the marshlands. While on the boardwalk, the height of the bluffs also provide a wall of colorful and exotic vegetation which adds aesthetic appeal.

Figure 5.9. Design option 1: perspective drawing

Figure 5.10. Design option 1: cross-section

Figure 5.9., option 1; depicts the design of the boardwalk in relation to the landscape. The pathway will mimic the curvature of the bluffs. Some portions of the boardwalk will right up against the bluff while other portions will be a couple of feet away to allow wildlife movement. For the portions against the bluff, benches will be provided and will be integrated in the landscape. This means that the bench will look as if it's melded into the bluff. Also on some portions, vegetation will be allowed to flow onto the boardwalk to create a sense of wild wilderness creeping onto the pathway. Rails will be placed along the edges of the boardwalk. The lower portion of the rails will be covered to prevent the sight of footsteps that would startle wildlife.

Figure 5.10., , option 1; depicts a cross section of how the bench will be "melded" into the landscape and the integration of the boardwalk with surrounding habitats.

Figure 5.11. Design option 2: perspective drawing

Figure 5.12. Design option 2: cross-section

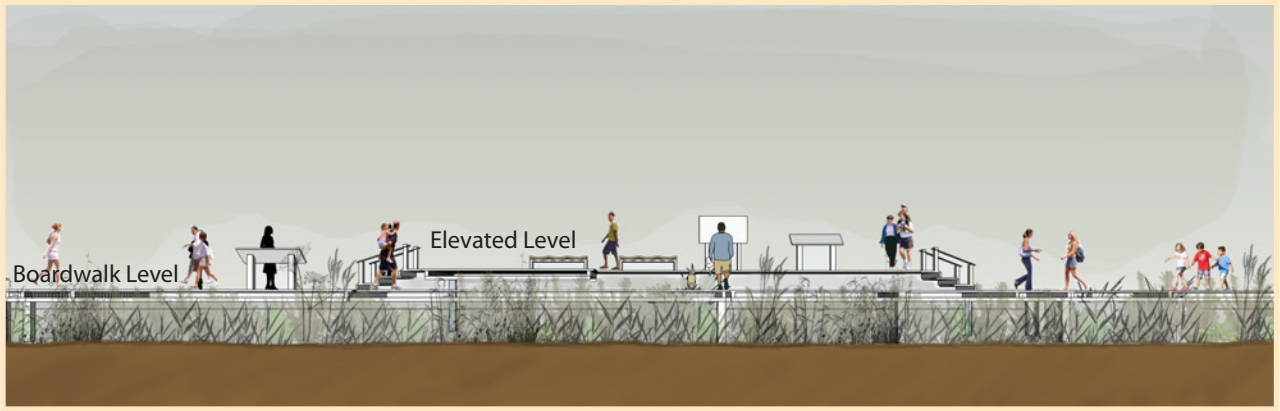


Figure 5.11., option 2; depicts the design of the boardwalk that allows for more human interaction and integration with surrounding vegetation. The design calls for a vertically-aligned boardwalk, rather than the conventional horizontal-alignment to fit with the theme of the boardwalk forward direction of travel. Several portions of the boardwalk will have uneven amount of deckboards to create aesthetic appeal and allow for sudden changes of movement direction. Also, areas of the deck will have holes to allow for vegetation to grow upward and create a sense of walking through a garden. The concept of vegetation integration tries to bring a more natural look to the boardwalk and can provide educational values.

Figure 5.12., option 2; depicts a cross section of the boardwalk from the side. Another feature of option 2's design is the concept of integrating elevation to the boardwalk. The elevated portion would feature educational displays, seating and add height to the boardwalk's flat surfacing. The space between the boardwalk level and the elevated level would have room for vegetation to grow through. Depending on the amount of vegetation surrounding the boardwalk, a handrail would be optional.

Figure 5.13., Viewing platform: cross-section

Figure 5.13., depicts a cross section of the boardwalk and the viewing platform near the water's edge. A short segment of the boardwalk leading to the viewing platform will not have handrails because the elevation of the boardwalk will be lower than the previous portion. There will be about a 2-foot difference in elevation change, so if heavy flooding occurs, the lower portion will need to be closed off for safety measures. The purpose of the elevation change allows visitors to get closer to the habitat but is also elevated enough that they will not be able disturb the surrounding ecosystem. The viewing platform will be located a couple of feet away from the water's edge to prevent visitors from touching the water. An educational display will explain how humans can harm habitats and the importance of restoration efforts.

This portion of the boardwalk will also allow visitors to get a view of lower Newport Bay and the beautiful landscape just before sunset.

Ne t tep : Mate ial and C t

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Deck Material	Pros	Cons
ECOPLASTIC RECYCLED PLASTIC source: Ecoplastic	• Made from 100% recycled plastics • Rot, mold, frost and vandalism resistant • Anti-slip textures • No paint or chemicals necessary for treatment • Lowest cost of annual maintenance • Estimated lifespan: 50-100 years	• Plastic expands when temperatures are hot and contracts when cold • Needs steel rods to strengthen support beams
PRESSURE- TREATED source: Lemley, Ecology Center	• Low initial cost • Able to withstand most weight • Lifespan: 15 years	• Contains a poisonous toxin-chromated copper arsenic-most used chemical for wood preservation • Heavy leeching from chemicals and paint • Disposal poses as an environmental problem • Heavy maintenance: old pressure-treated wood must be treated with sealant to lock in arsenic chemicals; wood needs 1-2 months to dry
COMPOSITE LUMBER source: ToolBaseServices	• Made from 50% wood fibers from saw dust and 50% waste plastics including polyethylene and PVC • More rigid than 100% recycled plastic because of extra reinforcement from wood fibers • Plastic binds wood together to prevent fungal rot • No need for paints and sealant • Best traction and surface roughness • Low moisture absorption and has resistance to decay and UV damage • Lifespan: 25 years	• Can absorb moisture and may not be completely insect resistant • Poor durability in freezing temperatures • Lower strength and stiffness than wood • Mold growth in high humidity
IPE WOOD source: Corkscrew Swamp Sanctuary	• Wood is very dense so chemical treatments are not necessary • Class A fire rating, on same level as concrete and steel • Heartwood is extremely resistant to fungi, decay and termites • Able to withstand extreme weight • Slip resistant in wet environment • Lifespan: 80-90 years	• Because of its durability, may be difficult to work with • Contains fine yellow dust that may cause dermatitis-allergic reactions and skin irritation

According to a document titled, "Constructing Wetland Boardwalks and Trails," by Jon Kusler, the cost of a boardwalk is as follows:

It costs $20 per lineal foot for a four-foot wide pressure treated boardwalk with eight-foot sections utilizing 4x4 pilings, 2x8 rafters and 2x8 decking with a two rail railing

For a six-foot wide boardwalk using composite materials, it costs $100 or more per lineal foot utilizing 8-foot section with 6x6 pilings, 2x10 rafters and 2x8 or 2x10 decking with railings, and consultation from professionals.

The boardwalk design for the West Bay is about 1225 feet in length and is about 8 to 10-feet wide. Thus it is safe to say that the amount can be at $200 per lineal foot by using the latter cost estimate of $100 per lineal foot of composite materials.

Therefore:

$200 * 1225 = $245,000

This is a very rough estimate for the cost of wood utilizing composite materials. Depending on the type of wood, it may be more or less. $245,000 does not include the cost of constructing stair steps, viewing platforms or amenities.

Newport Bay Naturalist and Friends is a non-profit organization that supports the protection of the Upper Newport Bay. To help reduce the cost of construction of the boardwalk, the organization may help raise money by explaining the delicacy and importance of the protecting the estuary to community members and commercial companies.

Within a few miles of the estuary, student organizations at the University of California, Irvine can fundraise and bring more awareness about coastal habitats to their student body.

C ncl i n

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While plans have been in place for the implementation of a boardwalk in the West Bay, there has been no further notice in the City of Newport Beach's public works or planning webpage about the solidification of the project. The longer these plans are put off, the quicker habitats will continue to deteriorate.

In designing a boardwalk system for Upper Newport Bay Nature Preserve and Ecological Reserve, I have learned, greatly, how even subtle human actions such as walking or running along undesignated trails can result in catastrophic consequences in the long-run. I hope that my boardwalk design will be practical enough in that it brings visitors safely down to the reserve and that is also educates them about the estuary's ecology. Many people are not aware of how their actions can affect every living thing, and by using the boardwalk to educate the public, they will not only be more cautious when traveling around Upper Newport Bay, but in also other natural settings.

I hope that further education about the bay, with the help of the boardwalk, will allow for its longevity, so even when every parcel of land has been constructed to everyone's liking, the Upper Newport Bay will remain a jewel amongst a sea of artificial concrete.

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INTERVIEWS

Questions:

1. What are some of the activities that you partake at the Upper Newport Back Bay Nature Preserve and Ecological Reserve?

2. At what times during the day do you usually visit this place?

3. Are there are improvements or changes that you wish to see or needs to be addressed?

4. Are you aware that the site is home to more than 200 species of wildlife including plants and birds?

5. What do you like most about the nature preserve?

Interviewee #1

Age: around 50

Name: Cherly Jaffe, Ambassador to Newport Bay

Sex/Ethnicity: female, Caucasian

Observed: walking dog near entrance of interpretive center

Time of Day: evening, 3-4pm after rain

1. Walking her dog
2. Anytime during the day for 30mins to 2 hours
3. Would like to see more balance between nature and humans; agrees with boardwalk idea
4. Very aware since she has an ambassador
5. Likes the interpretive center, the neighborhood watch program and working with the park rangers

Interviewee #2

Age: around 60

Name: unknown

Sex/Ethnicity: male, Asian

Observed: walking along bike path

Time of Day: evening, 3-4pm after rain

1. Jogging, walking
2. Everyday around 3-5 pm
3. No changes, likes the place for the way it is
4. Yes, has even seen a bobcat
5. Appreciates the fresh air

Interviewee #3

Age: around 50-60

Name: unknown

Sex/Ethnicity: female, Latino

Observed: walking dog along designated decomposed granite paths

Time of Day: evening, 3-4 pm after rain

1. Walking, playing tennis at the nearby YMCA
2. Everyday in the mornings, but since it rained in the morning, came out after rain
3. Would like to see drinking fountain
4. Is aware
5. Appreciates that there is such a place in the city

UPPER NEWPORT BAY PLANT LIST

Common Name	Latin Name	Plant Type
black willow	*Salix gooddingii*	tree/shrub
Brazilian pepper tree	*Schinus terebinthifolius*	tree
fan palm	*Washingtonia ssp.*	tree
Fremont cottonwood	*Populus fremontii*	tree
lemonadeberry	*Rhus integrifolia*	tree
Mexican elderberry	*Sambucus mexicana*	tree
Peruvian pepper tree	*Schinus molle*	tree
toyon	*Heteromeles arbutifolia*	tree/shrub
tree tabacco	*Nicotiana glauca*	tree
western sycamore	*Platanus racemosa*	tree/shrub
bladderpod	*Isomeris arborea*	shrub
brewer's saltbush	*Atriplex lentiformis ssp. Breweri*	shrub
bush mallow	*Malacothamnus fasciculatus*	shrub
California encelia	*Encelia californica*	shrub
coast prickly pear	*Opuntia littoralis*	shrub
Emory's baccharis	*Baccharis emoryi*	shrub
encelia, brittlebush	*Encelia farinosa*	shrub
four wing saltbush	*Atriplex canescens*	shrub
mulefat	*Baccharis salicifolia*	shrub
myoporum	*Myoporum laetum*	shrub
pampas grass	*Cortaderia selloana*	shrub
poison hemlock	*conium maculatum*	shrub
Russian thistle	*Salsola tragus*	shrub
sweet fennel	*Foeniculum vulgare*	shrub
white sweet clover	*Melilotus alba*	shrub
Australian saltbush	*Atriplex semibaccata*	plants with berries
California boxthorn	*Lycium californicum*	plants with berries
cheeseweed	*Malva parviflora*	plants with berries
poision oak	*Toxicodendron diversilobum*	plants with berries
white nightshade	*solanunm douglasii*	plants with berries
black mustard	*Brassica nigra*	plants with seed pods
Bur-clover	*Medicago polymorpha ssp. Hispida*	plants with seed pods
California poppy	*Eschscholzia californica*	plants with seed pods
California wild rose	*Rosa californica*	plants with seed pods
cocklebur	*Xanthium strumarium*	plants with seed pods
garden stock	*Matthoila incana*	plants with seed pods
sea rocket	*Cakile marittima*	plants with seed pods
Spanish broom	*Spartium junceum*	plants with seed pods
tansy mustard	*Descurainia pinnata*	plants with seed pods
wild cucumber	*Marah macrocarpus*	plants with seed pods
wild radish	*Raphanus sativus*	plants with seed pods

arundo	*Arundo donax*	grass
Blue-eyed grass	*Sisyrinchium*	grass
cordgrass	*Spartina foliosa*	grass
giant rye grass	*Leymus condensatus*	grass
pampas grass	*Cortaderia selloana*	grass
saltgrass	*Distichlis spicata*	grass
shoregrass, wiregrass	*Monanthochloe littoralis*	grass
alkali heath	*Frankenia salina*	halophytes
Australian saltbush	*Atriplex semibaccata*	halophytes
brassbuttons	*Cotula coronopifolia*	halophytes
brewer's saltbush	*Atriplex lentiformis ssp. Breweri*	halophytes
bulrush	*Scirpus californica*	halophytes
coast wolly heads	*Nemacaculis denudata*	halophytes
cordgrass	*Spartina foliosa*	halophytes
crystaline iceplant	*Mesembryanthemum crystallinum*	halophytes
dodder	*Cuscuta salina*	halophytes
Emory's baccharis	*Baccharis emoryi*	halophytes
four-winged saltbush	*Atriplex canescens*	halophytes
marsh fleabane	*Pluchea odorata*	halophytes
marsh rosemary	*Limonium californicum*	halophytes
pickleweed-Virginica	*Salicornia virginica*	halophytes
saltgrass	*Distichlis spicata*	halophytes
saltmarsh bird's beak	*Cordylanthus marittimus*	halophytes
saltwort	*Batis marittima*	halophytes
salty susan	*Jaumea carnosa*	halophytes
sharp-leafed rush	*Juncus acutus ssp. Leopoldii*	halophytes
shoregrass	*Monanthochloe littoralis*	halophytes
slender arrow grass	*Triglochin concinna*	halophytes
slender-leafed ice plant	*Mesembryanthemum nodiflorum*	halophytes
wild heliotrope	*Heliotropium curassavicum*	halophytes
yerba mansa	*Anemopsis californica*	halophytes

source: Newport Bay Naturalists and Friends

COMMON BIRDS

Geese & Ducks	Canada Goose, Brant, Gadwall, American Wigeon, Eurasian Wigeon, Mallard, Blue-winged Teal, Cinnamon Teal, Northern Shoveler, Northern Pintail, Green-winged Teal, Redhead, Greater Scaup, Lesser Scaup, Surf Scoter, Bufflehead, Ruddy Duck, Snow Goose
Loons	Common Loon, Red-throated Loon
Grebes	Pied-billed Grebe, Horned Grebe, Eared Grebe, Western Grebe, Clark's Grebe
Pelicans & Cormorants	American White Pelican, Brown Pelican, Double-crested Cormorant
Herons & Egrets	American Bittern, Great Blue Heron, Great Egret, Snowy Egret, Black-crowned Night-Heron, Green Heron
Diurnal Birds of Prey	Turkey Vulture, Osprey, White-tailed Kite, Northern Harrier, Cooper's Hawk, Red-shouldered Hawk, Red-tailed Hawk, American Kestrel, Peregrine Falcon
Rails	Clapper Rail, Virginia Rail, Sora
Gallinules & Coots	Common Moorhen, American Coot
Plovers	Black-bellied Plover, Semipalmated Plover, Killdeer
Stilts & Avocets	Black-necked Stilt, American Avocet
Sandpipers	Greater Yellowlegs, Lesser Yellowlegs, Willet, Spotted Sandpiper, Whimbrel, Long-billed Curlew, Marbled Godwit, Bar-tailed Godwit, Least Sandpiper, Western Sandpiper, peeps, Dunlin, Short-billed Dowithcer, Long-billed Dowitcher, Wilson's Phalarope
Gulls, Terns & Skimmers	Heermann's Gull, Ring-billed Gull, California Gull, Western Gull, Bonaparte's Gull, Caspian Tern, Elegant Tern, Forster's Tern, Least Tern, Black Skimmer
Dovers	Rock Pigeon, Mourning Dove
Owls	Barn Owl, Burrowing Owl
Swifts	White-throated Swift
Hummingbirds	Anna's Hummingbird, Allen's Hummingbird
Kingfishers	Belted Kingfisher

Woodpeckers	Nuttall's Woodpecker, Downy Woodpecker, Northern Flicker
Flycatchers	Black Phoebe, Say's Phoebe, Cassin's Kingbird
Shrikes	Loggerhead Shrike
Crows & Ravens	American Crow, Common Raven
Swallows	Tree Swallow, Northern Rough-winged Swallow, Cliff Swallow, Barn Swallow
Bushtits	Bushtit
Wrens & Wrentit	Cactus Wren, Bewick's Wren, House Wren, Marsh Wren, Wrentit
Vireos	Hutton's Vireo
Kinglets & Gnatcatchers	Ruby-crowned Kinglet, California Gnatcatcher, Blue-gray Gnatcatcher
Thrushes	Western Bluebird, Bushtit
Mockingbirds	Northern Mockingbird, California Thrasher
Starlings & Pipits	European Starling, American Pipit
Warblers	Orange-crowned Warbler, Yellow-rumped Warbler, Common Yellowthroat
Blackbirds & Orioles	Red-winged Blackbird, Western Meadowlark, Bullock's Oriole
Finches	House Finch, Lesser Goldfinch, American Goldfinch
Exotic Species	Black-necked Swan
Towhees & Sparrows	California Towhee, Spotted Towhee, Savannah Sparrow, Song Sparrow, White-crowned Sparrow

source: Sea and Sage Audubon Society