site are listed by Audubon as "Common Species in Decline". Examples of the Common Species in Decline documented at Hunters Point and Candlestick SRA are the Loggerhead Shrike which has declined 71%; the Greater Scaup which has declined 75% and Lark Sparrow which has declined 63%. Specific actions called for in the National Audubon report for protecting these species includes protecting local habitat, protecting wetlands, fighting global warming and combating invasive species. Some of these actions are being called for in this project. (*See* National Audubon Society, *The Audubon Watchlist*, http://web1.audubon.org/science/species/watchlist/browsewatchlist.php; *see also* National Audubon Society, *Watchlist Technical Report*, http://web1.audubon.org/filerepository/science/speciesprofiles/watchlist/files/TechnicalReport.pdf; North American Bird Conservation Initiative, *The 2009 State of the Birds*, available at http://stateofthebirds.audubon.org/cbid/browseSpecies.php).

Impact BI-6b (Construction at HPS Phase II would not have a substantial adverse effect, either directly or through habitat modifications, on any bird species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS. (Less than Significant with Mitigation)) focuses only on the Peregrine Falcon. There are many other birds that rely on the area (see above).

The DEIR fails to assess impacts to raptors in the Project area and its environs. Impact BI-7: *Foraging Habitat for Raptors* (*Construction at Candlestick Point would not have a substantial adverse effect on the quantity and quality of suitable foraging habitat for raptors*. (Less than Significant)) underestimates effects on raptors. The construction and development of these sites at Hunters Point and Candlestick and planting of 10,000 trees will negatively impact raptor foraging areas. The raptors depend on a variety of rodent and insect species which will be disturbed and destroyed during the construction of Hunters Point Shipyard and Candlestick. The new grassland areas may benefit some raptors (ex. American Kestrel, Red Tailed, Red-shouldered Hawks, Barn and Great Horned Owls) and new wetland restoration at Yosemite Slough and other wetland areas may benefit the Northern Harrier. New trees will not have tree cavities which American Kestrels and other cavity nesting birds require. A plan for suitable nesting boxes (correct size for species) for appropriate species in the appropriate locations (height and direction to available prey) as well as monitoring to ensure that the boxes are not inhabited by non-native species and maintenance so that the of nesting boxes can be used for years as the native trees grow may help. Other raptors that require trees of certain height with the strength to support large stick nests will take years to grow. Ground squirrels and other rodents are primary food sources for many raptor species. These animals will suffer when their burrows will likely be negatively impacted by the construction and development or when "animal control" efforts become necessary due to demands of increased human population in the area. The DEIR fails to adequately assess these impacts. 81-21 cont'd.

Impact BI-7b (*Implementation of the Project at HPS Phase II would not have a substantial adverse effect on the quantity and quality of suitable foraging habitat for raptors*. (Less than Significant with Mitigation)) appears to ignore the fact that the Project would result in a loss or alteration of 43 acres of grassland would alter the foraging areas that resident and migratory raptors depend on at Hunters Point and Candlestick. Again, the DEIR's failure to assess these impacts is glaring and constitutes a fatal flaw in the document.

Finally, the DEIR fails to adequately assess the impact of the construction of tall buildings in the area. (*See* III B-39 III B-40). Currently there are 20 foot buildings and industrial warehouses. The development will bring new buildings of 270 to 370 feet. Taller buildings, especially those with a lot of clear, glass windows and that may be lit at night pose significant threats to many bird species, especially migratory birds (that are protected by the Migratory Bird Treaty Act). The DEIR fails to assess impacts to birds that will result from new construction of tall buildings in the area.

Bird-friendly building design resources include:

- **City of Chicago Bird-Safe Building Design Guide** http://www.birdsandbuildings.org/docs/ChicagoBirdSafeDesignGuide.pdf
- **Bird-Friendly Development Guidelines** (City of Toronto Lights Out Program) http://www.birdsandbuildings.org/docs/TorontoDevelopGuidelines.pdf
- **Bird-Safe Building Guidelines** (NYC Audubon Program) http://www.birdsandbuildings.org/docs/BirdSafeBuildingGuidelines.pdf

81-21 cont'd.

F. Other Environmental Impacts that Are Not Addressed by the DEIR.

81-22

1. Comments Regarding Section III.B-32 Sustainability Plan

While the project calls for planting 10,000 (mostly native) trees it does not detail the type of trees. We recommend that native trees which are suited to the local geography and weather and have habitat value for native species of insects, birds, and other wildlife be planted to enhance this site. The BCDC Shoreline Design Guidelines are a recommended resource for this planning and can be found at http://www.bcdc.ca.gov/pdf/planning/PADG.pdf

The project did not appear to consider the Hunters Point Constructed Storm Water Wetland Feasibility Study prepared for the Golden Gate Audubon Society, Final Report – July 2004.

Based on this study we make the following twelve conclusions and recommendations which are discussed in more detail in Section 7 of the report:

- The development of new wetlands in Parcel E will comply with several of the guidelines set forth in the Hunters Point shipyard Citizen's Advisory Committee redevelopment plan.
- Remediation of the site should take into consideration the concerns and needs of the community living in and around the shipyard, with a focus on potential health effects.
- A properly constructed and operated wetland could result in an improvement in water quality in the San Francisco Bay by capturing and treating pollutants and sediment in storm water beforethey reach the Bay.
- Several issues exist related to the ability of the industrial landfill to contain waste and not function as a source of continued contamination to the area. Many of the issues and uncertainties would be ameliorated if the landfill was removed and replaced with a wetland.
- A permanent freshwater wetland system is the preferred alternative for Parcel E at Hunters Point. This alternative meets the multiple objectives of the project including year-round recreational opportunities, year-round habitat for wildlife, and storm water treatment.
- 46 acre-feet of make-up water are needed for the proposed wetland from April through October. The most suitable source of make-up water is recycled water from a satellite wastewater treatment plant proposed for the Hunters Point shipyard.
- A liner system should be installed between the wetland bottom and the existing soils on the site in order to isolate the wetland from contaminated ground water and soils.
- Any wetland design should include a forebay with easy drainage and access capabilities to capture, trap and remove contaminated sediment from storm water and keep it out of the wetland.
- To save money and ease construction, clean soils already on site should be used to fill in the excavated landfill after removal of the waste and to construct a liner to protect the wetland from underlying groundwater and soils.

- Wetlands can be designed and maintained to keep mosquito populations to a minimum by eliminating hydraulically static areas, controlling water level, disturbing water surface, minimizing anaerobic zones, and creating access for natural mosquito predators.
- Total construction costs are estimated at $1 million and annual O&M cost is estimated at $40,000. This estimated O&M cost is far below the current costs associated with management of the industrial landfill, which likely exceed $400,000 per year.

(*See:* http://www.goldengateaudubon.org/wp-content/uploads/Storm_Water_Wetland.pdf*)*

81-22 cont'd.

2. Comments Regarding Native Plants and Other Terrestrial Flora

81-23

Coyote Bush is mentioned in Yosemite Slough and other areas. This plant is also found in Candlestick Point SRA. Coyote Brush is an important plant for San Francisco's coastal scrub habitat. In the state it only exists in 15% of its former area due to agriculture and development. This plant has been used for restoration and is important for local wildlife for food and resting. (*See:* http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=1031)

Native trees and plants on which native species of bird, butterflies and other wildlife depend include the Coast Live Oak, Toyon, Flannel bush, California Buckeye, California Bay, Elderberry, Monterey Pine, native grasses. Native shrubs include coyote bush, ornamental buckbrush (*Ceanothus* spp.), firethorn(*Pyracantha* spp.), coffeeberry (*Rhamnus californica*), hummingbird sage (*Salvia spathacea*), and black sage (*S.mellifera*). Native plants were historically used by the Native Americans for a variety of uses. Native plants should be planted and educational signage or materials for the residents and visitors to understand the importance of these plants and why they are a key to keeping a healthy local environment. Today birds and other wildlife depend on native plants for food or shelter or to roost,

Section III.N-9 (Salt Marsh) fails to adequately discuss salt marsh plants. Saltwater plants of habitat importance include salt grass (*Distichlis spicata*), European sea rocket (*Cakile maritima*), coastal gumweed (*Grindelia stricta*), and sea lavender (*Limonium californicum*) and upland shrub silver beach bur (*Ambrosia chamissonis*). A coastal plant ecologist should provide a plan for the marsh restoration. The plan should be monitored

3. Comments Regarding Open Space

81-24

Golden Gate Audubon is disappointed not to see more park and open space included in the Project plan (See III.N-3 *Park and Open Space*). The DEIR states the current ratio of parks to people in this area is 108 acres per 1000 residents. (See III.P-29). The new proposal is for 13.7 acres per 1000 people yet still within City's General Plan 5.5 acre guidelines. Golden Gate Audubon supports the largest possible area for parks and open space for people and wildlife within San Francisco.

We strongly urge the planting of native grasses and plants where ever possible. Moreover, we strongly recommend that natural grass playing fields and open space be installed instead of synthetic turfs, which contain heavy metals that can leach to groundwater and into storm water.

Moreover, all communal open space should include designated, fenced, dog play areas with waste bag dispensers and covered trash containers away from the shoreline, known bird nesting areas, and wetlands. Dogs should be on leash in other areas of the community and in the State Recreation Area since these are sensitive habitat areas for birds, plants and other wildlife.

Section III P-G discusses new open space, but is vague in terms of the number of new parks and open space acreage. The DEIR describes the 150 acres of Candlestick Park State Recreation area, which already exists. Moreover, Senate Bill 792 (Leno) reduced the CPSRA by approximately 23 acres in a cash-for-public land swap to benefit the Lennar development at Candlestick Point. Sixty-eight acres of park land described in the DEIR is actually a capped, formerly toxic area that is dedicated to stadium and event parking. A parking lot is not legitimate recreational or wildlife open space. **81-24 cont'd.**

Finally, the DEIR fails to address the effects of seal level rise on the open space and park land that are included in the Project. Rising sea levels will significantly alter the shoreline and require certain remediation measures to protect the new development. *See:* Bay Conservation & Development Commission, http://www.bcdc.ca.gov/planning/climate_change/ maps/16_55/cbay.pdf We believe the DEIR's failure to adequately address sea level and other climate change issues is a significant weakness of the DEIR. **81-25**

Golden Gate Audubon also disagrees with the proposition asserted in Impact RE-2 (*Implementation of the Project would not increase the use of existing parks and recreational facilities that would cause the substantial physical deterioration of the facilities to occur or to be accelerated, nor would it result in the need for, new or physically altered park or recreational facilities.* (Less than Significant with Mitigation)) The DEIR projects that 24,465 new residents in the area will increase the use of existing parks and open space. The current ration of parks to people is 108 acres per 1000 residents; the new proposal will result in 13.7 acres per 1000 residents. We would ask that this discrepancy be clarified in the final EIR. **81-26**

a. Comments Regarding Specific Parks **81-27**

The Grasslands Ecology Park and designated large dog play should be very distinct with separation, fencing, and signage. The details provided were vague in terms of the location of each site. The Grassland Ecology Park will be very beneficial to native plant, bird, butterfly, and other species. Within the Grasslands Ecology Park visitors should have sufficient covered trash containers so that wildlife will not have access to human food. Also within the Grasslands Ecology Park dogs need to remain on leash to prevent erosion, damage to plants, and disturbances to wildlife.

Alice Griffiths Community Park
Golden Gate Audubon supports the community garden and the fenced and designated dog play area. What is the definition of a specimen tree?

Candlestick Point Neighborhood Park
We support the community garden and community area for outdoor recreation which is separate from the Candlestick SRA. A fenced and designated dog play area at either this park and/or the Bayview Gardens Wedge Park is provided if these residents have pets.

Bayview Gardens Wedge Park
We support this community park.

Mini Wedge Park
We support this park within the residential development area. The dog run is supported but should be fenced to be distinct from the other areas of the park. What are the implications of runoff after bio swale treatment into the Candlestick SRA? How often will the bio swale be monitored and maintenance conducted?

13 of 14

Median Boulevard Parks
Golden Gate Audubon encourages the boulevard parks proposed. 81-27 cont'd.

G. Conflicts with Plans, Policies or Regulations.

Section III.B-36-39 addresses conflicts with other plans, policies or regulations. Notably, Impact LU-2 (*Implementation of the Project would not conflict with land use plans, policies, or regulations adopted to avoid or mitigate an environmental effect.* (Less than Significant)) is erroneous. The plan for the proposed bridge over Yosemite Slough is inconsistent with BCDC and SF Bay Trail plans. 81-28

H. The DEIR's Biological Assessments Were Insufficient and Fail to Reflect the Biodiversity of the Area. 81-29

The biological assessments were conducted on 3 days, one day in August, 2007 one in May, 2008 and one in July, 2008. (*See* III.N.2 *Biological Resources: Setting*; *see also* III.N.3 *Biological Review*) These were drought years in California so species were likely low. The limited survey times also neglected to capture the many species of migratory birds in the spring and fall as well as the birds that spend the winter in this site. Large flocks of a variety of bird species use the Pacific Flyway each spring and fall. A variety of shorebirds and waterfowl depend on this habitat each winter. The records from Golden Gate Audubon's Yosemite Slough Survey in 2003-2004, the San Francisco Field Ornithologist records for the Hunters Point Block and Golden Gate Audubon's Christmas Bird Count Data should also be reviewed for additional documented bird species that depend on Hunters Point and Candlestick SRA.

In 2000 the US Navy provided a list of Bird Species Potentially Inhabiting Hunters Point Shipyard see Hunters Point Constructed Storm Water Wetland Feasibility Study page 2-7 including the Western Snowy Plover, Peregrine Falcon, California Black Rail, California Clapper Rail, California Least Tern, Swainson's Hawk, Clarks and Western Grebe, Tri Colored Blackbird, Burrowing Owls, Barrows Goldeneye, Common Loon, Sharp Shinned Hawk, Loggerhead Shrike, California Gull Alameda Song Sparrow, Long-billed Curlew, and Double-crested Cormorant. See table for federal and state status of these species.

I. The DEIR's Descriptions of Lighting Impacts Are Vague and Confusing. 81-30

All lights that are installed as part of the Project should include measure to reduce light pollution and light "spill" above the horizontal plane of the light fixture. The DEIR and Project plans should also include requirements that light fixtures be shielded to reduce light pollution and, where practicable, require the use of light sources with a CCT no higher than 3000K. Golden Gate Audubon requests a curfew on public lights installed as part of the Project to reduce unnecessary illumination in the area.

Section ES-33 address stadium lighting. Golden Gate Audubon strongly encourages that any new lighting at the stadium be installed with measures that reduce light pollution and conserve energy.

Section MM AE-7a.1 (*Lighting Direction/Fixtures and Screening Walls to Minimize Glare and Light Spill.*) states that the Project Applicant "shall ensure that all parking lots and other security lighting shall be directed away from surrounding land uses and towards the specific location intended for illumination" and that "[s]tate-of-the-art fixtures shall be used, and all lighting shall be shielded to minimize the production of glare and light spill onto surrounding use." Golden Gate Audubon supports these measures and reiterates that any new lighting fixtures should also include measures to promote energy conservation.

Currently, Golden Gate Audubon does not believe that Impact AE-7b (*Implementation of the Project at HPS Phase II would not create a new source of substantial light or glare that would adversely affect day or night views in the area or that would substantially impact other people or properties.*) is accurate. We anticipate that a development of the size anticipated by the Project in the area will significantly increase the background illumination in the area. Moreover, we recommend that the "night views" to specifically mention night sky visibility. 81-30 cont'd.

We also find PS MM AE-7b.1 (*Testing of the Field-Lighting System.*) and MM AE-7b.2 ("Stadium Lighting Orientation and Cut-Off Shields.) to be vague. The DEIR states that the Stadium Operator shall test installed lighting systems to minimize of light spill. We request that the DEIR be more specific as to what constitutes "operating requirements in the stadium" and "obtrusive spill". We recommend that the DEIR and Project plan include specific language that specifies the maximum acceptable light spill from the stadium. The DEIR should also include provisions that the stadium lighting be "fully shielded" or "fully cut off".

III. CONCLUSION

The proposed changes to the this community and the surrounding area will be significant and irrevocable. We ask that the lead agencies consider these comments and those of other community members and organizations and ensure that this environmental review is comprehensive and includes measurable and enforceable mitigation measures. 81-31

Thank you for this opportunity to comment on these plans. Please feel free to contact me at (510) 843-6551 or via email at mlynes@goldengateaudubon.org to discuss any of these comments and recommendations further.

Best regards,

Mike Lynes
Conservation Director

Cc: Saul Bloom, Arc Ecology
Laura Thompson, San Francisco Bay Trail
Peter Brastow, Nature in the City
Jake Sigg, California Native Plant Society
David Goggin, San Franciscans for Smart Lighting
Arthur Feinstein, Sierra Club

Letter 81: Golden Gate Audubon Society (1/12/10)

Response to Comment 81-1

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the Project's potential effects on wildlife.

Response to Comment 81-2

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the Project's potential effects on biological resources of Yosemite Slough. The proposed bridge would run parallel to Third Street—about 0.7 mile to the east of Third Street—so there is no way that it cannot bypass the existing community and businesses on Third Street. However, it is at the eastern-most edge of San Francisco in an undeveloped area, and, therefore, could not possibly divide an "established community." Physical division of an established community means that one part of a community is completely cut off from another part, in that the residents/patrons of each portion could not physically travel from one part to the other. This would not occur under the Project.

Response to Comment 81-3

This comment contains introductory or general background information on existing wildlife use of Yosemite Slough and the benefits of the Yosemite Slough Restoration Project, and is not a direct comment on environmental issues or the content or adequacy of the Draft EIR. No response is required.

Response to Comment 81-4

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the Project's potential effects on biological resources of Yosemite Slough and to Master Response 4 (Purpose and Benefits of the Yosemite Slough Bridge) for a discussion of the traffic-related justification for the bridge.

Response to Comment 81-5

The transportation-related benefits of the proposed Yosemite Slough bridge extend beyond transit and auto access to the stadium. Refer to Master Response 4 (Purpose and Benefits of the Yosemite Slough Bridge) for discussion of benefits of bridge to transit overall (including non-game days) and to bicycle and pedestrian connectivity between the Hunters Point Shipyard and the Candlestick Point development areas.

Response to Comment 81-6

Refer to Responses to Comments 31-9 and 31-11 for a discussion of the Bay Trail alignment.

Response to Comment 81-7

The commenter disagrees with the Draft EIR's findings that the Yosemite Slough bridge will not have significant impacts on nearby aquatic resources and that the Draft EIR should be revised to address bridge construction impacts, including increases in turbidity, pollution, mobilization of contaminants in water, and other disturbances to the natural environment related to the Project.

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of potential effects of the bridge on Yosemite Slough, the Yosemite Slough Restoration Project, and wildlife use of the area.

As discussed in the Impact BI-4c starting on page III.N-67 of the Draft EIR, construction of the bridge is expected to affect wetlands and aquatic habitats, and therefore, mitigation measures are prescribed to mitigate potentially significant impacts to less than significant levels (MM BI-4a.1, MM BI-4a.2, and MM BI-4c). Mitigation measure MM BI-4a.1 requires the Project Applicant to obtain a CWA Section 404 permit, a CWA Section 401 Water Quality Certification, and a CWA Section 402 National Pollutant Discharge Elimination System permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities. By obtaining CWA permits and certifications and complying with their conditions, construction of the bridge would be in compliance with the CWA and its implementing regulations. In addition, complying with the conditions of the CWA permits would reduce impacts from increased turbidity, pollution, mobilization of contaminants in water, and other disturbances to the natural environment to a less than significant level.

The commenter also expresses concern regarding four impact statements included in the Draft EIR, but does not state what these concerns are. The commenter's concern regarding these impacts statements is noted.

Response to Comment 81-8

The Draft EIR addresses increased stormwater pollution resulting from bridge operation, including pollution originating from automobiles, transit vehicles, cyclists and pedestrians. The Draft EIR states on page III.M-92 that:

> Stormwater runoff from the Yosemite Slough bridge and discharges of materials from bridge maintenance activities would not cause or contribute to an exceedance of water quality standards. Primary pollutants of concern in stormwater runoff from transportation-related land uses include fuels, PAHs, sediment, metals, and litter and debris. …

The primary pollutant associated with pedestrians and cyclists is trash and the primary pollutants associated with automobiles and transit vehicles include fuels (and associated constituents such as PAHs), sediment, and metals.

Automobiles would only be a source of stormwater pollutants on game days, which would occur twelve days out of the year, because the bridge would only allow automobile traffic on game days. Game days are currently scheduled from September through early December, with the post-season extending through January, and therefore would only occur during a portion of the rainy season (the rainy season is typically defined as October 1 through May 31).

The Draft EIR states, on page III.M-92, that:

> … Impacts from bridge operation would be reduced via compliance with the existing stormwater runoff programs. …

Existing stormwater runoff programs are the Phase II Municipal Stormwater General Permit, and local requirements for incorporating site design, source control, and treatment control BMPs into the project (which are subject to approval by the SFPUC). The existing stormwater runoff programs would address potential new pollutants introduced into Yosemite Slough from operation of the bridge. Increased pollution from transit vehicles, pedestrians, and cyclists would be addressed under the Post-Construction Storm Water Management in New Development and Redevelopment element of the Municipal Stormwater General Permit, and implemented through compliance with SFPUC's San Francisco Stormwater Design Guidelines. As described on pages III.M-47 to III.M-48 of the Draft EIR, the San Francisco Stormwater Design Guidelines require capture and treatment of a precipitation depth of 0.75 inch in volume-based BMPs (such as a detention basin), or a rainfall intensity of 0.2 inch per hour for flow-based BMPs (such as a vegetated swale). The City's requirements for stormwater treatment comply with the Maximum Extent Practicable performance standard in the Municipal Stormwater General Permit, which requires that the City ensure that controls are in place that would prevent or minimize water quality impacts from development projects.

As described in Chapter II (Project Description) on page II-38 of the Draft EIR, the Yosemite Slough bridge would be constructed with a 40-foot-wide greenway, which would be converted to automobile travel lanes on 49ers game days only. The greenway would also be designed to provide treatment for stormwater pollutants associated with automobiles, and reduce the impacts of vehicle-related stormwater runoff to a less-than-significant level. Runoff from the transit vehicle lanes would be routed to the greenway, and/or to land-based stormwater treatment controls such as swales. The stormwater treatment components for the bridge would be described in the Project Stormwater Control Plan, which is subject to approval by the SFPUC.

In addition, the Pollution Prevention/Good Housekeeping for Municipal Operations element of the Municipal Stormwater General Permit would address increased pollutants from transit vehicles, pedestrians, and cyclists, because the Permit requires the City to implement a program to reduce the amount and type of pollution that collects on streets and roads. The City would likely implement a street sweeping program to comply with this element of the Permit, and street sweeping would reduce the sediment, litter, debris and oil and grease on the bridge that could potentially be discharged in stormwater runoff. Compliance with existing stormwater runoff programs would reduce the impacts from bridge operation to a less-than-significant level, and therefore no mitigation is required.

In response to the comment and to clarify the elements of the Project related to the bridge and stormwater runoff, the Draft EIR text on page III.M-92 (Impact HY-6c) has been revised as follows:

> Stormwater runoff from the Yosemite Slough bridge and discharges of materials from bridge maintenance activities would not cause or contribute to an exceedance of water quality standards. Primary pollutants of concern in stormwater runoff from transportation-related land uses include fuels, PAHs, sediment, metals, and litter and debris. The pollutants could originate from automobiles, transit vehicles, cyclists, and pedestrians. Automobiles would only be a source of stormwater pollutants on game days, which occur twelve days out of the year, because the bridge would only allow automobile traffic on game days. As described in Chapter II (Project Description) on page II-38, the Yosemite Slough bridge would be constructed with a 40-foot-wide greenway, which would be converted to automobile travel lanes on 49ers game days only. The greenway would also provide vegetative treatment for stormwater pollutants associated with automobiles, and would reduce the impacts of automobile-related stormwater runoff to a less than

> significant level. Runoff from the transit vehicle lanes would also be routed to the greenway and/or to land-based stormwater treatment controls such as swales. The stormwater treatment measures for the bridge would be described in the Project's Stormwater Control Plan, which is subject to SFPUC's approval.
>
> Bridge maintenance activities such as welding and grinding, sandblasting, and painting can also adversely affect water quality if materials generated from maintenance are allowed to discharge into the Bay. It is anticipated that bridge operation would be under the jurisdiction of the City, and thus stormwater runoff mitigation would be performed under the Municipal Stormwater General Permit, which requires development of a pollution prevention program for municipal operations. The municipal operations program would also include street sweeping to remove litter and sediment-associated pollutants generated by transportation land uses.
>
> Pollutants generated from transit vehicles, cyclists and pedestrians would also be addressed under the pollution prevention program for municipal operations implemented by the City. The pollutants would also be reduced through compliance with local stormwater treatment requirements (i.e., San Francisco Stormwater Design Guidelines), which were put into effect to comply with the new development requirements in the Municipal Stormwater General Permit.
>
> Impacts from bridge operation would be reduced via compliance with the existing stormwater runoff programs, specifically, elements of the Municipal Stormwater General Permit, and local requirements for stormwater treatment measures that would be subject to approval by the SFPUC. Operation of the Yosemite Slough bridge would not cause an exceedance of water quality standards or contribute to or cause a violation of waste discharge requirements and a less than significant impact would result. No mitigation is required.

In response to the comment and to clarify the elements of the Project related to the bridge and stormwater runoff, the Draft EIR text on page II-38 (Project Description) has been revised as follows:

> 5. **Yosemite Slough Bridge.** A new Yosemite Slough bridge would extend Arelious Walker Drive from Candlestick Point to Hunters Point Shipyard. The 81-foot-wide, seven-lane bridge would cross the slough at its narrowest point and would primarily function for transit, bicycle, and pedestrian use. Figure II-12 illustrates the bridge location. The bridge and its approach streets would have two dedicated 11-foot-wide BRT lanes and a separate 12-foot-wide Class I bicycle and pedestrian facility, which would be open at all times. The bridge would also have a 40-foot-wide greenway, which would be converted to four peak direction auto travel lanes on 49ers game days only. Those four lanes would be open on game days to vehicle traffic in the peak direction of travel. The roadway would be planted with grass and would serve as an open space amenity on all non-game days. Two-foot-tall barriers would separate the BRT lanes from the bicycle/pedestrian plaza and the vehicle lanes. The greenway would be designed to function as a stormwater treatment control facility for the auto travel lanes. Runoff from the BRT lanes would also be routed to the greenway and/or to land-based stormwater treatment facilities, in accordance with the City's requirements for stormwater treatment.

Response to Comment 81-9

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the project's potential effects on biological resources of Yosemite Slough. Due to the low volume of traffic that will be using the bridge, as described in Master Response 3, significant impacts to Yosemite Slough from traffic-related pollution are not expected to occur.

Response to Comment 81-10

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the Project's potential effects on biological resources of Yosemite Slough.

Response to Comment 81-11

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the potential effects of shading on biological resources of Yosemite Slough.

Response to Comment 81-12

The commenter suggests that plant life, including coastal scrub, may be affected by the bridge and asks whether the project will prevent invasion by weeds, erosion, and sediment deposition due to traffic on the bridge. The commenter also asks how revegetation will be accomplished.

A small amount of coastal scrub dominated by coyote brush will be impacted at the southern approach to the Yosemite Slough bridge. However, this regionally abundant plant species and habitat type will continue to be present in other shoreline areas, and some restoration/creation of such habitat is planned. Revegetation efforts are described in the Draft Parks, Open Space, and Habitat Concept Plan provided in Appendix N3 of the Draft EIR. That Plan also describes the process by which invasive plants will be removed, monitored, and controlled on the site. Traffic use of the bridge is not expected to result in increased erosion or sediment deposition.

Response to Comment 81-13

As stated on pages II-38 to II-39 of Chapter II (Project Description) of the Draft EIR, the Yosemite Slough bridge will be approximately 81 feet wide and approximately 900 feet long based on preliminary designs. As the Project proceeds through the final design phase, the bridge design will be refined. Final Project design, including the bridge, will undergo review by City and Agency staff to ensure that any design modifications would not change the environmental analysis in the EIR. For a discussion of effects of the bridge on biological resources from lighting, traffic, and shadow, refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]). Page III.M-58 of Section III.M (Hydrology and Water Quality) describes mitigation measure MM HY-1a.1, which sets forth the requirements for a Storm Water Pollution Prevention Plan that must be prepared by the Project Applicant. As noted on page III.M-72 of Section III.M:

> With respect to water quality impacts caused by construction of the Yosemite Slough bridge, including pollutants transported through erosion and sedimentation or the incidental release of construction materials or the accidental spill of substances commonly used in construction directly to the Lower Bay, implementation of mitigation measures MM HY-1a.1 (SWPPP—Combined Sewer System), MM HY-1a.2 (SWPPP—Separate Storm Sewer System), MM HZ-1a (Article 22 Site Mitigation Plan), MM HZ-2a.1 (Unknown Contaminant Contingency Plan), and MM HZ-9 (Navy-Approved Workplans for Construction and Remediation Activities on Navy-Owned Property) would reduce the potential for contaminants, sediments, or pollutants in stormwater runoff to enter the Lower Bay. While mitigation measures MM HY-1a.1 and MM HY-1a.2, each of which require the preparation of a SWPPP, are intended to address runoff that enters either the combined or separate sewer systems, the BMPs could also address bridge construction activities. In

addition, because the bridge would be constructed using piles driven in dry conditions (behind coffer dams), water quality impacts would be minimized.

Response to Comment 81-14

Refer to Master Response 3 (Impacts of the Project on Yosemite Slough [Biological Resources]) for a discussion of the project's potential effects on biological resources of Yosemite Slough, including wildlife. While some wildlife species will be able to adapt or habituate to shading or other effects of the bridge, others will not, resulting in the loss of a small area of habitat under and immediately adjacent to the bridge.

The commenter suggests that the EIR provide a diagram depicting the bridge dimensions relative to vegetation conditions, a diagram depicting shadow at various times during the day and its impacts on wetlands, and a diagram depicting night lighting from the bridge. Master Response 3 discusses the potential effects of the bridge, including shading and increased night lighting, on wetlands and other sensitive habitats; diagrams are not needed to convey these effects. While some night lighting will be required on the bridge, such lighting will be limited to the minimum necessary for human safety. Given the urban context in which Yosemite Slough occurs, species using the area will have to be habituated to some lighting, and the Lead Agencies do not expect lighting impacts on wildlife to be substantial; refer to Master Response 3 for further discussion of the effects of increased night lighting on biological resources of Yosemite Slough.

The commenter also recommends that the bridge be constructed and designed using guidelines from a reference from the Arizona Game and Fish Department. The design and construction of the bridge generally follow the principles outlined in that publication, although due to the very different conditions in Yosemite Slough as compared to streams in Arizona, site-specific design and construction measures that take into account the types and sensitivity of biological resources at Yosemite Slough have been (and will be) employed.

Response to Comment 81-15

This comment contains introductory or general background information and also reflects the commenter's opinions. No response is required. However, the commenter's general issues regarding impacts are specifically responded to in Responses to Comments 81-2 through 81-14.

Response to Comment 81-16

Chapter III.N (Biological Resources) describes the project's potential impacts to the habitats and species referred to in this comment. The Project applicant has already engaged the BCDC regarding potential Project effects on all resources regulated by that agency, and has met with BCDC staff on several occasions. The applicant will continue to pursue the necessary permits from the BCDC, thus addressing any issues of project consistency with the San Francisco Bay Plan.

The commenter suggests that the Draft EIR underestimates potential impacts to the Bay. Actually, a very conservative approach to estimating Bay fill was taken in the Draft EIR, in that impacts resulting from removal of Bay fill on HPS, as described in Impact BI-4b on pages III.N-64 to III.N-67, were considered "fill" activities because of the movement of existing fill and potential temporary impacts to water quality that might result. In actuality, removal of fill along the shoreline may occur under dewatered conditions, using coffer dams, so that no impacts to water quality will occur. Thus, such activities would actually be beneficial by removing Bay fill even though they are considered impacts to aquatic habitats in the Draft EIR.

Response to Comment 81-17

Refer to Response to Comment 47-88 regarding potential project impacts to eelgrass. Specifically, MM BI-5b.1 and BI-5b.2 have been modified somewhat to require more extensive surveys for eelgrass, both in and within 750 feet of in-water construction activities at HPS Phase II and the Yosemite Slough bridge, prior to such in-water activities. Otherwise, potential project impacts to eelgrass were adequately described in the Draft EIR in Impacts BI-5a and BI-5b on pages III.N-69 and III.N-70, and the associated mitigation measures reduce impacts to eelgrass beds in and adjacent to construction areas to less than significant levels by requiring impact avoidance if practicable, best management practices to avoid water-quality impacts, and compensatory mitigation for unavoidable impacts to eelgrass. Regarding compliance with BCDC's eelgrass recommendations, the Project applicant has already engaged the BCDC regarding potential Project effects on all resources regulated by that agency, and has met with BCDC staff on several occasions. The applicant will continue to pursue the necessary permits from the BCDC, thus addressing any issues of project consistency with the San Francisco Bay Plan.

Response to Comment 81-18

The commenter suggests that the biological conditions of CPSRA were not adequately described and comments that biological surveys were conducted on only two days. The existing conditions section of Chapter III.N (Biological Resources) contains descriptions of the habitat types and wildlife communities of the entire project area, including CPSRA, and Figure III.N-2 maps the habitats in this portion of the project site. Although PBS&J biologists were on-site on only three days, as noted in Section III.N.2 on page III.N-3, the description of biological resources in Chapter III.N was also informed by multiple field visits conducted by H. T. Harvey & Associates biologists during general reconnaissance surveys, wetland delineation surveys, and tree surveys, as well as by a number of background references as described on pages III.N-3 and III.N-4 of the Draft EIR.

The commenter also suggested that the Draft EIR did not adequately describe the bird species that could potentially nest on the site and listed a number of bird species that nest on CPSRA. The intent of Chapter III.N of the Draft EIR was not to provide an exhaustive list of animals that occur on the site, but rather to describe the general wildlife community, noting representative common species that occur on the site, and to provide more detail on potentially occurring special-status species. Some of the species listed by the commenter as breeding on CPSRA, such as double-crested cormorant, black-crowned night-heron, snowy egret, great egret, Caspian tern, white-throated swift, and several others, are not indicated by the 2003 *San Francisco Breeding Bird Atlas* as having been confirmed breeding on CPSRA, and suitable breeding habitat for some of these species is absent from the site.

Regarding the comments pertaining to potential effects on wildlife resulting from increased human use of the site, refer to Response to Comment 64-5 for a discussion of such effects.

Response to Comment 81-19

The commenter suggests that the project will result in an increase in the human population of the area and a concomitant increase in pets, particularly cats and dogs, and makes recommendations for limiting the potential for such animals to impact wildlife. The Impact BI-16a discussion, Draft EIR page III.N-101, mentions the potential for impacts to wildlife resulting from increased human activity and increased presence of domestic animals, as follows:

> Human activity at Candlestick Point following completion of construction would affect wildlife, including invertebrates, reptiles, amphibians, birds, and mammals. Potential adverse effects include disturbance of individuals (including nesting birds) in terrestrial, shoreline, and aquatic habitats due to movement by humans, domestic animals, and vehicles; depredation of native species by domestic animals; injury or mortality of individuals due to vehicular traffic; and other impacts. However, as discussed in Impact BI 2, adverse effects of human disturbance and other operational factors would occur primarily to small numbers of regionally abundant species, and operational impacts would not substantially affect populations of these species. Impacts would be less than significant, and no mitigation is required.

Response to Comment 81-20

The commenter suggests that the project will result in an increase in trash and food waste, which degrade the aesthetics of the park and subsidize populations of nuisance birds and mammals, which could in turn adversely affect more sensitive native wildlife species. The commenter suggests that the Draft EIR did not adequately analyze the impact.

In response to the comment, the Impact BI-2 discussion, Draft EIR page III.N-50, has been revised to add the following sentence after the fourth sentence of the first paragraph under this impact:

> … areas/ornamental plants. <u>In addition, an increase in trash, particularly food waste, could potentially subsidize nuisance species such as common ravens (*Corvus corax*), American crows (*Corvus brachyrhynchos*), raccoons, rats, and feral cats, which in turn could increase predation on more sensitive wildlife species.</u> …

In addition, Impact BI-16a, page III.N-101 of the Draft EIR has been revised to add the following sentence to the second paragraph under this impact, after the second sentence:

> … and other impacts. <u>In addition, an increase in trash, particularly food waste, could potentially subsidize nuisance species, which in turn could increase predation on more sensitive wildlife species.</u> …

Response to Comment 81-21

The commenter suggests that the Draft EIR did not adequately characterize the value of the project area to wildlife. The Draft EIR considered not only the results of the Yosemite Slough Watershed Wildlife Study but also other species that could potentially occur in the project area when describing existing conditions and assessing impacts to habitat.

The commenter disagrees with statements that certain birds were considered California Species of Special Concern only when breeding and states that the reference cited in the Draft EIR does not support this statement. However, the reference cited in the document (a list of bird Species of Special Concern on the CDFG's website [http://www.dfg.ca.gov/wildlife/nongame/ssc/ birds.html] and the compendium on which this list is based (Shuford and Gardali 2008) both indicate a "Season of Concern" for these species. The Draft EIR did not "dismiss conservation concerns" regarding species that occur on the project site during the non-breeding season; rather, the importance of the site to all species was considered regardless of the season, even for species that are not considered Species of Special Concern when they occur as nonbreeders on the site. It was determined that those particular species that were considered Species of Special Concern only during the breeding season, and that occur on the site only as nonbreeders, would not be significantly impacted by the Project, but this was based on the Project-specific impacts to these species' populations rather than on the basis of whether or not they were considered Specifies of Special Concern.

The commenter notes that a number of birds that have been recorded on the site are on the Audubon Watch List. Impacts to all species, whether or not on a list of species of concern, were considered during impact assessment. The commenter also notes that a number of bird species rely on the project area and questioned why only the peregrine falcon was considered in Impact BI-6b. This impact was not intended to focus only on the peregrine falcon; rather, Impact BI-6b on page III.N-75 in the Draft EIR contained the following text:

> Similar to development at Candlestick Point, construction-related activities including, but not limited to, grading, materials laydown, facilities construction, vegetation removal, and construction vehicle traffic may result in loss of a special-status and/or legally protected avian species' active nest and/or mortality of the nest's occupants; this would be considered a significant impact. Implementation of mitigation measures MM BI 6a.1 and MM BI 6a.2 (as detailed in Impact BI 6a) would reduce the effects of Project construction and implementation on nesting special-status and legally protected avian species to less-than-significant levels.

Thus, the Impact BI-6b discussion on page III.N-75 referred to the discussion under Impact BI-6a, Draft EIR page III.N-72, which stated:

> In addition to recognized special-status species, as discussed above in Regulatory Framework, all native bird species that may use the site are protected under the MBTA and California Fish and Game Code. These laws protect many common species in addition to those considered special-status species.

Therefore, impacts to all native bird species were addressed in Impacts BI-6a and BI-6b, and mitigation measures MM BI-6a.1 and MM BI-6a.2, Draft EIR pages III.N-73 and -74, were applied to both Candlestick Point and HPS. Peregrine falcons were discussed specifically because they are presently a State-listed endangered species and because a resident pair breeds on the site.

The commenter suggests that impacts to raptors were not adequately analyzed, and claims that Impact BI-7b "appears to ignore the fact that the Project would result in a loss or alteration of 43 acres of grassland." The comments acknowledge that some raptors will benefit from new grasslands and that the nest box program, which is a component of the Draft Parks, Open Space, and Habitat Concept Plan provided in Appendix N3 of the Draft EIR, would benefit additional species. Refer to Response to Comment 64-4 for more discussion of the project's impacts to raptors (e.g., for clarification that the 43 acres of grassland impacted at HPS will be impacted due to grassland restoration efforts).

The commenter suggests that the Draft EIR did not adequately assess the impacts of tall buildings to birds. Refer to Impacts BI-20a and BI-20b on Draft EIR pages III.N-108 to -111; these impacts discuss the potential effects of tall buildings and associated reflections and lighting on birds. These impact discussions also cite some of the same references that are cited by the commenter.

Response to Comment 81-22

The commenter recommends that the 10,000 trees to be planted on the site be natives. The Draft Parks, Open Space, and Habitat Concept Plan, provided in Draft EIR Appendix N3, describes the trees that will be planted as follows:

> While native vegetation shall be favored, site-appropriate non-native trees and shrubs that provide food or structural resources that are particularly valuable to native wildlife may also be considered.

It is expected that the vast majority of trees to be planted will be natives.

The commenter also suggested that the project did not appear to consider the Hunters Point Constructed Storm Water Wetland Feasibility Study prepared for the Golden Gate Audubon Society. The majority of the commenter's recommendations pertain to creation of wetlands and remediation issues that are subject to remediation decisions to be made by the Navy, and that are not in the control of the Project applicant.

Response to Comment 81-23

The commenter lists native plants that are present on the site and that provide habitat value for wildlife. This comment is noted; native plants such as these will be planted on the site as described in the Draft Parks, Open Space, and Habitat Concept Plan provided in Appendix N3 of the Draft EIR.

The commenter states that the Draft EIR did not adequately discuss salt marsh plants, yet the description of the salt marsh community on page III.N-9 of the Draft EIR contains all of the plants listed in this comment.

Response to Comment 81-24

The comment regarding open space is noted. The Project's ratio of 13.8 acres per 1,000 residents provides substantial amounts of open space.

The comments regarding native grasses, natural playing fields, and dog play areas are noted. The specific elements of the CPSRA improvements, including landscaping and plantings will be determined through the CPSRA General Plan Amendment process. No synthetic turf is proposed for the Project's playing fields. Dog recreation areas will accommodated within community parks outside of CPSRA.

Figure III.P-2 shows the location of proposed parks and the reconfiguration of CPSRA. Refer to Responses to Comments 47-3, 47-28, and 47-29 for further discussion of the reconfiguration. As shown on Figure III.P-2, the Candlestick Park stadium area will not be developed as a park, and is not included in any park area calculations.

Response to Comment 81-25

Refer to Master Response 8 (Sea Level Rise) for a comprehensive discussion of the sea level rise documents reviewed, the levels of sea level rise taken into account for various Project components, and the plan to provide flood protection if higher levels of sea level rise occur.

Response to Comment 81-26

Refer to Response to Comment 47-29 for discussion of this standard of significance. While the Project site's parkland ratio will be reduced from its current level (which is particularly high because the area has a very small population), the ultimate ratio of 13.8 acres per 1,000 residents is well above the standard of 5.5 acres provided in the 1986 San Francisco General Plan and used in the Draft EIR. This impact is, therefore, less than significant.

Response to Comment 81-27

The comments regarding park programming are noted. In contrast with typical nursery-grown trees, a "specimen tree" is often older or larger and has particularly exceptional aesthetic qualities. In landscape design, a specimen tree may be used at focal points, in small courtyards, or in other places where the tree's exceptional qualities will be noticed and have a strong impact on the sense of place.

Impacts related to stormwater runoff on Candlestick Point are discussed in Impact HY-6, beginning on Draft EIR page III.M-78.

Response to Comment 81-28

The commenter states there is no basis for the assertion that the Project is consistent with BCDC and Bay Trail plans. Refer to Response to Comment 47-58 for a discussion of the Project's consistency with BCDC policies and the Bay Plan policies with respect to biological resources. Refer also to pages III.B-13 through III.B-15 for a discussion of consistency with BCDC policies related to fill. Project consistency with the Bay Trail Plan is analyzed on pages III.B-16 through III.B-19 of Section III.B (Land Use and Plans) of the Draft EIR.

Response to Comment 81-29

Refer to Response to Comment 81-18 for a discussion of the number of days on which biological resources surveys were conducted and of the information on which the biological resources assessment was based. The bird species listed by the commenter as having been considered as potentially occurring by the Navy in 2000 were all considered during the preparation of the special-status species table and the impact assessment in the Draft EIR.

Response to Comment 81-30

The Draft EIR, page III.E-75 discloses that the Project site will change from an "area of low to moderate-level illumination to moderate to high illumination." Thus, the Project would result in day and night lighting that is typical for other urbanized locations in San Francisco. Page III.E-76 identifies that "views of the night sky are diminished as they are in all urban areas" The Draft EIR identifies mitigation measures that reduce spill light and require shielding of light fixtures to reduce light pollution (refer to mitigation measures MM AE-7a.1 through AE-7a.3, page III.E-72). Mitigation measure MM AE-7a.1 restricts light fixture direction, prescribes state-of-the-art light fixtures, and shielding. Mitigation measure MM AE-7a.2 requires the use of low-level and unobtrusive light fixtures for landscape illumination and exterior sign lighting; and mitigation measure MM AE-7a.3 requires the Applicant to prepare a Lighting Plan for each phase of the Project to be approved by the Agency prior to issuance of building permits to minimize glare and prevent spill light.

Page III.E-73 of the Draft EIR describes that the requirements for lighting for the stadium are subject to "NFL Sports Lighting Design Criteria." As these requirements are already in force at Candlestick, the new light and glare attributed to the new 49ers stadium is a relocation of impacts from Candlestick Point to HPS Phase II, that would be reduced to less than significant with mitigation measures MM AE-7b.1 and MM AE-7b.2. No more detail is necessary to identify or address the impact of stadium lighting associated with the Project.

Response to Comment 81-31

This comment contains introductory, closing, or general background information and is not a direct comment on environmental issues or the content or adequacy of the Draft EIR. No response is required. However, the commenter is requesting that the lead agencies consider their comments and those of other community members and organizations. All comment letters and responses will be forwarded to the decision makers for their consideration prior to approval or denial of the Project.

Letter 82: Arc Ecology (1/12/10)

Letter 82

Arc Ecology

Environment, Economy, Society, & Peace

12 January 2010

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Mr. Stanley Muraoka
Environmental Review Officer
San Francisco Redevelopment Agency
One South Van Ness Avenue, Fifth Floor
San Francisco, California 94103

RE: Public Comment on Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project *(formerly the "Bayview Waterfront Project")* Draft EIR [DEIR]

Dear Sirs:

Arc Ecology is submitting the enclosed pages as our formal commentary on Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project *(formerly the "Bayview Waterfront Project")* Draft EIR [DEIR]. 82-1

Sincerely,

Saul Bloom
Executive Director
Arc Ecology

Enclosures: bound pages of Arc Ecology Comment, multiple documents

4634 3rd Street, San Francisco, California 94124, United States of America
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Comments made by Arc Ecology

Preliminary comments on selected impacts and mitigation measures listed in Table ES-2. Michael F. McGowan, Ph.D. Staff Scientist, Arc Ecology. 12/8/2009

Impact AQ-4 Operation of the Project would violate BAAQMD CEQA significance thresholds for mass criteria pollutant emissions from mobile and area sources and contribute substantially to an existing or projected air quality violation at full build-out in the year 2029. 82-2

1. This significant and unmitigated impact exacerbates local environmental injustice with respect to public health and constitutes a cumulative negative impact on the quality of the environment for the city of San Francisco and the Bay Area. The project should be modified such that project air quality emissions would neither worsen existing air quality, nor contribute substantially to projected air quality violations.

Impact HZ-1 Construction activities associated with the Project would not expose construction workers, the
Public, or the environment to unacceptable levels of hazardous materials as a result of the disturbance of soil and/or groundwater with known contaminants from historic uses.
Impacts HZ-2 to HZ-14 82-3

2. The mitigation measures proposed for these potentially significant impacts are not spelled out in adequate detail to judge whether they would be effective in mitigating the impacts to less than significant. Stating that a plan will be made later to mitigate any hazardous release from construction impacts is not a mitigation measure but a promise of the intent to have a mitigation measure. There is no certainty that any mitigation measures will be possible, therefore these impacts should be considered potentially significant and unmitigable, not less than significant and mitigable.
3. This comment applies especially to **HZ-10b** and its mitigation measure. The installation of pilings through a landfill cap that will be used to contain likely, but unspecified contaminants including radiological materials is extremely problematic. This impact should be considered potentially significant and unmitigable. An unmitigable radiological release is not acceptable, therefore the plan needs to be revised to provide a clear alternative to any option for placing pilings through the cap or cover into contaminated fill. 82-4

Comments made by Arc Ecology

Impact HZ-15 Construction and grading activities associated with the Project would not disturb soil or rock that could be a source of naturally occurring asbestos in a manner that would present a human health hazard.

MM HZ-15 Asbestos Dust Mitigation Plans and Dust Control Plans.

82-5

4. The asbestos air monitoring should be required, not at the option of BAAQMD, because the "no visible dust" standard does not protect against asbestos dust which is not visible to the naked eye.
5. The threshold of asbestos concentration requiring shut-down and implementation of dust control measures should be specified based on accepted cancer risk assessment guidelines and Hunters Point current standards, i.e., fewer than 1 in 10,000 excess cancers. 82-6
6. Mitigation should include hiring an independent third party to validate the positioning of the asbestos dust monitors and to review and report the monitoring data to the public. 82-7

Impact BI-10a and BI-10b and BI-10c Construction of the Candlestick Point would require the removal of hard substrates (riprap) used by native oysters, but would not have a substantial adverse effect, either directly or through habitat modifications, on this species.

82-8

7. This impact statement is incorrect because the hard substrate used by native oysters is the limiting habitat for the species, therefore removing it would be a significant impact. Acceptable mitigation would be replacement of the square footage of hard substrate with a similar amount of hard substrate preferably made from oyster shells. The mitigation habitat could be placed at or below the tide level of the hard substrate removed by the project. The mitigation should be monitored by a competent biologist to demonstrate successful mitigation.

Impact BI-11c Construction of the Yosemite Slough bridge would not have a substantial adverse effect on designated
critical habitat for green sturgeon and Central California Coast steelhead through permanent and temporary impacts to aquatic
and mudflat foraging habitat.

82-9

8. The mitigation measures for this impact are not complete. A Section 7 consultation with the National Marine Fisheries Service is required to determine potential impacts to green sturgeon and their critical habitat in San Francisco Bay. Depending on the outcome of this consultation, the impact may not be mitigable, in which case the bridge would not be allowed. This should be spelled out clearly in the project description.

Comments made by Arc Ecology

Impact BI-19a Implementation of the Project at Candlestick Point would not result in impacts to aquatic organisms through the
re-suspension of contaminated sediments. 82-10

9. Re-suspension of sediments potentially impact eelgrass, macroalgae, and phytoplankton by blocking sunlight. The potential impacts of re-suspended sediments, whether contaminated or not, on such organisms should be evaluated, or there should be a full explanation why not.

Impact BI-19b and Mitigation Measure MM BI-19b.1 Work Windows to Reduce Maintenance Dredging Impacts to Fish during Operation of the Marina. 82-11

10. The LTMS (2001) standard is no longer the only regulation that must be considered to protect fish and fish habitat from impacts of dredging. There are no work windows for green sturgeon (federal) or longfin smelt (state) so Section 7 consultations and/or California Department of Fish and Game biological opinions will need to be prepared to mitigate for potential dredging impacts. In addition, if any eelgrass beds are nearby, then light monitoring in compliance with National Marine Fisheries Service protocols will need to be done as a condition of the dredging permits.

Impact BI-20a and MM BI-20a Lighting Measures to Reduce Impacts to Birds. 82-12

11. The proposed mitigation measure in MM BI-20a, "Use strobe or flashing lights in place of continuously burning lights for obstruction lighting. Use flashing white lights rather than continuous light, red light, or rotating beams." May not be permissible near water because the U.S. Coast Guard restricts flashing (strobe) white lights to emergency beacons. Please confirm that the use of white strobe lights to deter birds is allowed under these circumstances or propose a different mitigation measure.

MM BI-18b.1 Maintenance Dredging and Turbidity Minimization Measures for the Operation of the Marina. Maintenance dredging for the marina could remove or generate sediment plumes that could impact special status species, their habitats, and Essential Fish Habitat (EFH). To minimize this effect, the following measures shall be implemented by the Project Applicant: 82-13
1. Conduct a detailed survey for native oysters in all suitable substrates within the marina, (and the following under this Mitigation Measure).

12. This mitigation measure is ill-conceived to address habitat impacts of turbidity plumes from dredging in the new Hunters Point marina. First, native oysters have no special status under federal or state law except catch limits under the Fish and Game Code.

Comments made by Arc Ecology

Second, substrate within a marina is not the natural habitat of this species so possible effects of dredge sediment plumes are not relevant to protecting native oyster habitat within the marina. Third, dredge sediment plumes should be measured during the first dredging episode to assess potential impact, if any, outside the marina. If no impact is found then the monitoring should not be needed in subsequent dredging episodes. Fourth, a detailed hydrodynamic plume model requires extensive data on bathymetry, tidal currents, and other factors, including actual verification and validation of the model by collecting field data. With good field data on the sediment plume there is no need for the model and its input data. Fifth, native oysters are widely distributed in San Francisco Bay but their settlement and survival in any one area is highly variable and good cause and effect relationships with, e.g., suspended sediment, are lacking. While monitoring and restoration of native oysters and their habitat in San Francisco Bay is a worthy endeavor, making it a costly requirement of maintenance dredging in a new marina is not justified. 82-13 cont'd.

MM BI-19b.1 in part "The spawning season for the Pacific herring is March 1 to November 30. Therefore, the window that shall be applied to minimize impacts to sensitive fish species (during which dredging activities cannot occur) is March 1 to November 30." 82-14

13. My comment. This statement about the spawning season is incorrect. In San Francisco Bay the spawning season for Pacific herring is October to April (California Department of Fish and Game website). Therefore an arbitrary dredging window would be May-September. In practice, regulation of dredging impacts on herring is done on an ad hoc basis using real time observations of herring spawning so as not to unneccessarily constrain dredging projects when there are no herring spawning in the bay. The LTMS 2001 Management Strategy Appendix F that was cited in the mitigation measure actually says that dredging will be restricted in historic herring spawning areas, when they are present, during December 1-February 28. Please change the wording in the mitigation measure to reflect the correct spawning season and the correct wording of the regulation with regard to Pacific herring.

Hazardous Materials

In MM HZ-1a: change the word "comparable" in the second paragraph to "equivalent" because the investigation and treatment should be at the same level of protectiveness in the CPSRA areas as in the land subject to San Francisco Health Department Article 22a. 82-15

The proposed mitigation measures seem appropriate if they are properly implemented. There should be a mechanism for peer review of the plans, independent verification of the performance of the mitigation, and community outreach to reassure and confirm the success of the mitigation as implemented. 82-16

Hydrology and Water Quality 82-17

Comments made by Arc Ecology

The mitigation measures should specify that revegetation will be done with native, non-invasive species. 82-17 cont'd.

The mitigation measures should specify that shoreline improvements will incorporate the principles of natural, living shorelines, wherever feasible. 82-18

The allowance of three feet for future sea level rise may not be adequate. Other California authorities are using a 55 inches by year 2100 estimate. It would be prudent to allow for more sea level rise because it will be much easier to build out farther if sea level doesn't rise more than expected than it will be to protect existing structures from more than three feet of sea level rise if it does occur.. 82-19

The proposed mitigation measures seem appropriate if they are properly implemented. There should be a mechanism for peer review of the plans, independent verification of the performance of the mitigation, and community outreach to reassure and confirm the success of the mitigation as implemented. 82-20

Shoreline Improvements 82-21

The frequent mention of the potential use of natural shorelines is to be commended. Arc Ecology endorses the use of living shorelines for erosion protection, public access and education, and habitat preservation and enhancement. The relative amounts of sandy beach and natural shoreline in the plan are small compared to their potential development. Please consider living shorelines for erosion protection where there is now deteriorating riprap, e.g., at much of the Candlestick Point shoreline where rubble riprap is ineffective, unattractive, and hazardous. Moreover, some areas suitable for natural shorelines were stated to be planned for riprap by the Navy. Please plan for natural shoreline areas at these locations and encourage the Navy to implement them as part of the remedy for contamination so they do not have to be redone later. Examples of these areas are Parcel B IR 7, Parcel B Drydocks 5 to 7, Parcel D Berths 16 to 20, Parcel E Berths 37-42, Parcel E-2 entire shoreline.

When considering the suitability of the natural, living shoreline, approach to shoreline protection and enhancement be sure to include the construction of deep intertidal and shallow subtidal eelgrass meadows and native oyster beds and reefs. These habitat enhancements also attenuate wave action and thus reinforce the effectiveness of marsh and wetlands plants in stabilizing soil along the shore. 82-22

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December 21, 2009

Saul Bloom
Arc Ecology
4634 Third Street
San Francisco, CA 94124

Subject: Candlestick Point-Hunters Point Shipyard Phase II Development Plan Draft EIR Review

Dear Saul:

As you are aware, the Draft Environmental Impact Report (EIR) for the Candlestick Point-Hunters Point Phase II Development Plan analyzes the proposed project (which includes the Yosemite Slough Bridge) and Alternative 2 (the proposed project without the Yosemite Slough Bridge). LSA Associates, Inc. (LSA) prepared a preliminary review of the Draft EIR focused on the traffic-related analyses of the proposed project and Alternative 2 to determine whether the bridge is an essential component of the redevelopment plan. 82-23

No figure is presented to illustrate the design of the bridge's transportation elements. Page 38 of Section 2, Project Description, provides a written description that is later repeated in other sections. The 81-foot bridge would provide two 11-foot bus rapid transit (BRT) lanes, a 12-foot Class 1 bicycle and pedestrian path, and four game-day lanes. After the BRT lanes and bicycle path have been accounted for, 47 feet remain for the game-day lanes and the separation between lanes. 82-24

Pages 33–35 of Section 6, Alternatives, state that the construction, intersection, freeway, transit, bicycle, pedestrian, and parking impacts of Alternative 2 are the same as or similar to those of the project. The Transportation Study, located in Appendix D of the Draft EIR, similarly states that the impacts of Alternative 2 are the same as those of the project for intersections (page 235), freeway mainline and weaving segments (page 212), freeway ramp junctions (page 216), transit capacity (page 288), bicycle circulation (page 295), and pedestrian circulation (page 300). In fact, Appendix D, Chapter 7, Mitigation Measures, reveals that no additional mitigation measures are considered necessary for Alternative 2. Even Table VI-12, the summary table comparing the significant unavoidable impacts of the project to those of each of the alternatives, states that the traffic impacts of Alternative 2 are all equal to those of the project. 82-25

Despite the statements of equal impacts contained in the analysis portions of the Draft EIR, some statements in the summary paragraphs imply that Alternative 2 would result in increased traffic-related impacts. The following statement from Section 6, page 160, is an example: 82-26

> "Alternative 2 (CP-HPS Phase II Development Project, HPS Phase II Stadium, State Parks Agreement, and without the Yosemite Slough Bridge) would avoid Project impacts related to biological resources, water quality, and hazardous materials because the Yosemite Slough [bridge] would not be constructed. However, because the Yosemite Slough bridge would not be constructed, Alternative 2 would result in increased traffic-related impacts, particularly on game days."

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Statements such as these in summary paragraphs are troublesome because they imply to anyone who does not read the document in depth that the bridge alleviates traffic impacts. In reality, the analysis text of the Draft EIR limits discussion of the bridge's benefits to the BRT and game-day traffic. These two topics are discussed in more detail below. 82-26 cont'd.

BRT

In lieu of the project BRT route over the bridge, Alternative 2 proposes that the BRT continue west on Carroll Avenue until reaching the abandoned Navy rail right-of-way. The BRT would then travel along the rail right-of-way adjacent to Hawes Street, adjacent to Armstrong Avenue, and east of Ingalls Street; then cross Hawes Street to reach Shafter Avenue; and then continue adjacent to Shafter Avenue to rejoin the proposed project BRT alignment. This alternative BRT route would travel in dedicated right-of-way. 82-27

Despite this clear description in the text, Figure VI-1 illustrates a confusing line along Ingalls Street labeled, "Alternative 2 Proposed BRT Route." Additionally, the summary paragraph describing the transit impacts of Alternative 2 on page 34 of Section 6 fails to indicate that the alternative BRT route would travel entirely on dedicated right-of-way.

Section III.D, Transportation and Circulation, mentions that the project BRT route would be "rail ready" and would not preclude conversion to light rail at some point in the future. The Draft EIR does not make this statement about the Alternative 2 BRT route. However, it is illogical to state that the Navy rail right-of-way could not accommodate a light-rail line at some time in the future. 82-28

Table VI-4, Attainment of Project Objectives, states that Alternative 2 meets Objectives 1 and 2 to a lesser extent than the project because of a lack of direct transit connection without the bridge. This could be a continuation of the misleading statements in other summary paragraphs overlooking the dedicated right-of-way utilized by the alternative BRT route, or it could also be the result of an error in the Transportation Study being carried forward into the Draft EIR. 82-29

Page 288 of Appendix D (Transportation Study) states that Alternative 2 would increase BRT travel time by "approximately five minutes" and would decrease BRT ridership by "approximately 15 percent." No technical analysis is presented in the Draft EIR justifying the claimed travel time savings. 82-30

The travel time increase in the Draft EIR is similar to statements made in the Bayview Transportation Improvements Project (BTIP) Transportation Study dated August 15, 2008, which identified 4 minutes and 37 seconds in travel time savings with the bridge. However, LSA believes that the BTIP erred in its determination of the differences in travel time by adding 1 minute to the travel time of the no-bridge alternative west of the bridge and failing to add travel time across the bridge to the with-bridge alternative. It should be noted that the BTIP no-bridge alternative assumed the BRT would travel on Ingalls Street in mixed-flow lanes. Alternative 2 of the Draft EIR includes the use of dedicated lanes within abandoned Navy rail right-of-way. The project BRT route and Alternative 2 BRT route would both utilize dedicated lanes for the entire trip. Because the BRT would not travel in mixed-flow lanes in Alternative 2, the travel time savings of the bridge identified in the Draft EIR should be even less than the corrected BTIP travel time savings.

LSA ASSOCIATES, INC.

A simple analysis identified that the stated 5-minute increase in travel time with Alternative 2 is greatly exaggerated. Between Carroll Avenue and Shafter Avenue, the bridge route would travel approximately 2,245 feet. The route around Yosemite Slough for Alternative 2 is approximately 5,450 feet. Stating that the trip around Yosemite Slough in dedicated lanes requires 5 additional minutes is equivalent to stating that the BRT has an average speed of 7.3 miles per hour. 82-30 cont'd.

Based on other BRT lines operating in dedicated lanes, the expected average speed should be between 20 and 25 miles per hour. This would equate to a travel time savings for the Yosemite Slough Bridge of between 1 minute and 27 seconds and 1 minute and 49 seconds, which is far less than stated in the Draft EIR.

The inaccuracies in the travel time estimate most likely led to an error in calculating a 15 percent decrease in BRT ridership without the bridge. The inaccuracy in calculating Alternative 2 BRT travel time may have also led to an error in determining that Alternative 2 impacts a transit route that the project does not (Appendix D, page 290). It should be noted that the impact to Route 28L is not mentioned in the body of the Draft EIR; the reference to it only appears in Appendix D.

Route 28L travels north-south between the Presidio and Daly City, on the opposite side of the peninsula from the project. It is not immediately clear how the Transportation Study concludes that the project would impact this route, that 16 additional vehicles would be necessary in both the a.m. and p.m. peak hours to maintain headways as a result of the project, and that elimination of the Yosemite Slough Bridge would require an additional 7 vehicles in the a.m. peak hour and 12 vehicles in the p.m. peak hour to maintain headways on Route 28L. 82-31

Game Day

Table VI-4, Attainment of Project Objectives, states that Alternative 2 meets all project objectives except for Objective 5. Objective 5 is to encourage the 49ers to remain in San Francisco by providing a world-class site for a new waterfront stadium and necessary infrastructure. The reason given for stating the objective is not met is that Alternative 2 "would not facilitate the efficient handling of game-day traffic to as great an extent as the Project." 82-32

The Draft EIR does not provide a technical analysis of post-game traffic flow comparing with and without bridge scenarios. It is therefore inappropriate for the Draft EIR to make a conclusion that the bridge is necessary infrastructure or that Alternative 2 would not facilitate the efficient handling of game-day traffic.

Game-day traffic is a condition that would occur 10 times per year (or up to 12 times per year if the 49ers are participating in the playoffs). When discussing game-day traffic, the Draft EIR states that "vehicle arrival is spread over about six hours" (Section III.D, page 22) and that because the arrival occurs over a long period of time, traffic facilities are not substantially impacted (Section III.D, page 23). It is the departure of vehicles from the parking lot over a short period of time that constitutes the majority of game-day traffic impacts.

The number of vehicles exiting any stadium parking lot exceeds the capacity of the surrounding roadway network. Congestion will occur on either the regional transportation routes, the local streets, or in the parking lot itself. Ideally, exiting traffic would be metered to match the ability of the regional and local road networks to absorb the additional vehicles and excess demand would be contained on the event site. Appendix D (Transportation Study), page 325 acknowledges that "the existing egress system [from Candlestick Park] effectively meters the traffic that can merge onto U.S. 101 and other routes so as to minimize mainline congestion." 82-32 cont'd.

The Draft EIR assumes that the three additional lanes provided by the bridge for vehicles exiting the parking lot are beneficial. However, the project (with Yosemite Slough Bridge) would not provide more capacity on regional transportation routes than Alternative 2, nor would the project provide more capacity on local streets than Alternative 2. It is possible that a greater number of lanes exiting the parking lot will overwhelm the local street system and that metering the flow of vehicles exiting the parking lot, by not providing a bridge, would result in more efficient handling of vehicles and reduce the level of queuing and congestion on local streets.

The Draft EIR describes the project's shortfall of 3,059 parking spaces for the stadium (a 15 percent shortfall) as a social inconvenience and hypothesizes that the inconvenience could encourage some patrons to take transit instead (Section III.D, page 138). Any inconvenience associated with waiting to exit the parking lot resulting from eliminating the bridge could similarly encourage some patrons to take transit instead. 82-33

Conclusion 82-34

The Draft EIR compared traffic-related impacts for redevelopment of Candlestick Point and Hunters Point Shipyard with or without a bridge. The text of the analysis stated that impacts without the bridge would be similar to or the same as impacts with the bridge. Summary statements in the Draft EIR indicate that Alternative 2 (without the bridge) does not meet the project objectives as well as the project (with the bridge) seemingly because of the bridge's perceived benefits to the BRT and game-day traffic.

However, benefits to the BRT are exaggerated because the travel time savings of the bridge are 1 minute and 27 seconds to 1 minute and 49 seconds. Benefits to game-day traffic cannot be substantiated because the Draft EIR provides no analysis to determine whether or not the bridge would provide a benefit to game-day traffic. It is possible that providing the bridge for game-day traffic would increase congestion on local streets. Because of the similar impacts associated with redevelopment of Candlestick Point and Hunters Point Shipyard with or without a bridge, it does not appear that the bridge is a necessary component of the transportation system.

LSA hopes that the discussion of traffic-related issues informs your analysis of the Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project Draft EIR. If you have further questions, please feel free to contact us.

Sincerely,

LSA ASSOCIATES, INC.

Meghan Macias

Meghan Macias
Principal

Comments made by Arc Ecology

COMMENTS ON THE CANDLESTICK POINT-HUNTERS POINT SHIPYARD PHASE II DEVELOPMENT PLAN PROJECT DRAFT EIR DATED NOVEMBER 12, 2009

Section 6, Page 30

Comment 1: "Under Alternative 2, motorized and non-motorized traffic would be required to circumnavigate Yosemite Slough because no bridge would be constructed." 82-35

This statement misleads the reader by implying that additional automobiles would be added to the street network without the bridge when in fact, automobiles would not be allowed on the bridge. The section should correctly inform readers that neither the Project or Alternative 2 would provide bridge access for automobiles.

Comment 2: "The primary roadway connection for automobiles and other vehicular traffic between Candlestick Point and HPS Phase II…" 82-36

This statement is similarly misleading. A more accurate statement would inform the reader that the circulation system proposed for automobiles is the same for the Project and Alternative 2.

Figure VI-1

Comment 3: Although the text clearly indicates that the abandoned rail route would provide dedicated right-of-way for the BRT, the figure displays an "Alternative 2 Proposed BRT Route" along Ingalls Street. This could confuse readers who view the figure without reading the text in depth. Figure VI-1 should be corrected to show the BRT route along the RR ROW, as described in the text. 82-37

Comment 4: At the same time, the line along Innes Avenue should be discussed in the text or removed from Figure VI-1 if Figure VI-1 is in error. 82-38

Comments made by Arc Ecology

Section 6, Page 32

Comment 5: The first paragraph should indicate that, similar to the project, the alternative BRT route would be "rail ready" (not to preclude possible conversion to light-rail). It is illogical to state that the rail right-of-way, to be utilized by the BRT to circumnavigate Yosemite Slough, would not be capable of accommodating rail. 82-39

Section 6, Page 33 – Transportation and Circulation 82-40

Comment 6: "The main roadway connection between Candlestick Point and HPS Phase II would be via Ingalls Street."

This statement misleads the reader by implying that additional automobiles would be added to the street network without the bridge when in fact, automobiles would not be allowed on the bridge. A more accurate statement would inform the reader that the circulation system proposed for automobiles is the same for the Project and Alternative 2.

Section 6, Page 34 – Intersection Conditions

Comment 7: "In general, intersection conditions would be significant and unavoidable effect of Alternative 2." This sentence misleads the reader into believing that Alternative 2 has significant impacts that the Project avoids, when in fact Alternative 2 and the Project have identical impacts to intersections. This section should inform readers that impacts of Alternative 2 are the same as the Project. 82-41

Comment 8: "During game days at the football stadium, with no Yosemite Slough Bridge, the entrance and exiting capacity for vehicles would be reduced about 40 percent compared to the Project; four out of a total 11 exit lanes would be available without the bridge." 82-42

This statement is in error. Section III.D, page 45 indicates that one out of the bridge's four lanes would remain open to off-peak direction traffic for local traffic and emergency vehicles. In addition, Alternative 2 would provide the same number of lanes accessing regional transportation facilities and the same number of lanes in the local street system. Only the number of lanes leaving the parking lot is reduced from ten to seven.

Comments made by Arc Ecology

Comment 9: "A mitigation measure to implement a Travel Demand Management Plan for the stadium events would reduce but not avoid traffic impacts, which would be significant and unavoidable."

This statement misleads the reader by implying that impacts associated with Alternative 2 cannot be mitigated whereas similar Project impacts could be mitigated. The statement should inform the reader that the Project's Travel Demand Management Plan would also reduce but not avoid stadium traffic impacts which would also be significant and unavoidable. 82-43

Section 6, Page 34 – Transit Impacts 82-44

Comment 10: The second paragraph misleads the reader into believing that the Alternative 2 route does not provide dedicated right-of-way when in fact the alternative BRT route around Yosemite Slough would still operate in dedicated right-of-way and is technically feasible.

Comment 11: Pursuant to State CEQA Guidelines Section 15151, the EIR should provide a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which takes into account the environmental consequences of the project. While an EIR must contain facts and analysis, not just an agency's conclusions or opinions (Citizens of Goleta Valley v. Board of Supervisors, 1990), no technical analysis is presented in the Draft EIR justifying the claimed travel time savings. Based on the additional distance around Yosemite Slough (3,205 feet) and average BRT travel speeds (20 to 25 miles per hour), the alternate BRT route should require between 1 minute 27 seconds and 1 minute 49 seconds of additional travel time. 82-45

Comment 12: Identical misleading statements regarding dedicated right-of-way and travel time are made in Appendix D (Transportation Study) and should be removed because these statements are not supported by facts or analysis presented in the Draft EIR. 82-46

Comment 13: The reference to VRT on this page is a typographical error. 82-47

Section 6, Page 58 – Attainment of Project Objectives 82-48

Comments made by Arc Ecology

Comment 14: The statement that Alternative 2 would meet transportation-related objectives to a lesser extent than the Project is inconsistent with the remainder of the section and should be removed from the Final EIR. Earlier in Section 6 the Draft EIR states that construction, intersection, freeway, transit, bicycle, pedestrian, and parking impacts of Alternative 2 are the same as or similar to the Project (Section 6, Pages 33-35). Additionally, Appendix D (Transportation Study) makes the same conclusions: 82-48 cont'd.

- "Therefore, the traffic impacts associated with Alternative 2 would be the same as the Project." (Page 235)
- Impacts at Mainline and Weaving Segments are the same (Page 212) and Impacts at Ramp Junctions are the same (Page 216)
- "As with the Project, Alternative 2 impacts on transit capacity would be less than significant." (Page 288)
- "As with the Project, Alternative 2 impacts on bicycle circulation would be less than significant." (Page 295)
- "As with the Project, Alternative 2 impacts on pedestrian circulation would be less than significant." (Page 300)

Comment 15: Stating that Alternative 2 meets most of the Project objectives is incorrect. Like the Project, Alternative 2 provides for BRT connection between Candlestick Point and Hunters Point along dedicated right-of-way. Alternative 2 and the Project have identical traffic-related impacts. Additionally, the Draft EIR does not provide analysis demonstrating the necessity of the bridge to accommodate game day traffic (a scenario occurring only 10 or 12 times a year). Based on the analysis provided in the Draft EIR, Alternative 2 meets all the Project objectives while reducing impacts to Hazards and Hazardous Material (Section 6, Page 42), Geology and Soils (Section 6, Page 44), and Biological Resources (Section 6, Page 47). 82-49

Table VI-4 – Attainment of Project Objectives Alternative 2 82-50

Objective 1

Comment 16: The statement that removing the bridge eliminates direct transit connection is false; Alternative 2 provides a BRT connection in dedicated right-of-way.

Comments made by Arc Ecology

Comment 17: The statement that removing the bridge eliminates continuous shoreline and open space access contradicts the previous sentence which correctly states that Alternative 2 provides "the same shoreline improvements and open space network" as the Project. 82-51

Comment 18: Alternative 2 meets this objective to the same extent as the Project because a grade-separated connection is not necessary to produce tangible community benefits. 82-52

Objective 2

Comment 19: The statement that removing the bridge eliminates a direct connection between Candlestick Point and Hunters Point Shipyard is false; Alternative 2 provides a BRT connection in dedicated right-of-way. 82-53

Comment 20: Alternative 2 meets this objective to the same extent as the Project because direct connection is provided by transit in dedicated lanes and the opening of Crisp Avenue. 82-54

Objective 5

Comment 21: Alternative 2 includes the same stadium as the Project, the same number of lanes on local streets as the Project, the same connection to U.S. 101 as the Project, and meets Objective 5 as well as the Project. The technical analysis in the Draft EIR does not support the statement that a bridge over Yosemite Slough is necessary infrastructure. An EIR must contain facts, not just an agency's conclusions or opinions (Citizens of Goleta Valley v. Board of Supervisors, 1990). Because the conclusion that the bridge is "necessary infrastructure" is not supported by fact, such statements should be removed from the Final EIR. 82-55

Comment 22: The Draft EIR does not provide an analysis of post-game traffic flow with and without the bridge. The Draft EIR only assumes that a greater number of lanes exiting the parking lot is beneficial. It is possible that a greater number of lanes exiting the parking lot will overwhelm the local street system without speeding the delivery of vehicles onto U.S. 101. 82-56

Comment 23: Because the Draft EIR does not provide an analysis of post-game traffic flow with and without the bridge, it is improper to make a conclusion that the bridge is necessary infrastructure. Such statements should be removed from the Final EIR. 82-57

Comments made by Arc Ecology

Section 6, Page 160 – Environmentally Superior Alternative 82-58

Comment 24: "Alternative 2… would avoid Project impacts related to biological resources, water quality, and hazardous materials because the Yosemite Slough [bridge] would not be constructed. However, because the Yosemite Slough bridge would not be constructed, Alternative 2 would result in increased traffic-related impacts, particularly on game days."

This statement is inconsistent with the analysis contained within the section. Earlier in Section 6 the Draft EIR states that construction, intersection, freeway, transit, bicycle, pedestrian, and parking impacts are the same as or similar to the Project (Section 6, Pages 33-35). Additionally, Appendix D (Transportation Study) makes the same conclusions:

- "Therefore, the traffic impacts associated with Alternative 2 would be the same as the Project." (Page 235)
- Impacts at Mainline and Weaving Segments are the same (Page 212) and Impacts at Ramp Junctions are the same (Page 216)
- "As with the Project, Alternative 2 impacts on transit capacity would be less than significant." (Page 288)
- "As with the Project, Alternative 2 impacts on bicycle circulation would be less than significant." (Page 295)
- "As with the Project, Alternative 2 impacts on pedestrian circulation would be less than significant." (Page 300)

Comment 25: Please explain how this paragraph can state Alternative 2 would result in increased traffic-related impacts when that statement is in direct conflict with Table VI-12: Comparison of the Significant and Unavoidable Impacts of the Project to Each of the Alternatives, which found Alternative 2 to be equal to the Project. 82-59

Comment 26: The Draft EIR assumes that a greater number of lanes exiting the stadium parking lot is beneficial, but provides no analysis demonstrating that the number of vehicles delivered by Ingalls Street and the bridge (three outbound lanes each) will not exceed the capacity of the Harney Way and 3rd Street ramps and U.S. 101. It is possible that metering the flow of vehicles exiting the parking lot, by not providing a bridge, would result in more efficient handling of vehicles and reduce the level of queuing and congestion on local streets. 82-60

Appendix D, Chapter 6, Page 288 82-61

Comments made by Arc Ecology

Comment 27: The second paragraph of Alternative 2-No Bridge misleads the reader into believing that the Alternative 2 route does not provide dedicated right-of-way when in fact the alternative BRT route around Yosemite Slough would still operate in dedicated right-of-way and is technically feasible. 82-61 cont'd.

Comment 28: Pursuant to State CEQA Guidelines Section 15151, the EIR should provide a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which takes into account the environmental consequences of the project. While an EIR must contain facts and analysis, not just an agency's conclusions or opinions (Citizens of Goleta Valley v. Board of Supervisors, 1990), no technical analysis is presented in the Draft EIR justifying the claimed travel time savings. Based on the additional distance around Yosemite Slough (3,205 feet) and average BRT travel speeds (20 to 25 miles per hour), the alternate BRT route should require between 1 minute 27 seconds and 1 minute 49 seconds of additional travel time. 82-62

Comment 29: The third paragraph of Alternative 2-No Bridge asserts that the alternative BRT route would increase travel time by 5 minutes and decreases ridership by 15 percent. These statements are not supported by analysis presented anywhere in the Draft EIR and should be removed from the Final EIR. 82-63

Comment 30: The travel time increase in the Draft EIR is similar to statements made in the Bayview Transportation Improvements Project (BTIP) Transportation Study dated August 15, 2008 which identified 4 minutes 37 seconds in travel time savings with the bridge. The BTIP, however, erred when determining the differences in travel time by adding 1 minute to the travel time of the no-bridge alternative west of the bridge and failing to add travel time across the bridge to the with-bridge alternative. It should be noted that the BTIP no-bridge alternative assumed the BRT would travel on Ingalls Street in mixed-flow lanes. Alternative 2 of the Draft EIR includes use of dedicated lanes within abandoned Navy rail right-of-way. The Project BRT route and Alternative 2 BRT route would both utilize dedicated lanes for the entire trip. Because the BRT would not travel in mixed-flow lanes in Alternative 2, the travel time savings of the bridge identified in the Draft EIR would be less than the corrected BTIP travel time savings. 82-64

Comment 31: The stated 5 minute increase in travel time with Alternative 2 is greatly exaggerated. Between Carroll Avenue and Shafter Avenue the bridge route would travel 82-65

Comments made by Arc Ecology

approximately 2,245 feet. The route around Yosemite Slough for Alternative 2 is approximately 5,450 feet. Stating that the trip around Yosemite Slough, in dedicated lanes, requires 5 additional minutes is equivalent to stating that the BRT has an average speed of 7.3 miles per hour. 82-65 cont'd.

Comment 32: Based on other BRT lines operating in dedicated lanes, the expected average speed should be between 20 and 25 miles per hour. This would equate to a travel time savings for the Yosemite Slough Bridge of between 1 minute 27 seconds and 1 minute 49 seconds. 82-66

Comment 33: Errors in calculating the travel time savings of the bridge were undoubtedly carried forward into estimations of BRT ridership to and from the Hunters Point Shipyard and impacts to route 28L-19th Avenue/Geneva BRT route. All analyses that utilized the incorrectly calculated travel time savings should be corrected and reported so that the actual costs and benefits of the bridge can be considered. 82-67

Appendix D, Chapter 6, Page 290

Comment 34: Please explain how development in Bayview (and specifically whether or not a bridge providing approximately 1.5 minutes of travel time savings is built) affects a bus line travelling between Daly City and the Presidio. 82-68

FarWest
RESTORATION
ENGINEERING

July 31, 2006

Ms. Eve Bach
Arc Ecology
4634 Third Street
San Francisco, CA 94124

Subject: Transmittal of Preliminary Design Proposal for Hunters Point Shipyard Parcel E Stormwater Treatment Wetlands, San Francisco, California

Dear Eve:

I am pleased to submit this preliminary design report for a system of stormwater treatment wetlands at the Parcel E landfill of the former Navy base in San Francisco, California. In addition to improving water quality, the proposed wetlands will also provide excellent wildlife habitat and public access and educational opportunities to the local community. 82-69

I appreciate the opportunity to provide these services to Arc Ecology. Please do not hesitate to call me at (510) 522-7200 with any questions or comments.

Sincerely,

Roger Leventhal, P.E.
Principal Engineer

538 Santa Clara Avenue
Alameda, CA 94501
Phone (510) 865-2840

Preliminary Design Report for Hunters Point Shipyard Parcel E Stormwater Treatment Wetlands

San Francisco, California

July 31, 2006

Prepared by

FarWest Restoration Engineering
538 Santa Clara Avenue
Alameda, California 94501

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cont'd.

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HUNTERS POINT SHIPYARD PARCEL E STORMWATER TREATMENT WETLANDS

PRELIMINARY DESIGN REPORT

Executive Summary

This report presents a preliminary design for stormwater treatment wetlands at the industrial landfill on Parcel E of the former naval shipyard at Hunters Point, including design calculations, grading plans, and a cost estimate. The proposed design is a perennial wetland system that consists of a forebay pond flowing into a pair of permanent wet ponds, which in turn flow into two freshwater marshes that ultimately discharge into San Francisco Bay. Preliminary calculations indicate that the proposed system can treat the proposed 40 acre Hunters Pt site development and potentially an additional 200 acres of upland urbanized watershed.

In addition to stormwater treatment, the design also provides for a functioning wetland system with valuable habitat for a variety of birds and other wetland species. Furthermore, the proposed wetlands will provide significant public access and community education opportunities for an important and historically underserved part of San Francisco. 82-69 cont'd.

1.0 Introduction

This report presents a preliminary design for stormwater treatment wetlands at the industrial landfill on Parcel E of the former naval shipyard at Hunters Point in San Francisco (Figure 1). It contains an evaluation of the effectiveness of the proposed wetland system to treat pollutants in stormwater, preliminary grading plans and concept renderings, and an estimate of final design and construction costs.

1.1 DESIGN OBJECTIVES

In a 2004 feasibility study for the Golden Gate Audubon Society (Brown and Caldwell 2004), three primary objectives were identified for the creation of wetlands at the site: (1) improve the quality of stormwater effluent before it is discharged to San Francisco Bay; (2) create marsh habitat for desirable birds and aquatic species; (3) provide opportunities for public education, access and recreation. The study identified a permanent freshwater wetland system as the preferred alternative for meeting those objectives.

With funding provided by the Coastal Conservancy, Arc Ecology, a community based environmental group, retained FarWest Restoration Engineering to prepare this preliminary design on the basis of the conceptual design included in the 2004 feasibility study. In addition to advancing the conceptual design with design calculations, preliminary grading plans, and a cost estimate, this preliminary design incorporates modifications to improve and enhance operation of the stormwater treatment potential of the wetland complex, which the conceptual design did not address, and to enhance public safety. 82-69 cont'd.

1.2 SUMMARY OF PROPOSED DESIGN

The proposed wetland design is potentially an important element of the Hunters Point community revitalization process that is now underway. It would provide opportunities to treat stormwater and improve water quality before stormwater is discharged to San Francisco Bay; create wildlife habitat; and offer educational and recreational facilities.

The proposed design is a perennial wetland system that consists of a “forebay” flowing into a pair of ponds, which in turn flow into two freshwater marshes that ultimately discharge into San Francisco Bay (Figure 2). Brown and Caldwell’s 2004 feasibility study identified the preferred stormwater treatment method as extended stormwater detention and biofiltration through a pond and marsh system. The design provides for a functioning wetland system with valuable habitat for a variety of birds and other wetland species. The wetlands will also provide significant public access and community education opportunities for this important and historically underserved part of San Francisco.

1.3 DESCRIPTION OF EXISTING SITE

Parcel E consists of 167 acres in the southwestern portion of the Hunters Point Shipyard; the project site (see Figure 2) is located in the western portion of Parcel E. The industrial landfill at the site encompasses approximately 20 acres with fill ranging in depth from 2 to 32 feet. A landfill cap covers approximately 15 acres of the landfill. The waste consists of a wide range of materials. The landfill reportedly has no bottom liner or leachate capture system, and bottom waste is in direct contact with groundwater.

The Parcel E site's proximity to the bay and to existing wetlands at Hunters Point makes it the ideal location for a treatment wetland. Current master planning efforts identify a portion of Parcel E as open space, including the landfill location, which is not slated for commercial development; thus the treatment wetland will have no negative impact on proposed development plans. (The wetlands' benefits in the proposed development plan will be discussed in *From Pollution to Parkland: Alternatives for a Waterfront Park at Hunters Point Shipyard* (Arc Ecology 2006). Furthermore, we have identified no other site at Hunters Point that is suitable for construction of a stormwater treatment wetland.

82-69 cont'd.

1.4 PREVIOUS STUDY AND CONCEPTUAL DESIGN

The feasibility study on which this design report is based was performed by by the consulting firm Brown and Caldwell, in association with Professor Rhea Williamson of San Jose State University, in 2004 for the community-based group Arc Ecology (Brown and Caldwell 2004). The study investigated various wetland treatment alternatives, and the report included a conceptual design for the alternative that the Brown and Caldwell study identified as preferred (a forebay flowing into a pair of ponds and wetland marshes, as described above). The key assumption supporting the feasibility of the design was that recycled water would be available to supplement surface-water runoff during the summer months. The study focused primarily on the wetlands' benefits to wildlife habitat and less on the design basis for stormwater treatment.

The feasibility study report contained detailed information on the site's history, characteristics of the Parcel E landfill, and pollutants found there, as well as general background information. It should be read in conjunction with this preliminary design report.

1.5 SCOPE OF WORK

1.5.1 Scope of Preliminary Design

The scope of work for this preliminary design includes the following elements.

- Develop the design calculations that provide the basis for stormwater treatment of the proposed wetland system and its effectiveness for pollutant removal

- Prepare a preliminary grading plan
- Further develop the conceptual design to evaluate implementation and constructability
- Prepare preliminary cost estimates for construction, operation, and maintenance of the system
- Participate in a community meeting and presentation of the system's design

1.5.2 Assumptions and Limitations

This report is based on the following assumptions and limitations.

- The topographic base map of Parcel E was provided by Hargreaves Associates using a scan of a map from a report prepared by Tetra Tech Inc. for the Navy (Tetra Tech 2003). No project datum or date of the survey was provided. We have therefore assumed a datum for this survey of feet NGVD (National Geodetic Vertical Datum, mean sea level 1929).
- We assumed that the area of the watershed draining into the wetlands — 38 acres — was correct as cited in the Brown and Caldwell feasibility report, since Navy regulations prevented us from visiting the site and we were unable to obtain current topographic maps.
- The footprint of the system will be equivalent to the footprint of the existing landfill, an area of approximately 20 acres. 82-69 cont'd.
- Final development plans for the Parcel E watershed are not yet available; however, we understand that the watershed area is intended for high-density residential housing. We have made a conservative assumption that the surface of the watershed draining into the wetlands is 80 percent impervious. A more pervious watershed area would result in less runoff and leave additional treatment capacity in the wetland.
- The proposed wetland system is designed only for stormwater treatment and not for reduction of flooding. We have assumed that flow equalization, if required, will occur upstream of the wetlands or is not required because the flow will be discharged into the bay. Some equalization of flood flows may occur in the wetlands, but designing expressly for flood equalization would require information about the proposed upstream development that is unavailable to us at this time, and it is therefore not included in the scope of this report.
- Since the details of the watershed development are unknown, we have assumed that stormwater will enter the forebay at the inlet location shown on the grading plans either by gravity or from pumping. The design of the inlet structure into the wetland system should be coordinated with the watershed development site drainage plans during final design activities for the system.
- This report is based on the assumption that the Navy or others will remove pollutants and debris from the landfill to allow for construction of the project. While not necessary for the successful construction of wetlands on

Parcel E, the removal of the industrial landfill has been the Bayview–Hunters Point community's preferred strategy since the 2000 fire at the landfill, and we have therefore based this report on that scenario.

- We have developed two cost alternatives (detailed in Section 5.0). The first assumes the Navy will remove all contaminated soils and leave the site at an elevation of –10 feet NGVD. The second assumes a combination of hot-spot removal and in situ cleanup along with importation of clean soils so that after the Navy completes its cleanup activities the site's elevation will be at 0 feet NGVD. Notice that construction of the wetland will not necessarily depend on the Navy's cleanup decisions, since there are a range of possible remediation scenarios, each with its own associated cost However, the cleanup remedy implemented will strongly influence the quality of surrounding bay water habitat and compliance with community values and will be the subject of negotiations with the community and regulatory agencies.
- We have assumed that residual groundwater contamination will remain after cleanup, which will require a liner system between the wetland marshes and ponds and the groundwater.
- If significant groundwater contamination remains after cleanup, a groundwater extraction and treatment system may be required. However, the costs of such a system are not included in this proposal. 82-69 cont'd.

1.5.3 Modifications to Conceptual Design

This preliminary design addresses stormwater treatment and public safety by incorporating the following modifications to the 2004 feasibility study (Brown and Caldwell 2004).

- Adds a 5-foot-wide safety bench around the edge of each pond and the forebay to reduce the possibility of accidental drowning of anyone who may enter those areas. The benches consist of earthfill and wetland vegetation at an elevation approximately 1 foot below the design water level.
- Adds a small channel at a slope of approximately 0.5 percent graded into the bottom of each wetland marsh cell to allow for drainage if required.
- Increases the size of the forebay to contain enough volume to treat stormwater, as described in Section 4.
- Removes the large predator trench (described in the conceptual design as 8 feet deep and 20 feet wide) from the Dragonfly Pond. The proposed design maintains water in this pond with no drawdown, and therefore a deep trench provides no additional protection against predators. However, in the Wading Bird Pond, which is intended to draw down over a three- to four-week period, we kept a predator trench reduced in size to approximately 3 to 4 feet deep to inhibit predator access to the loafing island. The size of this trench has been reduced to save costs.

- Modifies public access routes to reduce the impact of walking trails on use of the site by birds, while still maintaining generous public access. Also, the preliminary design reduces the extent of boardwalks over wetland cells to minimize human impact on the wetlands and reduce construction costs.

2.0 Stormwater Treatment Concepts

This section presents the major concepts and related considerations in stormwater treatment as proposed in this preliminary design.

2.1 HOW LAND DEVELOPMENT AFFECTS STORMWATER RUNOFF

Every site has its own natural hydrology, or patterns of water flow — through the air, across its surface, and under the ground. Constructing buildings and roads typically changes both the volume and pattern of the flow of water at a site and the kinds and quantities of pollutants and debris carried in the water.

When rainwater flows over the surface of a site, it is called runoff. Under natural conditions — that is, on land where no buildings, sidewalks, roads, or parking lots have been built — most of the rain that falls typically soaks into the soil, and runoff occurs only when the ground is saturated, for example during a heavy rainstorm. 82-69 cont'd.

Areas covered by buildings, sidewalks, roads, and parking lots, on the other hand, are impervious to runoff — they cannot absorb it. The denser a development is, the more impervious its surfaces, and the more runoff it generates. The surfaces of commercial and industrial areas typically are highly impervious to runoff. In general, the more impervious the surface of a watershed, the more pollutants its runoff contains (Center for Watershed Protection 2003).

Furthermore, land development typically leads not only to more but faster runoff, which can increase erosion and widen and deepen creek and river channels. Development also alters the timing and pattern of the flow of water. For example, relatively small flows that typically occurred once every one to two years before a site has been developed may occur several times a year after it is developed. These kinds of changes to a site's hydrology have detrimental effects on ecosystems and waterways downstream.

Finally, land development changes the nature of the pollutants carried by runoff. The type and proportion of pollutants in runoff generally correspond to the use of the land over which the water flows. When properly designed, stormwater treatment systems can lessen the impact of development on a site's hydrology and improve the quality of the water.

2.2 POTENTIAL POLLUTANTS IN STORMWATER RUNOFF

Stormwater treatment wetlands are most successful when they are designed with known pollutants in mind. The pollutants typically of concern in urban stormwater runoff include the following.

- Mineral and organic matter (frequently reported as total suspended solids or TSS)
- Excessive plant "nutrients" (primarily nitrogen and phosphorus in plant fertilizers), which can cause excessive algal growth and depletion of oxygen)
- Hydrocarbons (such as oil, grease, and gasoline)
- Other "organic" chemicals such as pesticides
- Trace metals
- Pathogens

The actual pollutants in stormwater depend on the specific conditions at a site and its watershed. Some information on the Hunters Point site is available from the Navy's past stormwater monitoring, but redevelopment of the watershed will undoubtedly alter runoff characteristics significantly.

Land use strongly influences the types of constituents that may be found in runoff. Residential areas typically contain more turf, and the runoff that flows from them typically contains elevated levels of fertilizers and pesticides. Runoff from commercial and industrial areas may contain fewer of those chemicals but more metals associated with mechanical and industrial processes. The level of automobile traffic in an area is correlated with levels of hydrocarbons in runoff. 82-69 cont'd.

The preliminary design for the Hunters Point Shipyard project is based on the assumption that pollutants in stormwater runoff from the redeveloped watershed area will be comparable to runoff from other high-density residential developments. The extent to which previous land use will continue to influence pollutants in the runoff is unknown.

Table 1 summarizes data from stormwater monitoring the Navy performed at the Hunters Point Shipyard in 2004–2005, which involved two rounds of collection and analysis of stormwater samples at three locations. To assess the potential effectiveness of wetlands in treating stormwater at the site, we also examined several data sets of national and regional average conditions (Center for Watershed Protection 2003; Kadlec and Knight 1996). Table 2 compares the Hunters Point monitoring data with data for selected residential areas a set of national data; a set of data averaged from four areas with low rainfall (Phoenix, Arizona; San Diego, California; Boise, Idaho; and Denver, Colorado); and data for the San Francisco Bay Area. The data show what chemical constituents are typical in residential areas, in order-of-magnitude concentrations. These data are useful only for planning purposes, to provide a very rough estimate of the types and amounts of pollutants that would likely be found in the influent of the proposed wetlands once residential development has been completed upland from the wetlands site.

Some studies have shown that urban stormwater runoff in arid areas may have higher chemical constituent concentrations than runoff in areas with more rainfall (Center for Watershed Protection 2003). As Table 2 shows, both the existing data on the site and the regional data for the Bay Area show constituent concentrations comparable to the averaged concentrations in the four low-rainfall areas. The Hunters Point data show comparatively elevated levels of some metals, as might be expected given the history of land use at the site. We anticipate that regulations will require the proposed wetland design to treat runoff typical of high-density residential development, and possibly also elevated levels of metals, depending on the extent to which redevelopment and cleanup remove the sources of pollutants.

2.3 STORMWATER TREATMENT PROCESSES

Pollutant removal in stormwater treatment systems — including ponds and wetlands — involves a range of physical, chemical, and biological processes. The main treatment mechanisms are water detention [storage of water to allow for physical settling of particles] and biofiltration (adsorption of particles to wetlands vegetation).

2.3.1 Physical and Chemical Processes: Sedimentation and Adsorption

The primary physical and chemical processes involved in stormwater treatment in general (and the proposed design in particular) are adsorption and sedimentation. These processes both remove pollutants suspended in the water. Adsorption is a physical process by which particles adhere to another surface or medium (such as soil or vegetation). Sedimentation happens when particles suspended in water fall to the bottom and are removed from the water stream.

The proposed design does not include any elements specifically based on chemical precipitation, which is a less important removal mechanism for most stormwater treatment wetlands. There are exceptions under certain conditions for specific pollutants; for example, under high-pH conditions, chemical precipitation may be used to remove phosphorus. **82-69 cont'd.**

In addition to the pollutants listed in Section 2.2, stormwater runoff typically carries a high proportion of solid materials. The materials vary but may include soil particles from eroding surfaces, incompletely decomposed organic matter such as grass clippings, wood fragments, and small particles from asphalt, tires, and so forth. These types of pollutants would typically be removed in the forebay of the proposed project, which is designed to settle large particles and debris.

A large percentage of the pollutants typically carried in stormwater may be adsorbed onto particles of these solid materials. The particles can then settle out in a detention basin or wet pond. This process removes pollutants from the flow of water where they can be removed at a later date or are safely contained at the site. Furthermore, once they have settled, the sediments at the bottom of the basin or pond can continue to adsorb more pollutants.

Organic matter produced within a pond or wetland — the remains of plants, animals, and microorganisms — also settles to the bottom. The sedimentation of this decomposing matter "sequesters" them, keeping chemical nutrients from producing excessive vegetation growth of algae which reduce oxygen levels. Chemical nutrients in bottom sediments can be released into the water under anoxic (oxygenless) conditions. Therefore it is important that pond waters be maintained in a well-oxygenated condition.

2.3.2 Enhancing Sedimentation and Adsorption

The primary physical design parameters for enhancing sedimentation and adsorption are (1) residence time and (2) the ratio of surface area to volume of water. Residence time is defined as the time water spends in a pool while flowing from inlet to outlet. A longer residence time allows for more adsorption, sedimentation, and biological processing.

A suspended particle has both a forward velocity resulting from the flow through the pond and a vertical settling velocity. For a particle to settle out before it is discharged from the pond, its residence time, or time spent in the pool, must be equal to or greater than its settling time. The average residence time is defined as follows:

tr = Qp/q (Qp = volume of pool or pond; q = inflow)

Settling time is defined as follows:

ts = Dp/Vs (Dp = pool depth; Vs = settling velocity)

The settling velocity and settling time depend on the size and specific gravity of the particle to be settled. Table 3 shows typical particle settling velocities and times.

Other things being equal, shallow ponds and wetlands are preferable to deeper. Particles settling in deeper pools take longer to reach the bottom than in shallower pools. (Notice that pool depth is the second term in the settling time calculation shown above.) Once particles reach the bottom, additional energy is required to re-suspend them. In addition, the sediment-water interface is where most adsorption occurs, and therefore the more surface area available in relation to the volume of influent the better. 82-69 cont'd.

Consider a 1-acre pond with vertical sides 2 feet deep, and a 2-acre pond 1 foot deep. The latter has almost twice the surface area of the former for the same volume, and therefore twice the potential area for physical processes to operate. (The 2-foot-deep pond has a relatively minor increase in the surface area of its sides compared to the 1-foot-deep pond.) In wetlands, both nitrogen and phosphorus removal are related to the area of wetland vegetation (Kadlec and Knight 1996). However, effective treatment system design requires balancing the desirability of a high surface area for treatment against other considerations. Usually available treatment area is limited by economics or land availability. Water at least 3 feet deep is required to inhibit the growth of wetland vegetation and maintain open water areas. Deeper water also helps maintain cooler water temperatures, which can be important to some species.

2.3.3 Biological Processes

Biological processes involved in stormwater treatment include both direct use and transformation of pollutants by organisms (such as bacteria and plants) and the modification of physical and chemical conditions that in turn support or influence other processes. The interactions between biological and physical processes that contribute to reducing pollutants and improving water quality are complex. The specific pollutant determines which processes are important. This section summarizes biological processes related to treating chemical nutrients, trace metals, and pathogens in wetland treatment systems.

2.3.3.1 *Plant Nutrients*

Wetland treatment systems have been shown consistently to reduce total nitrogen concentrations in many situations (Kadlec and Knight 1996). Their ability to remove phosphorus over the long term is more variable. Nitrogen removal involves a diverse set of biological and chemical processes. Excess nitrogen in stormwater runoff can be removed in a wetland by being released to the atmosphere as a gas (in a process called nitrification). The complex series of transformations required to achieve this removal (ammonia to nitrite to nitrate to nitrogen) are mediated by different species of bacteria, some species preferring anaerobic and others aerobic conditions. Shallowly flooded soils in wetlands help create anaerobic conditions in soil sediments. Bacteria live in association with the stems and roots of wetland and aquatic species of plants, as well as in the soil. Plant roots and rhizomes provide surfaces for bacterial growth. Plants translocate oxygen from shoots to roots. The root zone therefore offers an oxidized microenvironment in an otherwise anaerobic substrate. This microenvironment stimulates both the decomposition of organic matter and the growth of nitrifying bacteria.

Algae and bacteria use plant shoots and leaves as substrates for growth. Plants, algae, and other microorganisms all make direct use of nutrients as well. However, the nutrients taken up directly by organisms are recycled to the system when they die. Only a fraction of the nutrients are removed from the system by being deposited in sediments as incompletely decomposed biomass. 82-69 cont'd.

Wetlands can work well to remove nitrogen because they contain a combination of aerobic and anaerobic conditions favorable to the nitrification-denitrification process. Plants help create these physical conditions.

Phosphorus, which lacks a gaseous phase like nitrogen, is only removed on a long-term basis by being sequestered in sediments. The potential long-term phosphorus removal rate by wetlands is therefore generally lower than for nitrogen. Phosphorus binds chemically to soil particles. New wetlands often have a large capacity to adsorb phosphorus, and therefore removal rates in the first few years after construction are often high. Eventually, however, sediments reach their capacity to adsorb phosphorus and removal rates decline, and long-term sustainable removal rates are much lower.

2.3.3.2 *Metals*

Wetlands interact strongly with trace metals in a number of ways and thus are potentially capable of retaining significant amounts of trace metals. There are three major retention mechanisms for metals:

- Binding to soils, sediments, particulates, and soluble organics
- Precipitation as insoluble salts, principally sulfides
- Uptake by bacteria, algae, and plants

Metals taken up by bacteria, algae, or higher plants may be either incorporated into tissues or transformed into less-toxic compounds, but the primary long-term repository for trace metals is wetland sediments. Sulfide precipitation, a source of odors, is controlled by bacteria within sediments in a wetlands system. High levels of many metals can be toxic to wildlife, plants, and humans, and must therefore be monitored closely. In situations where a waste stream is very high in specific metals, phytoremediation (remediation using plants) systems may employ specific plant species with known affinities for those specific metals; but at the lower concentrations typical of urban stormwater, it is generally assumed that the varied plant and microbial complexes of wetlands can do the job.

Under high loads of pollutants, the capacity of wetland soils to bind metals can eventually be exceeded, which stops them from fully functioning as part of a treatment system. Under such conditions it is important to monitor pollutant levels in the sediments; this monitoring is included in the proposed design. The design allows for draining the ponds and wetlands, removing the affected soils and replacing the soils with clean substrate, which will allow the treatment system to begin functioning again. The need to follow this procedure is anticipated to be very infrequent, because the land use in the wetlands drainage area is anticipated to be high-density residential and thus would not be expected to produce large amounts of trace metals.

2.3.3.3 Pathogens

The intense microbial activity in wetlands provides many opportunities for predation and degradation of human pathogens such as bacteria. A suite of factors make wetlands a relatively hostile environment for pathogens: unfavorable temperatures, exposure to ultraviolet light, and biological interactions.

82-69 cont'd.

2.4 TREATMENT COMPONENTS OF THE PROPOSED DESIGN

Various options exist for treating stormwater, each employing these processes to varying degrees. The effectiveness of a given stormwater treatment system will vary based on factors including the type and load of pollutants. Combining different treatment components into a "train" can increase a system's overall effectiveness in treating a range of pollutants.

The proposed design combines three components that move the runoff in the following sequence: a forebay flowing into a pair of permanent wet ponds, with the ponds then flowing into two wetland marshes (Figure 3). The single forebay receives all incoming waters from the watershed. The flow out of the forebay is split into two ponds, and the outflow from each pond passes through the marshes before exiting into San Francisco Bay.

2.4.1 Forebay

In the proposed design, larger particles in the stormwater influent are intended to be settled in the forebay. The accumulation of the bulk of larger sediments in the forebay means that regular maintenance must be planned to remove the accumulated materials. The design of the forebay must account for the extra depth required for storage of settled materials.

2.4.2 Wet Ponds

Wet ponds are designed to use gravitational forces and biological activities to remove urban stormwater pollutants before discharging the treated runoff into a waterway. They are typically designed as flow-through systems that can also meet the onsite stormwater detention requirement for streambank erosion protection and flood mitigation.

Wet ponds in general are designed to have three stages with three corresponding volumes that are intended to meet water quality and detention requirements. The first two stages, permanent pool and extended detention, are required for all ponds and function primarily as a water quality control. The second stage may also provide some flow equalization. The third, optional stage, flood control detention, provides flood control. This third stage is not currently included in the proposed design and is not discussed further below.

The permanent pool and extended detention volume are designed to treat the entire drainage area, thus contributing to the control of pollutants that are not already addressed by water quality controls of the watershed development. As described in Section 4, the proposed design provides excess treatment capacity to accommodate treatment of runoff from additional watershed area.

- **Permanent Pool.** A wet pond has a permanent pool that is in place before a storm begins and is the lowest stage of the pond. This pool provides wildlife habitat as described in Section 3; it also has important water quality benefits. A permanent pool lengthens residence time, especially during the initial first flush of pollutants into the system, and it continues settling and biodegradation after the storm has passed. The permanent pool should remain nearly full at all times to provide a source of water for wetland plants, which are used for biological uptake and to minimize turbulence within the pond during storm events which may result in re-suspension of sediment. During storm events the pond is designed to flush out the treated water and replace it with "new" runoff. 82-69 cont'd.
- **Extended Detention Volume.** The extended detention treatment pool sits at a higher elevation than the permanent pool. This volume holds stormwater above the permanent pool elevation and is intended to fill up during storm events and provide 48 to 72 hours of stormwater treatment prior to emptying into the wetland cells for additional treatment. The extended detention portion of the pond minimizes turbulence in the pond by decreasing the pond flow-through rate and increasing the time in which treatment can occur during the storm through dynamic settling. The extended detention volume does not include the volume provided in the permanent pool because the permanent pool is designed to be full at the start of the rainfall event.

The removal efficiency of wet ponds is directly related to the time the runoff is held in the pond. The longer the runoff is held in the pond, the more settling and biological uptake that can occur. Given national and local monitoring data, we estimate that a hydraulic residence time of two weeks would provide an equivalent level of water quality treatment as sedimentation/filtration. Design guidelines (Caltrans 2002; California Stormwater Quality Association 2003) recommend that the permanent pool volume be at least two to three times the required water quality treatment volume for optimum treatment without short-circuiting through the system.

The flow path of the pool needs to be as long as possible without creating "dead zones" within the pools where water stagnates and is not moved through the system. As described below, the proposed pond system has an island built into each pond to increase the flow path and improve the treatment effectiveness of the ponds.

As shown in Table 3, the time required to settle silt and larger particles is within the range of most pond systems. However, the settling rate of very fine clays and colloids is longer than would be practical for the proposed system. Sedimentation rates in the ponds will be much lower than in the forebay and will require much less frequent maintenance.

In the proposed design, we have assumed that supplemental water will be available to maintain the design pond level. As a rule of thumb for optimum water quality functioning, Ferguson (1998) recommends the permanent pool be equal in volume to the largest average monthly runoff. A larger volume may be desirable for habitat purposes. However, a wetland treatment design should also maintain a high surface-area-to-volume ratio to provide sufficient surface area for treatment.

2.4.3 Freshwater Marsh Cells

The constructed wetland cells in the concept plan are designed to support "emergent" (wetland) marsh vegetation. Wetland plants such as tule and bulrush (*Scirpus* spp.), rush (*Juncus* spp.), and cattail (*Typha* spp.) are called emergent because their roots and lower shoots grow under water, but most of the plant shoots and leaves emerge into the air above the water surface. These species grow best in shallow water (6 to 18 inches). **82-69 cont'd.**

The wetland cells provide additional opportunities for particle sedimentation and sequestration, associated not only with additional residence time but with biological processes that flocculate smaller particles into larger and allow them to settle or be incorporated into biological materials. The presence of plants and their roots helps reduce sediment re-suspension. Densely rooted plants slow down stormwater and distribute flow uniformly. Dense stems and leaves provide surface area where biologically active algae and microorganisms live and process pollutants from the stormwater.

Treatment capabilities are related primarily to the surface area of the wetland, in relationship to the loading rate and residence time. For vegetation success, the primary design consideration for emergent marsh is to provide the appropriate shallow water level. Stormwater wetlands subjected to typical flash flows of urban hydrology are frequently less ecologically diverse than their natural counterparts. The forebay and pools above the wetlands in the proposed design should help to attenuate the effects of the developed watershed hydrology and improve the ecological value of these wetlands. Supplemental water in the dry season should also help dampen the oscillations typical of stormwater wetlands.

3.0 Wildlife Habitat Design Concepts

The proposed design is intended to integrate wildlife habitat with stormwater improvement. Habitat design components were well developed in the feasibility study (Brown and Caldwell 2004). Below we have summarized and expanded on key design concepts.

Through a wetland complex of freshwater ponds and emergent marsh, the proposed design focuses on providing habitat for a diversity of resident and migratory bird species. The wetland will be located on the Pacific flyway, next to San Francisco Bay and to existing, though degraded, tidal wetlands. A 2003–04 wildlife census (LSA Associates 2004) at Candlestick Point State Recreation Area, immediately next to the project site, identified 118 bird species, in addition to another 36 bird species identified over several previous years of observation by other Audubon naturalists. The creation of 20 acres of new wetlands at Hunters Point will provide important support to many of these local and migratory wildlife species.

3.1 STRUCTURAL COMPLEXITY

Structural complexity is one of the most important components in developing a wetland that will support a wide range of wildlife species. Structural complexity can be achieved both through the physical design of the wetland system and through the plant communities and aquatic ecosystems established there. 82-69 cont'd.

The availability of water, through capture of stormwater runoff and through the reuse of reclaimed water, provides an opportunity to establish a range of plant communities and aquatic ecosystems that support different suites of bird species, as well as other associated wildlife.

- **Deep water** areas will provide habitat for open water feeders, including grebes, scaups (diving ducks), mergansers, and other species that dive for food, and for species that forage over open water, such as terns.

  To support this suite of species, water should be deep enough to preclude the growth of emergent vegetation, four to six feet, or deeper. Some open water areas should be of adequate length, approximately 200 feet or longer, to accommodate birds that need a running start to take flight from the water surface.

- **Shallow water** areas will provide habitat for dabbling ducks and other species that feed by skimming food off the water surface or tipping forward to feed in the shallows, such as mallard, pintail, teals, coots, and gulls. Shallow water areas are also important for wading birds such as the great blue heron and the great egret, which typically feed while wading or standing at the water's edge.

  Shallow water areas should range from 1 to 3 feet deep. These areas will support algae and aquatic vegetation.

- **Pond edge and mudflat** areas will provide habitat for shorebirds that feed while wading in shallow water or probing in mud at the water's edge, such as avocets, plovers, and sandpipers.

  Mudflats are characterized by moist substrate, absence of vegetation, and the presence of soil-dwelling invertebrates and other species. Typically mudflats are present where the water inundation cycle prevents emergent vegetation from growing and temporarily exposes a moist substrate. Mudflats can be created along pond edges by periodic draw down of water levels.

- **Freshwater marsh** will provide habitat for species associated with emergent vegetation, such as the green heron, rail, marsh wren, red-winged blackbird, and salt-marsh yellowthroat. Tall wading birds will also use the marsh.

  The two large wetland treatment cells will be managed to create emergent marsh conditions.

- **Grassland** areas will provide habitat for species that prefer open habitats, such as meadowlarks and American goldfinch.

  The berms between the wetland cells and the perimeter edges of the wetland complex can be planted and managed as grassland habitat.

- **Generalists.** All the plant communities developed at the wetlands will provide habitat for generalist bird species that are tolerant of human presence or attracted to landscaped areas, such as doves, hummingbirds, jays, mockingbirds, and robins. 82-69 cont'd.

The overall structural complexity of the wetland will be enhanced by the use of several cells. The forebay, two ponds, and two wetland cells included in the design will each be designed and managed slightly differently to enhance the diversity of habitat in the wetland.

The physical diversity of a site can also be enhanced through the design of islands and loafing strips. Islands provide waterfowl with resting habitat that is protected from predators. They also provide the birds using them with clear lines of sight. Loafing strips — long, thin areas of very shallow water — can be connected to islands and provide birds with excellent resting, nesting, and foraging habitat. The proposed design includes two islands.

3.2 PLANT SPECIES

The primary drivers of wetland ecological success are site hydrology in relation to topography and soils. Wetlands are areas inundated by water for at least a portion of the growing season. This water regime produces hydric (frequently water-saturated) soils, and only plant species adapted to these conditions can survive there. The depth and length of time an area is flooded, and the pattern of flooding and drying over time, are the primary drivers of what specific types of vegetation will prevail in any given location.

Emergent plants, such as various species of bulrush and tule (*Scirpus* spp.), rush (*Juncus* spp.), reed (*Phragmites communis*), or cattail (*Typha* spp.) grow up and out of shallow water. Though they are capable of surviving and thriving in permanently flooded shallow water, they are generally tolerant of occasional drying out, as long as it does not persist too long. All require drier moist soil rather than flooded condition to establish from seed, but once established they can continue to expand through vegetative reproduction.

Submerged and floating aquatic plant species typically grow completely within the water column, though some may raise their flowers above the water. Submerged aquatic species grow with their roots in the soil, while floating aquatic species grow on the water surface with their roots in the water column. Typical submerged aquatics include pondweeds (*Potamogeton* spp.), milfoils (*Myriophylum* spp. — includes native as well as nonnative invasive species), and *Ruppia* spp. Native aquatics include duckweed (*Lemna* spp.) and water fern (*Azolla* spp.).

The best results in establishing a diverse suite of native plant species in a wetland complex are achieved through the design of varied site topography, the provision of adequate water and the management of that water, and through the introduction and planting of a diverse suite of native plants grown from locally collected ecotypes. The exact locations where different species may thrive is difficult to predict, given the complexities of interactions between water level patterns, water and soil fertility, and other factors. Over time, after the introduction of a diverse set of plant species to the site, those best adapted to the various niches created will begin to occupy those niches wherever they occur.

82-69 cont'd.

4.0 Preliminary Stormwater Wetland Design

This section describes the preliminary design and presents the design basis for the wetland system. Figure 3 shows a grading plan for the proposed wetland system as well as the major public access and trail routes. Figures 4 and 5 are illustrative views of the wetland. Figure 6 shows cross-sections through the system.

4.1 SYSTEM LAYOUT AND CONFIGURATION

This section describes the grading and configuration of the various parts of the proposed system. The layout and grade slopes are subject to change during final design, especially after the project geotechnical engineer makes recommendations on allowable levee and pond grading slopes and levee construction details.

Table 4 summarizes the volume capabilities and other design characteristics of the proposed system.

4.1.1 General

The site is surrounded by a 12-foot-wide roadway that provides access to all parts of the site ponds and wetland cells. Maintenance roadways also run between the various ponds and cells. Roadways are maintained at elevation +12.5 feet NGVD along the forebay, grading down to elevation 12 feet NGVD for the levee around the Dragonfly Pond, and to elevation +11 feet NGVD for the levee around the Wading Bird Pond, finally grading down to elevation +6 feet NGVD for the levees around the wetland cells. The maintenance road also functions to provide trail access through the site at designated locations (see Figure 3).

4.1.2 Forebay

The forebay is approximately 1.5 acres in area. The bottom elevation of the forebay is set at +2.5 feet NGVD and the normal operating pool level within the forebay is +8.5 feet NGVD, giving a depth under normal day-to-day conditions of approximately 6 feet. The forebay sides are graded on a 3:1 slope from the perimeter access road at elevation +12.5 feet NGVD down to a 5-foot-wide safety bench at elevation +7.5 feet NGVD. At a normal water level, the safety bench will be submerged approximately 1 foot, allowing for the growth of fringe wetland vegetation around the perimeter of the forebay. An access road is also graded into the forebay to facilitate removal of accumulated sediments. The forebay is designed to allow for approximately 2 feet of sediment accumulation in the bottom areas, that is, accumulation to an elevation of approximately +4.5 feet before maintenance is required.

The forebay includes an inlet pipe where stormwater from the watershed area enters the site. Since details of the upstream development are not known at this time, the details of this connection will need to be developed during final design. The forebay inlet structure should also be designed to divert very high flows (above the system design capacity) away from the forebay to the existing seasonal wetlands south of the proposed treatment wetland. This will limit the potential for re-suspension of sediments in the forebay due to high turbulence, and the possible transport of contaminated sediments out of the forebay and into the pond/wetland system. 82-69 cont'd.

4.1.3 Wet Ponds

On leaving the forebay, the stormwater flow splits approximately half and half into two extended detention ponds: the Dragonfly Pond to the east and the Wading Bird Pond to the south. Each pond will be just under 3 acres in surface area at the permanent pond elevation, which is +7 in the Wading Bird Pond (provides for a permanent pool depth of 5 feet at maximum depth) and at elevation +8 feet NGVD in the Dragonfly Pond (provides a permanent pool depth of 6 feet). Each pond contains an island with a loafing strip that provides nesting, refuge, and foraging habitat for birds. The islands also act as berms, splitting the pond into two effective treatment cells, thereby inhibiting short circuiting and promoting water treatment.

The water elevation in the Dragonfly Pond will be held constant at a depth of 6 feet to provide habitat for appropriate bird species. The water level in the Wading Bird Pond will be designed to draw down slowly and refill every four to six weeks during the spring though fall. The bottom elevation of the Wading Bird Pond slopes gradually to the island to allow for emergence of mudflats at different elevations as the water level is periodically lowered. This will expose benthic animals living in the sediment, thereby facilitating foraging by mudflat loving bird species. The Wading Bird Pond also includes a predator trench, roughly 3 to 4 feet deep, around the circumference of the pond to prevent land predators from getting to the islands at low water levels.

Both ponds are graded at a 3:1 slope from the access road to a 5-foot-wide safety bench at an elevation just below the permanent pool depth. This safety area is located one foot below the permanent pool depth within the ponds. It is intended to reduce the possibility of accidental drowning by persons falling into the ponds. A safety fencing system should be developed during final design to further discourage people from entering the ponds.

4.1.4 Wetland Cells

Each pond will discharge into a separate wetland cell. Each wetland cell is approximately five acres in surface area at the normal pool level of +3 feet NGVD. The bottom elevation in each cell grades from approximately 2.5 feet near the inlet to 0 feet at the outlet. The water depth in the wetland cells will therefore vary from 6 inches at the inlet end to 3 feet at the outlet pipe into San Francisco Bay. Water depth over most of each cell will range from 6 to 18 inches, which is optimum for growth of emergent vegetation and water quality improvement. A shallow drainage swale has been graded into the bottom of each wetland cell to allow for drainage of the cells and to minimize stagnant water areas and help reduce mosquito production. (See Section 4.7.2 for further discussion of mosquito control techniques.)

A deeper permanent ponded area that will not drain by gravity has been graded into each cell to provide deep-water refuge for fish. These areas are excavated down to an elevation of –2 feet, approximately 6 feet deeper than the surrounding surface. A shallower pond, approximately 3 feet deep when water is at normal pool level, is contained within each cell at the outlet end. Depths of 3 feet should prevent colonization of the ponds by emergent vegetation.

Note that the outlet pipe elevation of 0 feet NGVD means that the wetland cells will not be able to gravity drain except at lower tide elevations. The outlet pipe will require a flap gate to prevent saltwater intrusion from the bay into the wetland cells. Should the outlet pipe check valve fail in the open position, salty bay water will enter the wetland cell potentially up to elevation +3.5 feet NGVD and would likely affect freshwater vegetation in the wetland cell. 82-69 cont'd.

4.2 STORMWATER TREATMENT EFFECTIVENESS

This section summarizes the preliminary design's potential effectiveness in stormwater treatment. We will consider water quality treatment volume first; then we will discuss potential pollutant removal rates.

4.2.1 Water Quality Treatment Volume

This section presents the results of analysis of stormwater treatment effectiveness for the proposed pond and wetland treatment system for the anticipated water quality treatment volume. In addition, we have estimated the additional area of watershed that could potentially be treated within the proposed system. Estimates of additional area that could be treated are approximate, since estimates of treatment effectiveness depend on many factors that are currently unknown.

The proposed pond and wetland system is a type of volume-based treatment system. The design goal is to contain the calculated water quality treatment volume within the system for a specified period, typically 48 to 72 hours, to allow for natural processes such as settling and biological uptake to remove pollutants. Volume-based stormwater treatment systems require determination of the water quality treatment volume, which is defined as the 85th percentile of all storms within the period of record of the site-specific rain gauge data (Camp, Dresser & McKee 2003).

The nearest full-time rain gauge with a significant period of record is the Mission Dolores Station, which has daily measurements from 1914 through 2005. FarWest Restoration Engineering purchased the data set and prepared a cumulative histogram of storm events for the entire period of record (Figure 7). From that information, we calculated the 85th-percentile storm event at approximately 1.5 inches of rainfall per day.

Assuming that the entire 38-acre watershed area is 80 percent impervious (see Section 1.5.2), we calculate the water quality treatment volume at approximately 1.2 million gallons of stormwater. We used this volume as the basis for the preliminary design.

- Figure 8 shows stage-storage curves (that is, the volume of water storage in each pond at different elevations) for the forebay and treatment ponds.
- The permanent water level elevation is the water level that is assumed to be continuously maintained by supplemental water as required to meet habitat and wildlife goals. The permanent pool volume is also essential for treating the first flush of stormwater.
- The extended treatment water level elevation is the capacity of the ponds and cells to store and treat water by physical settling and biological processes immediately following storm events. 82-69 cont'd.
- The remaining elevation from the top of the extended detention water level to the top of the levees is considered freeboard elevation and has been designed for a minimum of 2 feet.

A discussion of anticipated water control structures is included within each treatment unit. The discussion of water control structures is preliminary and will be refined during final design of the project. The final selection and sizing of water control structures will depend on the final hydraulic analysis of runoff into the treatment wetlands, which requires an understanding of the upstream development in the watershed.

4.2.2 Evaluation of Treatment Effectiveness

As described above, hydraulic residence time is the single best indicator of stormwater treatment effectiveness in a well-designed pond and wetland system. Final residence time calculations require knowledge of the watershed development and calculation of stormwater flows, which are then modeled with specialty hydraulics software to determine the treatment system flow characteristics such as residence time, detention storage, and outfall hydraulics. This level of hydraulic analysis was beyond the scope of the preliminary design but should be performed during final design activities in coordination with the proposed site development. A first-cut assessment was provided for the forebay.

As a substitute for detailed hydraulic analysis and calculation of residence time, we have used a conservative assumption that the combined extended detention storage volume of the forebay, ponds, and wetlands equals the effective treatment capability of the system. This approach is in accordance with Regional Water Quality Control Board guidance documents and essentially equates the treatment capacity with the effective storage capacity of a wetland system.

4.2.3 Forebay

4.2.3.1 Treatment Capacity

As shown in Table 4, the forebay has a permanent pool volume of 2.59 million gallons and an extended storage volume of 1.075 million gallons. The goal for the forebay is to maintain a minimum residence time of 60 minutes. That goal is based on an assumed inflow, which will require analysis of the proposed watershed development; as discussed above, that information will be obtained during final design activities. As a first-cut estimate of residence time we have assumed an average inflow of 0.6 cubic feet per second (cfs) (equivalent to 270 gallons per minute from a one-year Type IA storm; see Section 4.3.1 and Figure 9), which gives an average residence time of 1,075,000 gallons/270 gallons per minute, or approximately 66 hours of total residence time — more than enough to settle large particles, according to Table 3. The forebay thus has excess capacity for particle settling before water treatment in the wetland ponds and cells. The water control structures in the forebay will be designed to allow for a maximum residence time of 24 hours.

The final determination of residence time requires knowledge of the inflow into the forebay system. The time of concentration and detention storage characteristics of the upstream development — currently unknown — will also affect the flow into the system. 82-69 cont'd.

4.2.3.2 Water Control Structures

The forebay will require three types of water control structures.

- **Inlet Structure.** The inlet structure must allow for piping of the water quality treatment flows into the forebay while shunting higher stormflows away from the treatment wetlands and directly into the existing wetlands to the west. The outlet pipe into the existing wetlands should be designed with energy dissipation to avoid erosion.

  The exact configuration of the inlet pipe and diversions will need to be determined during final design activities in coordination with the upstream development and grading.

- **Flood Flow Overflow Structure.** The forebay should be graded with a lowered spillway section at elevation +11.5 to +12 feet NGVD to allow for overflow of high flows directly into the adjacent existing wetlands to avoid overtopping of the levees.

- **Pond Flow Structure.** There are a variety of pond overflow structures that can be used to move water from the forebay into the detention ponds. We anticipate that the forebay will contain two overflow structures that flow into each detention pond. The outlet flow structure (used to drain the forebay for maintenance purposes) will consist of an outlet riser pipe with an 8-inch discharge pipe to drain the forebay.

4.2.4 Wet Ponds

4.2.4.1 Treatment Capacity

The calculated treatment storage capacity; of the Dragonfly Pond is approximately 1.907 million gallons; the capacity of the Wading Bird Pond is approximately 1.655 million gallons (Table 4). Together the two ponds provide three times the capacity of the water quality treatment volume. Given the large capacity of the ponds, the water control structures can be designed to allow for draw down of the detention ponds over whatever residence time is required. Typically, for detention ponds a 48- to 72-hour draw down time is designed to avoid excessive ponding and mosquito production. The extended detention capacity of the ponds will be drawn down within 72 hours.

Additional residence time is provided within the permanent pool volume. Removal of nutrients could require up to one week of residence time. With a capacity of twice the design treatment volume, the permanent pools should provide an average of two weeks' residence time even in the wettest months.

4.2.4.2 Vegetation

The only vegetation in the detention ponds occurs in the 5-foot-wide safety bench that surrounds the ponds. In this bench, emergent vegetation such as tules will be planted and will provide some biological treatment as well as diversify wildlife habitat within the ponds. 82-69 cont'd.

4.2.4.3 Water Control Structures

The water control structures within each pond will vary because the operating regime within each pond is different.

Wading Bird Pond. Within the Wading Bird Pond, the operating regime is intended to draw the pond down slowly over a three- to four-week period. We anticipate using an inlet control vertical or riser type orifice with a perforated standpipe to allow for the gradual lowering of the water level.

Dragonfly Pond. We anticipate that this pond will have a standard riser and horizontal orifice inlet since the pond level is not designed to change continuously. All water control structures will be placed off the bank for both ponds to allow for easy access and maintenance.

4.2.5 Wetland Cells

4.2.5.1 Treatment Capacity

The wetland cells treat water primarily through biological treatment within the wetland vegetation. Residence time is also a key indicator of treatment effectiveness. The operating water level within the cells is approximately +3 feet NGVD. However, the emergent vegetation within the wetland cells treats stormwater as it flows through by a combination of physical and biological treatment.

4.2.5.2 Vegetation

In the wetland cells, we anticipate that the plantings will consist primarily of tules and rushes. Some cattails may establish themselves but won't be planted.

4.2.5.3 Water Control Structures

The water control structure proposed for both wetland cells 1 and 2 will consist of overflow weirs with a gravity drainage pipe at the bottom set at elevation 0 feet NGVD. Given that the ponds and cells are designed to allow for gravity drainage to San Francisco Bay at low tides, the outfall pipe will require a tide gate check valve to prevent inflow of bay waters into the project wetlands.

4.2.6 Overall System Treatment Capacity

The combined extended storage volume for the proposed pond and wetland system is approximately 7,660,000 gallons. This volume is approximately 6.4 times the required water quality treatment volume (as described in Section 4.2.1). At the assumed watershed development impervious percentage of 80 percent, the proposed wetlands system could treat an additional development area of approximately 200 acres over the current proposed development size.

4.2.7 Effectiveness in Removing Pollutants

We reviewed the U.S. Environmental Protection Agency (EPA) technology fact sheet for wet ponds as a guide to the treatment effectiveness of the proposed pond and wetland system (U.S. EPA 1999). 82-69 cont'd.

Table 5 shows expected treatment effectiveness for wet ponds.

Treatment effectiveness is improved by longer hydraulic residence times. Notice that these removal values are just for the wet ponds. The proposed system includes constructed wetlands that will further improve water quality prior to entering the bay. A review of the International Stormwater Best Management Practices database (U.S. EPA/ASCE 2006) also shows that the proposed pond and wetland system should be highly effective for the treatment of constituents commonly associated with stormwater from urban developments.

4.3 OTHER HYDROLOGY AND FLOW CONSIDERATIONS

4.3.1 Estimation of Flood Flows

This report evaluates the effectiveness of the proposed wetlands for stormwater treatment. Wetlands of this type are commonly used for flood flow equalization of stormwater flows after development. However, given that the discharge will flow into San Francisco Bay, it is not clear whether post-development hydrograph modification is required; if it is required, we have assumed that the developer will implement it upstream of the proposed wetlands.

As a first-cut estimate of stormwater flows, we have run the TR-55 program on the basis of a very impervious curve number of 95 (corresponding to an almost completely impervious watershed) to estimate potential flood flows into the system, which is a conservative assumption. We have also assumed a time of concentration

(Tc) of 0.25 hour (15 minutes); calculation of Tc requires knowledge of the flow characteristics of the developed watershed area to which we currently do not have access.

On the basis of a first-cut analysis of flood flows using TR-55, we estimate that for a Type IA storm (typical for this area) the peak stormflows for the 10- and 100-year rainfall events would be as follows:

10-year event: 9.6 cfs

100-year event: 33 cfs

The spillway leading into the forebay should be designed to handle the 100-year event by bypassing the proposed pond and wetland system and discharging directly into the existing wetland. Note that the hydraulic analysis above is very preliminary and is intended solely as an approximation of potential storm flows for this preliminary design report. A more detailed hydrologic analysis of flood flows should be performed as part of final design efforts for the project following analysis of the entire watershed and the proposed development.

4.3.2 Supplemental Water Volumes

The Brown and Caldwell feasibility study included an estimate of the supplemental water volumes required to provide the wetland and pond system with water on a year-round basis. Table 6 shows the required supplemental water volumes by month. **82-69 cont'd.**

Notice that the Brown and Caldwell study was based on the assumption that 39 percent of rainfall will infiltrate the ground and will not run off as stormwater. Depending on the final upstream development plans, the actual percentage of infiltration may be lower and the amount of annual runoff greater. However, the estimated supplemental water volume is probably accurate for the critical summer months.

We have assumed that the source of the supplemental water will be a recycled-water plant at Hunters Point. Designs for this facility are reportedly on hold pending site development plans. Section 4.8 discusses alternative sources of water in case the recycled-water plant is not built.

4.4 HABITAT DESIGN

4.4.1 Forebay

The forebay and wet ponds are designed to preclude the establishment of emergent and rooted aquatic vegetation over most of their areas. On the shallow perimeter safety benches, emergent vegetation will be established. Tules (*Scirpus acutus*) along with other bulrush species such as common three-square (*S. americanus*) and California bulrush (*S. californicus*) will be the dominant species. Plants for transplanting should be propagated from locally collected ecotypes. It is likely that cattails (*Typha* spp.) may also establish themselves in these areas, but cattails are not proposed for planting. In wetlands subject to regular disturbance such as stormwater wetlands, cattails can sometimes spread aggressively. The spread of cattails would diminish the area of open water necessary for effective functioning of the system. Cattail establishment should be monitored and management undertaken if necessary to keep this plant in check.

At the permanent pool's edge and up the slope of the berms other rushes, sedges, and grasses can be established. Baltic rush (*Juncus balticus*) grows at the upland edge of many marshes in the area and can be planted here. Other potential rush species include softstem rush (*J. effuses*), dagger-leaf rush (*J. ensifolius*), and gray rush (*J. patens*). Creeping wildrye (*Leymus triticoides*), Barbara's sedge (*Carex barbarae*), and clustered field sedge (*Carex praegracilis*) can be established in moist areas above the permanent pool elevation. Saltgrass (*Distichlis spicata*) is another candidate for establishment in this area. Other native grass species suited to drier conditions can be established on the upper portions of the slope. Patches of shallow rooted shrubs can be planted on the berms to further diversify the habitat. Wild rose (*Rosa californica*), mugwort (*Artemesia douglasiana*), blackberry (*Rubus ursinus*) are among the species that could be included.

While the permanent pool levels have been established to preclude the establishment of rooted aquatic plants over most of the pond area, some areas appropriate for establishment of these species will occur in the transition zones from deep water to the safety benches, and perhaps in areas along the safety benches as well. The most common freshwater aquatic species in the Bay area are pondweeds (*Polygonum* spp.), of which numerous species could be planted.

The forebay will provide habitat for migratory birds and dabbling or diving ducks. Species likely to be found in this pond would include diving ducks such as bufflehead, greater and lesser scaup, and ruddy ducks. Dabbling ducks such as mallards and American wigeon and other diving waterbirds such as horned grebes may also make use of this pond. 82-69 cont'd.

4.4.2 Wet Ponds

The vegetation of the two wet ponds will be similar to that of the forebay, though perhaps somewhat more diverse since the forebay will help to buffer the ponds against the "flashier" flows of urban stormwater runoff (more water flowing more quickly over impervious, paved areas) that would hamper the growth of vegetation. As with the forebay, a shallow safety bench will be built around the pond perimeter. A suite of species similar to those described for the forebay will be planted and allowed to find their niche within the ponds and on the upland slopes above the pond. The differences in management of the two ponds will likely result in a different suite of species becoming dominant in each. The grass, sedge, and rush species planted on the pond slopes can also be planted on the islands.

Dragonfly Pond. The Dragonfly Pond consists of a pool with a constant depth of 6 feet. This pool will be used primarily by diving waterbirds as resting and feeding areas. Such birds include buffleheads, ruddy ducks, greater and lesser scaups, and occasional ring-necked ducks, surf scoters and canvasbacks. Pied-billed and horned grebes may use the pond, as may coots. The island in the pond will attract shorebirds such as killdeer (which may also nest on the island), western and least sandpipers and willets. If fish are introduced to the pond system, terns and cormorants are likely to feed on them.

Wading Bird Pond. The water level in the Wading Bird Pond is intended to fluctuate up and down over a three- to four-week cycle. At greater water depths the pond should provide habitat for diving ducks (see above) and dabbling ducks. The latter prefer to feed in 12–18 inches of water, feeding not by diving but by simply putting their heads under water and their tails in the air. Dabbling ducks such as American wigeons, mallards, cinnamon and green-winged teals, northern shovelers and pintail ducks are likely residents. Wading birds such as great and snowy egrets are likely to be found at the pond edges as will the great-blue heron (especially if fish or mice and voles are present). Coots and grebes will also be found in this pond.

When the pond water level is lowered the bottom elevation will be exposed. At this depth, the pond should provide habitat for shorebirds and other birds that feed on the invertebrates such as worms and crustaceans found on or in the exposed mud. These birds include western and least sandpipers, spotted sandpipers, killdeer, willets, marbled godwits, yellowlegs, avocets, and many others. All of these species will also use the island as a roosting site.

4.4.3 Wetland Cells

The wetland cells will be planted with the same tule and bulrush species (*Scirpus acutus*, *S. americanus*, and *S. californicus*) as will be planted on the safety berms of the forebay and ponds. The berm slopes at and above the permanent pool elevation will be planted with a similar mix of native grasses, sedges, and rushes as discussed above for the forebay and ponds. **82-69 cont'd.**

The wetland cells should provide habitat for more secretive waterbird species such as rails. These birds, including the Virginia rail and the sora, hide and breed in dense wetland vegetation and feed in the open channels on invertebrates and small mammals. The combined presence of large wetland areas next to the large open water areas of the ponds will provide a suite of diverse habitats in close proximity, supporting a diverse wildlife community.

4.4.4 Other Wildlife Species and Opportunities

The grassland areas that border the ponds will likely be inhabited by mice and voles as well as lizards and harmless snakes such as the garter snake. Amphibians such as the Pacific tree frog may also be found in the ponds and adjacent uplands, as well as numerous invertebrates including dragonflies and damselflies. All these creatures will provide food for raptors such as the red-tailed hawk and for other predators such as the great blue heron and black-crowned night heron. Peregrine falcons will feed on ducks or grebes. Red-winged blackbirds will nest in the tules and the shoreline vegetation, as will species such as the marsh wren and the salt-marsh yellowthroat. Song and savannah sparrows, yellow-rumped warblers, and other passerines will make use of marsh and adjacent upland vegetation. Burrowing owls or even golden eagles may occasionally be seen.

An island has been designed into each pond to provide refuge and potential nesting habitat. Such protected habitat could be diversified and expanded through the installation of floating islands. These are small rafts designed to provide habitat for particular bird species. They can be designed to support wetland vegetation or not depending upon the species to be encouraged.

Given the presence of contaminated groundwater at the site, a clay liner has been included in the wetland design to separate the wetland waters from groundwater. No trees have been included in the planting design because their deep roots have the potential to penetrate and compromise the liner. If the groundwater contamination were remediated, the inclusion of small areas of willows within the overall wetland complex design would be very beneficial in diversifying the wildlife habitat value of the site. A natural habitat complex of willow woodlands, ponds, and wetlands was a common occurrence before the urbanization and land disturbance of the last 150 years.

The preliminary design focuses on providing stormwater treatment for the proposed residential development above it. Maximum use is made of the landfill site for that purpose. Educational and interpretive use of the site could be expanded if adjacent areas were also planted with appropriate native species, further diversifying the habitats. Additional patches could be developed to support butterflies, hummingbirds, and other high-visibility species.

4.5 PUBLIC ACCESS

Public access and education are important goals of the project. Figure 3 shows elements of the public access plan including location of trails, boardwalks, and an educational kiosk. The public access facilities shown need to be coordinated with conceptual planning efforts by Hargreaves Associates, the landscape architects for the Shipyard Waterfront Park Project. The public would access the wetland via a single entrance point located on the levee between the Dragonfly Pond and Wetland Cell 2. A number of observation decks with informational kiosks could also be included along the boardwalks. The observation decks would provide unobtrusive vantage points for observing the wetlands and wildlife. A wetland center near the public entrance or located as shown next to the forebay could be used to educate the public about the importance of wetland ecosystems. Office space could also be provided for volunteers to monitor and quantify bird use of the wetland, an important parameter in evaluating the success of the wetland system. In addition, a blind (a viewing area camouflaged from birds and wildlife) could be attached to the wetland side of the wetland center to allow for supervised, all-weather viewing of wetland plants and animals.

82-69 cont'd.

4.6 CONSTRUCTABILITY

In this section, we have identified specific construction requirements — elements of the project that might require a specialized contractor or coordination with other parties such as the upstream land developers.

As previously described, we are assuming that after landfill remediation and before wetland construction, the site will have a bottom elevation of 0 feet NGVD, sloping up 2:1 to match the existing ground elevation at the project boundary.

4.6.1 Levees

Levee construction will be an important part of the wetland system construction. The levees will be constructed on a soft foundation, only a few feet above the bay mud substrate. Most of the levees will have to be constructed with clean fill material. We have assumed that clean fill will be available from other excavation on site or from other construction projects nearby in San Francisco. Most of the levees have been assumed to have 2:1 or 3:1 side slopes for stability. More detailed geotechnical analysis will be done during the final design phase of the project.

At the project site, the soils are underlain by a deep foundation of bay mud and therefore construction of levees will require extra care and higher cost to achieve stability. The levees should have a wide base and may need to be raised frequently to compensate for long-term subsidence caused by compression of the underlying soils. The levee side slopes will be graded to promote vegetation growth while still retaining water. The percentage grade used for a given levee will depend on topographical features of the site, soil composition, vegetation selection, and the intended purpose of the constructed wetland. The exposed surfaces of the levee need to be protected from rain, wind, and wave erosion, as well as from burrowing animals. Rock riprap may be used to protect the levee, especially at outfall locations. If rodent burrowing and wind and rain erosion are not a serious problem, then the exposed surfaces of the levee may be covered with vegetation.

4.6.2 Impermeable Liner

Although it is assumed that most, if not all, of the existing waste and debris will be removed from the landfill area before the wetland is constructed, residual groundwater contamination is still likely. Therefore, an impermeable liner will likely be required to prevent infiltration of contaminated groundwater into the wetland ponds. Since the groundwater elevations are approximately +3 feet NGVD, an important design consideration for the project will be to secure the liner so that it does not float on top of the groundwater. This condition will be especially acute under conditions where the ponds are drained and there is no water weight in the ponds.

82-69 cont'd.

Pending more detailed analysis during final design, we have assumed that the pond liner will be installed at elevation –3 feet NGVD, which will prevent uplifting by allowing for 3 feet of soil fill above the liner to the pond bottom elevation of 0 feet NGVD. If additional fill depth is required, the pond liner may have to be installed at a lower depth; that analysis will be conducted during final design.

4.6.3 Permitting

The project likely will require permits from several agencies. Below is the full discussion of permitting from the feasibility report (Brown and Caldwell 2004).

The U.S. Army Corps of Engineers and the U.S. EPA will decide on a case-by-case basis whether or not particular bodies of water are considered waters of the United States. Although wetlands intentionally created from non-wetland sites for the purpose of wastewater or stormwater treatment are not normally considered waters of the United States, discharges from constructed wetlands to waters of the United States must meet applicable National Pollutant Discharge Elimination System (NPDES) permit effluent limits and state water quality standards (Hammer 1991). Since the existing seasonal wetlands on Parcel E may be considered waters of the U.S. and discharge from a constructed wetland at Parcel E could enter San Francisco Bay, the construction of a wetland in Parcel E could fall under the jurisdiction of the Clean Water Act (CWA), and the project will require fulfillment of CWA Sections 401, 402, and 404:

- **Section 401.** This section addresses water quality certification. It requires compliance with state or tribal water quality standards. Section 401 verification is necessary when projects result in discharges to waters of the United States and require Section 402 or 404 permits (Interagency Workgroup 2000). The San Francisco Bay Regional Water Quality Control Board implements Section 401 certification permitting in the Bay Area.
- **Section 402.** Section 402, which includes the NPDES stormwater program, is designed to regulate the discharge of a pollutant from a point source into waters of the United States. The state of California is authorized by the U.S. EPA to issue Section 402 NPDES permits. The construction of a treatment wetland at Parcel E would require a Section 402 NPDES permit if stormwater captured by the proposed wetland is released to the San Francisco Bay (Interagency Workgroup 2000; Hammer 1991).
- **Section 404.** This section regulates discharge of dredged or fill materials into waters of the United States. A Section 404 permit would be required if the constructed wetland at Parcel E was built in the vicinity of a pre-existing wetland or riparian corridor. As stated above, the U.S. Army Corps of Engineers and the U.S. EPA decide on a case-by-case basis whether or not particular bodies of water are considered waters of the United States. The U.S. Army Corps of Engineers administers Section 404 permits, with advisement from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (Interagency Workgroup 2000).
- **Other Permits.** In San Francisco Bay, an additional permit is required from the San Francisco Bay Conservation and Development Commission (BCDC), which has jurisdiction over the 100-foot shoreline band around the bay as well as the bay itself.

82-69 cont'd.

Typically, government approval and/or construction of a wetland requires preparation of a California Environmental Quality Act (CEQA) Initial Study followed by a period of public review (Silverman 1984). Additional studies or permits that could possibly be required to construct engineered wetlands include sediment and erosion control plans, dam safety permits, a Department of Fish and Game Streambed Alteration permit, local grading permits, and land use approvals or encroachment permits (U.S. EPA 1999). Given the environmental considerations associated with the landfill cleanup, it is likely that California Department of Toxic Substances Control will be involved in ongoing monitoring of pollution at the site.

4.7 OPERATION, MAINTENANCE, AND MONITORING

This section describes the operation and maintenance requirements for the system. Although this type of wetlands system may require less operation and maintenance than some other types of systems, some maintenance will be required. Monitoring will also be essential to maintain treatment effectiveness, as well as to determine the degree to which the facility is achieving other objectives such as provision of wildlife habitat and educational and interpretive opportunities. Adaptive management can be defined as management that is informed by monitoring and research, facilitating the modification of management actions based on objective feedback. The creation of ecological systems requires adaptive management because the complexity of biological systems rarely allows for detailed predictions of all possible variables.

4.7.1 General Maintenance and Monitoring

A long-term management plan for the wetlands should be developed that addresses each of the three primary objectives — stormwater quality improvement, provision of wildlife habitat, and provision of educational and interpretive opportunities. A regular schedule for maintenance activities should be established and the parties responsible for maintenance and monitoring activities should be identified.

In general, the wetland system will need to be maintained for the following parameters:

- Regular trash removal
- Inspection for clogging of outlet structures and cleaning and maintenance as necessary of water control structures
- Inspection and repair of eroded levee areas or burrowing by small mammals
- Regular observation of how users are interacting with the site and a general safety inspection of the site. Are design features functioning as intended? Are repairs or additional actions required? 82-69 cont'd.
- Observation of level of sediment accumulation

Other monitoring activities should include:

- Regular sampling and analysis of water quality parameters
- Qualitative and quantitative monitoring of vegetation health and identification of potential problems including areas needing replanting or invasive species removal
- Regular wildlife surveys to record use
- Monitoring of mosquitoes at the site and the health and effectiveness of control activities including fish and predatory invertebrate populations

4.7.2 Mosquito Control

By their nature as permanently wet places, constructed ponds and wetlands have the potential to provide habitat for mosquitoes. The shallow water and emergent vegetation of treatment wetlands are essential for optimizing water quality polishing, yet these characteristics also promote mosquito breeding unless the wetland is properly maintained. Proper design and management of stormwater treatment ponds and wetland cells can minimize and control mosquito production but cannot completely eliminate it. Areas of both fresh water and tidal wetlands currently exist in the project vicinity (Brown and Caldwell 2004). These wetlands undoubtedly already provide suitable habitat for mosquitoes. In general, well-designed and well-managed treatment wetlands do not pose a greater mosquito threat than existing natural wetlands (Knight et al. 2003). It is necessary to balance water quality improvement, increase in wildlife habitat, and educational objectives for the project against the controllable risk of mosquito production.

Mosquitoes lay their eggs on or near the water and the mosquito larvae live on the water surface, breathing air and feeding primarily on algae and organic debris (Borror 1976; Metcalf and Luckman 1975). Common mosquito control strategies include minimizing stagnant ponded areas, disturbing or adjusting water levels to drown larvae, minimizing anaerobic zones, and creating access for natural mosquito predators. The project design includes the following mosquito control features:

1. Prevent establishment of stagnant water areas
2. Raise and lower the pond water levels
3. Reduce areas of emergent vegetation, where feasible
4. Create ecologically diverse conditions that support mosquito predators (fish and invertebrates including dragonflies)
5. Provide ready access to ponds and wetlands for any necessary monitoring and treatment

In addition, long-term management of the wetland should include the following: 82-69 cont'd.

6. Monitor mosquito levels and treat as required

Two groups of mosquito species are of interest given their breeding habits: (1) pool-breeding and (2) floodwater species. Maintaining a permanent pool in the ponds and wetland cells provides potentially suitable habitat for pool breeding species but limited habitat for floodwater species. On the other hand, temporary detention of stormwater runoff above the permanent pool provides potentially suitable habitat for floodwater species, but is disruptive to pool-breeding species.

The proposed design calls for regular input of water from a supplemental water source during the warm season to maintain the permanent pool level. Regular input of water will maintain water circulation into and out of the pond and this circulation will prevent water stagnation and help to reduce the potential for the pond to support mosquitoes. The depths of the forebay and ponds have been specifically designed to sustain primarily open water at the permanent pool elevation and preclude the establishment of emergent vegetation. Within the ponds, only limited shallow areas (approximately 5 feet wide) around the perimeter will support emergent vegetation. These shallow perimeter benches are necessary for human safety and secondarily they provide wildlife habitat benefits. Access roads surround each pond and provide ready drivable access to all areas of fringing wetland vegetation to allow for mosquito control. In addition, boat access to the ponds is provided.

The temporary detention volume in the proposed design is designed to drain within two days following a storm. This design will disrupt the ability of floodwater species to complete their reproductive cycle.

While the growth of emergent vegetation in the ponds can be minimized, it is essential to the function of wetland cells for both water quality and wildlife habitat. However, other design features such as water circulation and diverse habitat structure will help minimize potential mosquito production.

As in the ponds, opportunities for water to stagnate in the wetland cells have been minimized. The wetland cells have been constructed to allow for complete drawdown if necessary, with the exception of two deeper pools. Two deep-water zones in each cell will provide habitat and refuge for fish and other aquatic mosquito predators. The design of the wetland cells includes a slight slope and a central swale to facilitate flow-through and drainage. As with the ponds, the wetland cells will benefit from supplemental flow during the dry season. This supplemental flow will provide continuous circulation and reduce stagnant water. Precise grading techniques such as laser leveling during construction can also be used to provide consistent elevations and minimize the production of isolated non-draining areas.

Fish are commonly introduced to ponds and wetlands as a natural method of controlling mosquito populations. The mosquito fish (*Gambusia affinis*) is the most widely used biological control agent and is harvested for mass inoculation into wetland systems. Sunfish (*Lepomis* spp.) and stickleback (*Gasterosteus* spp.) are two other fish species that can enhance mosquito control efforts. Recycled water from domestic wastewater treatment plants is generally of adequate quality to support fish in a wetland. Moyle (2002) recommends more attention be given to the potential for native fish species in mosquito control. Several species of fish can be stocked at the proposed wetland and their relative success monitored. **82-69 cont'd.**

As with the ponds, access roads surround each wetland cell and provide ready drivable access to the entire perimeter. Note that the City and County of San Francisco has no dedicated mosquito abatement district responsible for the control and monitoring of mosquitoes. Therefore, mosquito monitoring and maintenance should be an element of the long-term operation and maintenance plan for the wetlands.

4.7.3 Sediment Removal

The forebay has been designed to allow for accumulation of 2 feet of sediment at the bottom. The degree to which sediment accumulates in the forebay is a function of the sediment runoff from the proposed site development. Urban developments like those proposed for Hunters Point, largely covered by concrete and asphalt, typically do not have a high sediment load. We anticipate that this sediment will be periodically dredged and disposed of or reused at the site.

Given the site's environmental history, the sediment would require characterization before disposal.

4.8 DESIGN CONTINGENCIES

This section describes and addresses some of the major contingencies of the project and identifies alternatives for dealing with each contingency.

4.8.1 No On-Site Recycled Water Available

Like the feasibility study, the proposed design is based on the assumption that a source of fresh water will be available to provide a perennial wetland system. The required volumes of water are described in the feasibility study report (Brown and Caldwell 2004). To illustrate the types of freshwater sources needed for a perennial wetland system, we are assuming recycled wastewater from a proposed wastewater treatment plant to be constructed at Hunters Point will be used as freshwater input. However, this proposed plant has not yet been designed or approved. In addition, the water from the recycling plant should not be too high in plant nutrients that would affect the growth of vegetation.

To allow for the possibility that the wastewater treatment plant is not built, we have developed two design alternatives. Alternative sources of water for the wetlands system do exist, and an effective treatment system can be designed whether or not the treatment plant is built.

4.8.1.1 Pump Water from San Francisco Bay

82-69 cont'd.

It would be possible to design an intake from San Francisco Bay to pump bay water directly into the wetland system. In that event, the wetland would no longer be a freshwater treatment system, but instead a brackish water system. This change will alter the potential vegetation makeup of the wetlands. However, there is great deal of overlap between freshwater and brackish marsh vegetation such that effective stormwater runoff treatment would still be possible.

Some *Scirpus* species as well as *Typha* can tolerate moderate salinity levels. In the San Francisco Bay–Delta salinity levels in brackish marshes fluctuate seasonally, decreasing in the winter as rains increase freshwater input and increasing through the summer and into the fall as freshwater input declines. Salinity levels also follow a gradient from the seaward end of the estuary inland, with saltwater influence toward the east. The geographic extent of seawater influence likewise fluctuates seasonally, extending further east during the dry season. As a consequence, plant species typical of salt water and fresh water intermix continuously along this gradient, with species composition varying depending on the local pattern of fluctuation.

California bulrush is found all along this gradient, though it apparently can tolerate greater submergence with fresher water conditions (Josselyn 1983). Under "middle marsh" conditions, *S. americanus* is common, along with alkali bulrush (*S. robustus*) and *Typha* species.

Some care would be required in monitoring salinity levels, both in the wetlands and in the bay water intended for supplemental input, especially as the dry season progresses, but the creation of a brackish marsh system should be possible.

Periodic maintenance would also be required to remove debris and trash and occasionally clean out sediments and vegetation.

4.8.1.2 Bring Water from the Southeast Treatment Plant

Another approach would be to bring water in from the southeast treatment plant operated by the City of San Francisco. This approach would require piping water to the site over a distance of just over a mile. We anticipate that a 2-inch pipeline would be sufficient to bring enough makeup water to the site during months where supplemental water is needed. This solution is technically feasible, although it may be costly to bring a pipe through a mile of highly urbanized area, but it also appears likely that the site developer (Lennar) may install a pipe connection to the southeast treatment plant as part of the site development. In that event, it would be easy and a relatively small additional cost to add the supplemental water pipe within the construction trench to bring the recycled water to the project wetlands. These options will be explored during final design activities. The routing and costs for this alternative were beyond the scope of this report.

4.8.2 Seepage of Contaminated Groundwater into Wetlands

The proposed design accounts for the possibility of residual groundwater contamination after the landfill waste and debris are removed by including an impermeable liner to separate groundwater from the wetlands system. We have assumed that the Navy will be required to implement a monitoring system around Parcel E to assess the effectiveness of its remedial activities around the landfill. In the event of measured groundwater seepage into the wetlands, we have assumed that the Navy will implement a groundwater pumping and remediation program separate from the wetlands system to pump the groundwater for treatment.

82-69 cont'd.

5.0 Cost Estimates

Tables 7 and 8 each contains a preliminary cost estimate based on professional judgment and experience. The costs are intended to provide an order-of-magnitude estimate of costs for construction of the proposed system. Actual costs may vary owing to inflation, fuel costs, specific San Francisco construction and contracting requirements, and unforeseen field conditions.

The cost estimates reflect the following assumptions:

- No hazardous waste or environmental issues are involved in the wetlands project construction; Two alternatives were developed for cost estimates. Alternative 1 assumes the Navy or others will treat or remove pollutants and debris from the landfill site and leave the site at an elevation of –10 feet NGVD. Again, alternative 2 assumes that the Navy or others will treat or remove pollutants and debris from the landfill site but in this case will leave the site at an elevation of 0 feet NGVD. Earthwork volume calculations have been developed using each of these starting elevations.

- The Navy will use the existing 5-foot clay cap and native soil backfill (thickness assumed to be 3 feet) as on-site backfill materials.
- Import soils are available on site or near the site. Our estimate includes minimal costs for transport of clean fill soils to the site.

Furthermore, we have included no costs for acquisition of land or preparation of extensive permitting studies such as an environmental assessment, environmental impact report, or environmental impact statement.

The largest single cost in the estimate is earthwork and fine grading of the proposed pond systems. Regardless of which cleanup scenario the Navy selects, that is, complete removal and disposal of contaminated materials or a combination of hot-spot removal and in situ cleanup to below hazardous levels, the proposed design can be implemented as designed and presented in this report.

6.0 Recommended Next Steps

Since this design is preliminary, additional design work will be needed during the final design phase of the project, including the following:

- Development of an accurate and current base map for the project site and adjustment of the proposed layout to meet project limits
- Coordination with the upstream property developer to integrate the proposed wetlands with site development plans and to determine treatment and flood flows more accurately
- Performance of a more detailed hydraulic analysis to determine the input hydrograph and loadings into the system and to design water control structures
- Coordination with the Navy for the cleanup and removal of pollutants from the landfill site to allow for construction of the wetlands
- Finalization of construction and operating cost estimates
- Cooperation with the appropriate regulatory agencies to obtain permits for the project

82-69
cont'd.

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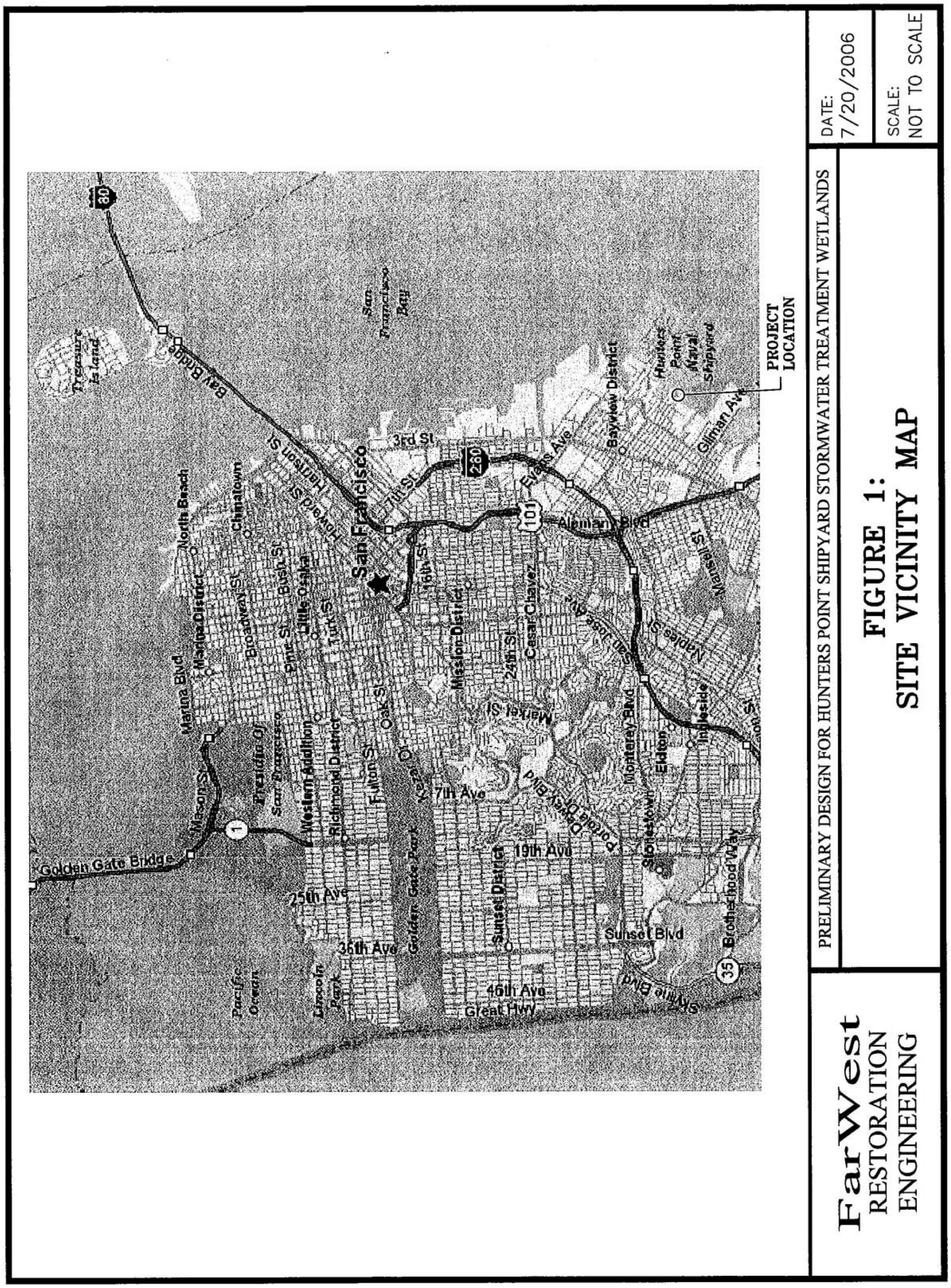

PRELIMINARY DESIGN FOR HUNTERS POINT SHIPYARD STORMWATER TREATMENT WETLANDS
FIGURE 1:
SITE VICINITY MAP
DATE:
7/20/2006
SCALE:
NOT TO SCALE
FarWest
RESTORATION
ENGINEERING
PROJECT
LOCATION
San Francisco
Golden Gate Bridge
Bay Bridge
Treasure Island
Pacific Ocean
Golden Gate Park
Mission District
Bayview District
Sunset District
Sunset Blvd
Great Hwy

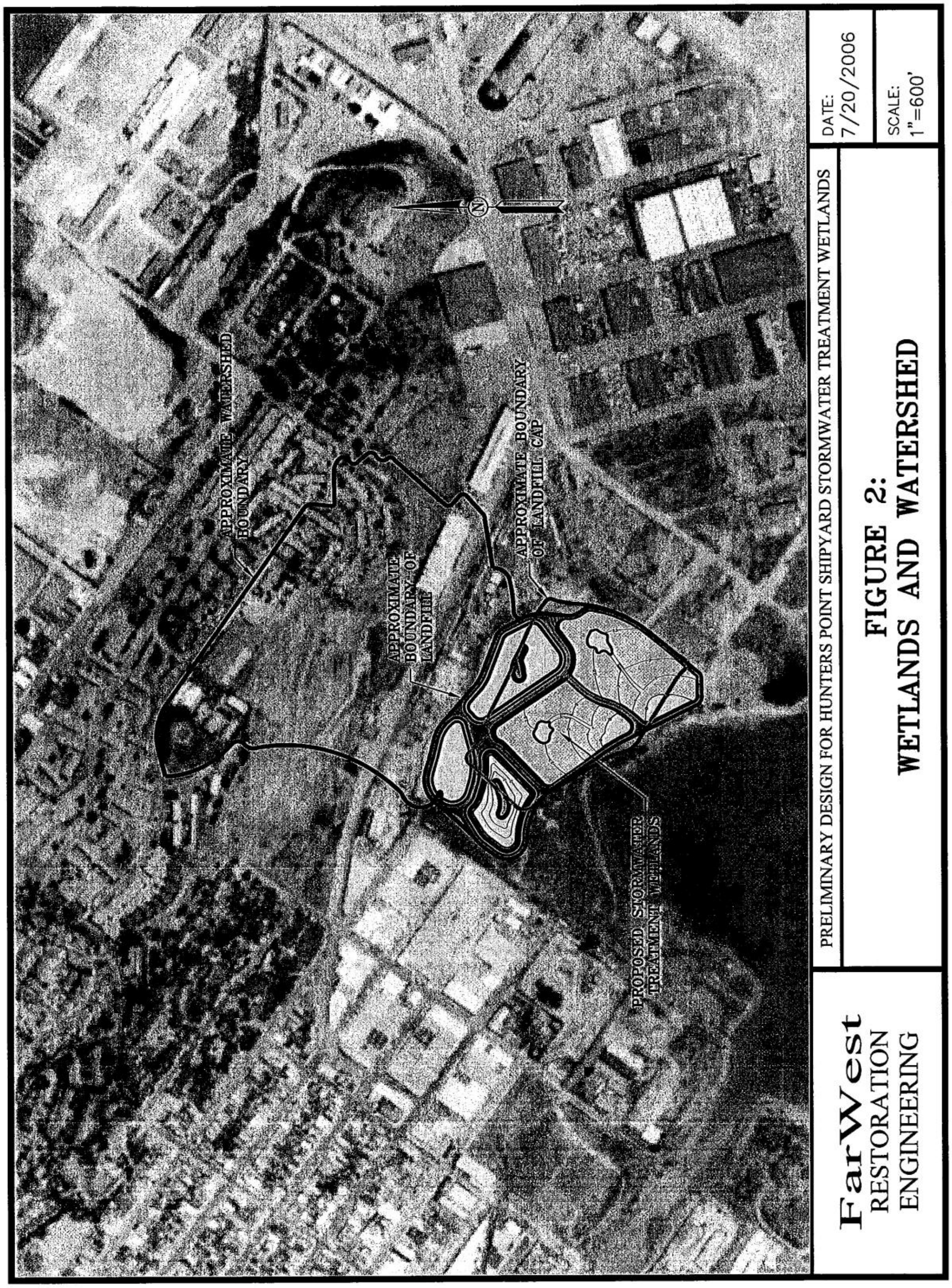
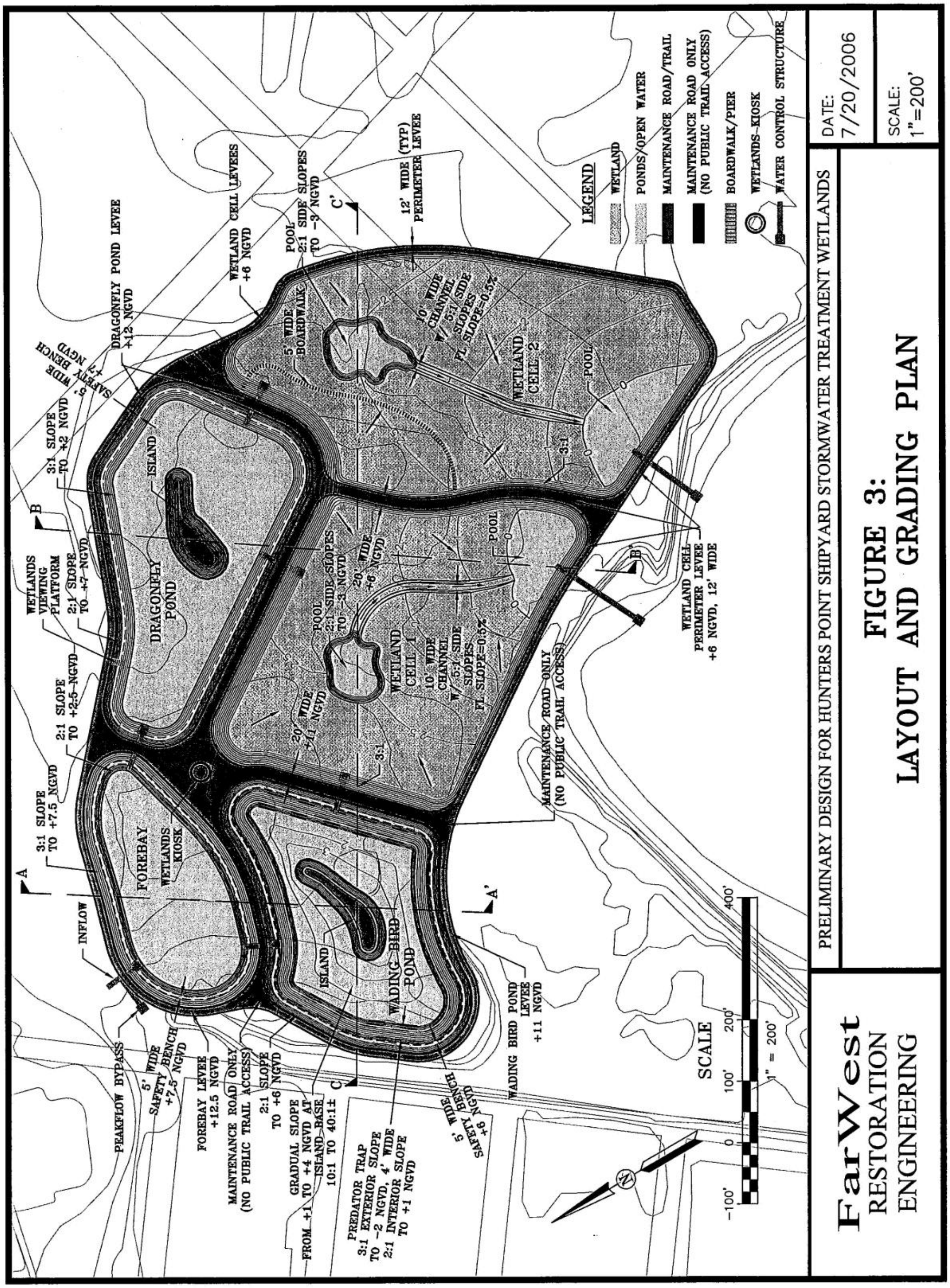


FIGURE 2:
WETLANDS AND WATERSHED


PRELIMINARY DESIGN FOR HUNTERS POINT SHIPYARD STORMWATER TREATMENT WETLANDS
FIGURE 3:
LAYOUT AND GRADING PLAN
DATE:
7/20/2006
SCALE:
1"=200'
FarWest
RESTORATION
ENGINEERING
LEGEND
WETLAND
PONDS/OPEN WATER
MAINTENANCE ROAD/TRAIL
MAINTENANCE ROAD ONLY (NO PUBLIC TRAIL ACCESS)
BOARDWALK/PIER
WETLANDS-KIOSK
WATER CONTROL STRUCTURE
FOREBAY
DRAGONFLY POND
WETLAND CELL 1
WETLAND CELL 2
WADING BIRD POND
SCALE
1" = 200'

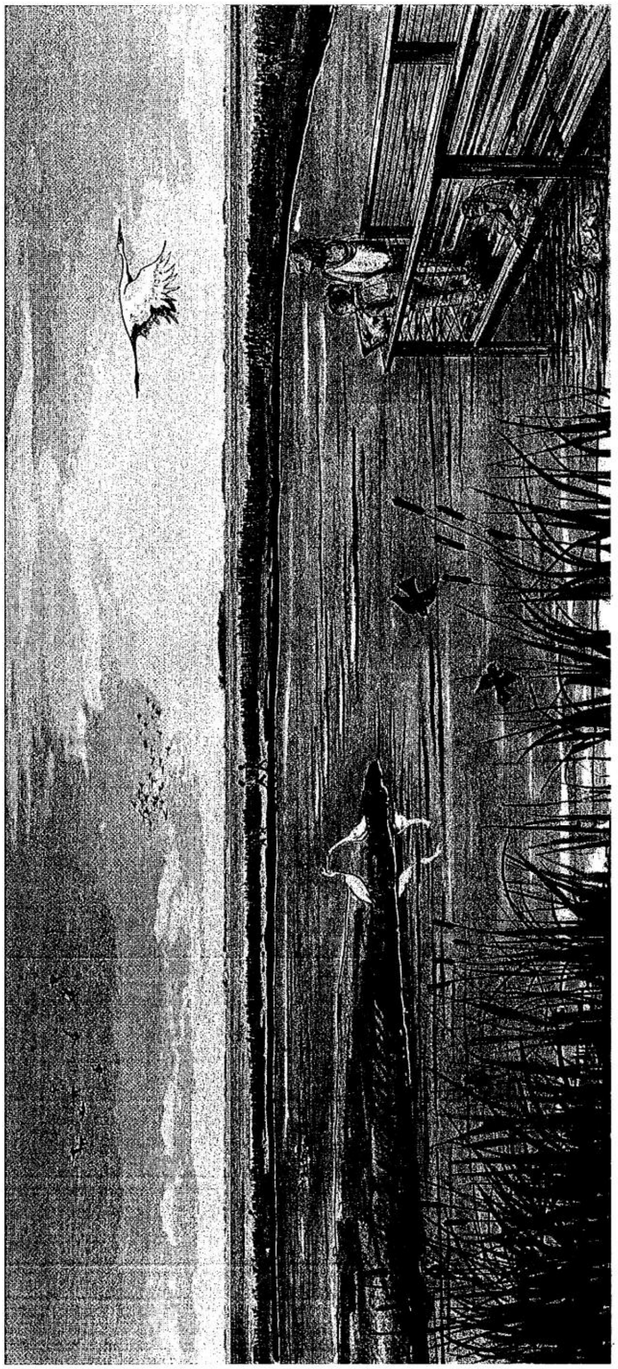
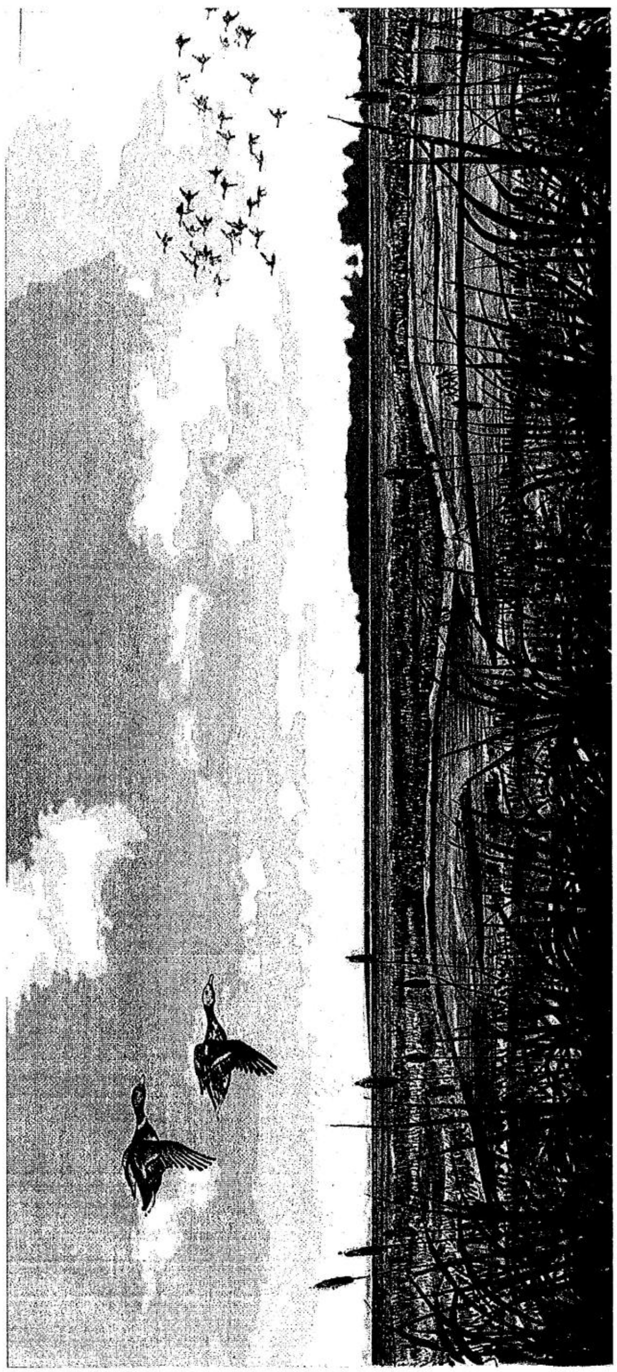
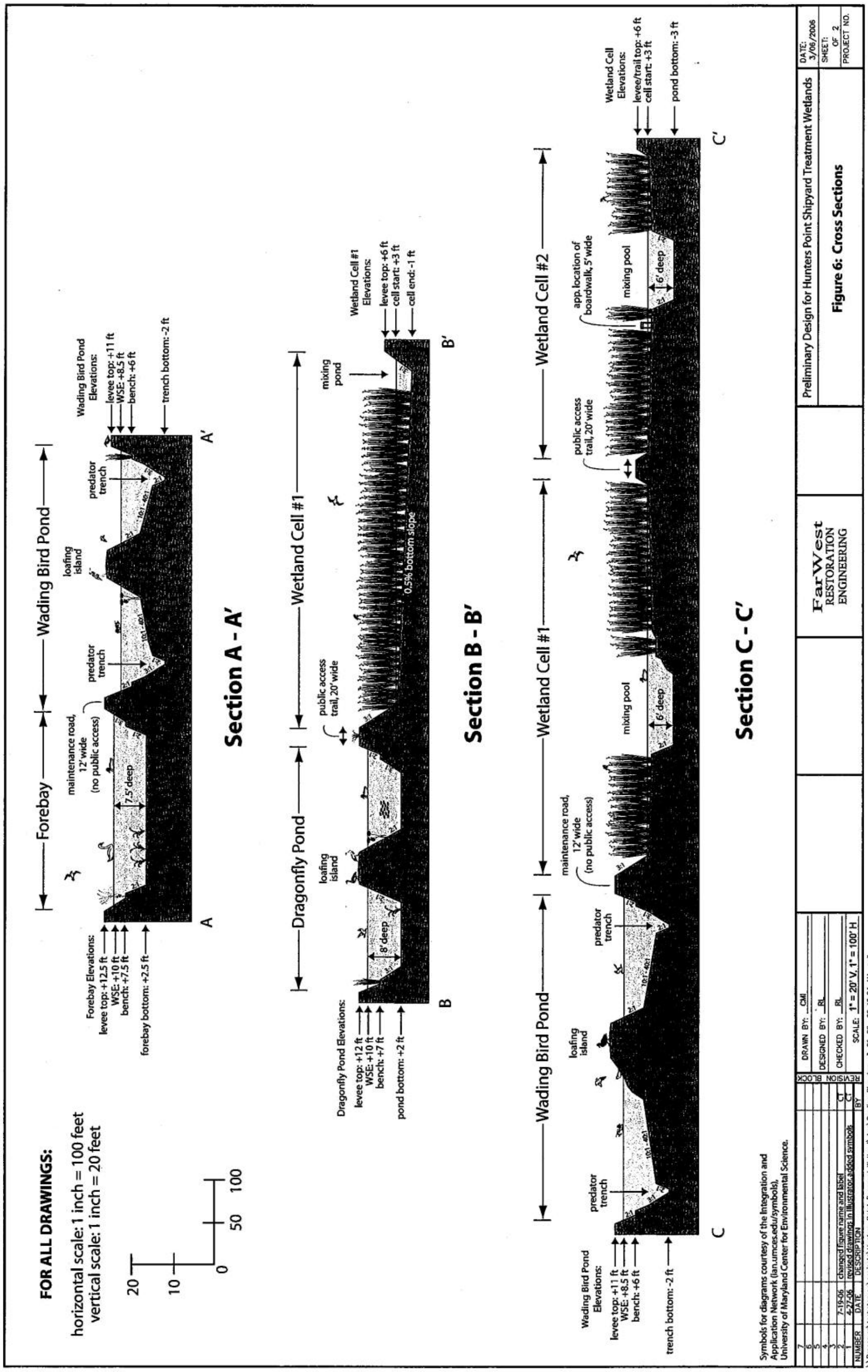


Figure 4: Illustrative Drawing of Dragonfly Pond
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands



INSIDEOUT

Figure 5: Illustrative Drawing of Wetland Cells
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands


FOR ALL DRAWINGS:
horizontal scale: 1 inch = 100 feet
vertical scale: 1 inch = 20 feet
Section A - A'
Forebay
Wading Bird Pond
Forebay Elevations:
levee top: +12.5 ft
WSE: +10 ft
bench: +7.5 ft
forebay bottom: +2.5 ft
maintenance road, 12' wide (no public access)
7.5' deep
predator trench
loafing island
Wading Bird Pond Elevations:
levee top: +11 ft
WSE: +8.5 ft
bench: +6 ft
trench bottom: -2 ft
Section B - B'
Dragonfly Pond
Wetland Cell #1
Dragonfly Pond Elevations:
levee top: +12 ft
WSE: +10 ft
bench: +7 ft
pond bottom: +2 ft
8' deep
public access trail, 20' wide
0.5% bottom slope
mixing pond
Wetland Cell #1 Elevations:
levee top: +6 ft
cell start: +3 ft
cell end: -1 ft
Section C - C'
Wading Bird Pond
Wetland Cell #1
Wetland Cell #2
mixing pool
6' deep
app. location of boardwalk, 5' wide
Wetland Cell Elevations:
levee/trail top: +6 ft
cell start: +3 ft
pond bottom: -3 ft
Symbols for diagrams courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science.
FarWest RESTORATION ENGINEERING
Preliminary Design for Hunters Point Shipyard Treatment Wetlands
Figure 6: Cross Sections
DATE: 3/06/2006
SCALE: 1" = 20' V, 1" = 100' H

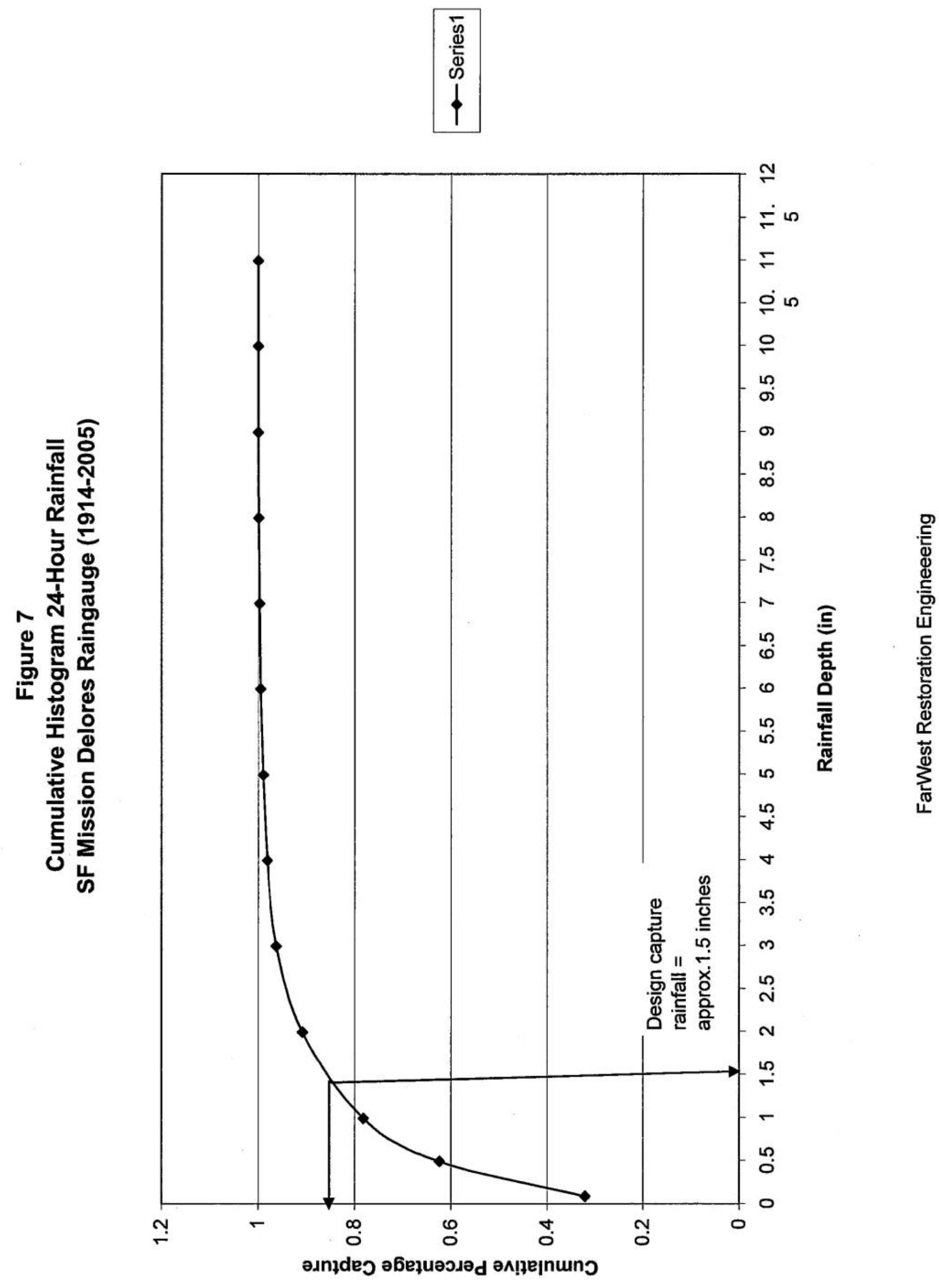


Figure 7
Cumulative Histogram 24-Hour Rainfall
SF Mission Delores Raingauge (1914-2005)
Series1
Cumulative Percentage Capture
1.2
1
0.8
0.6
0.4
0.2
0
Design capture rainfall = approx.1.5 inches
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12
Rainfall Depth (in)
FarWest Restoration Engineeering

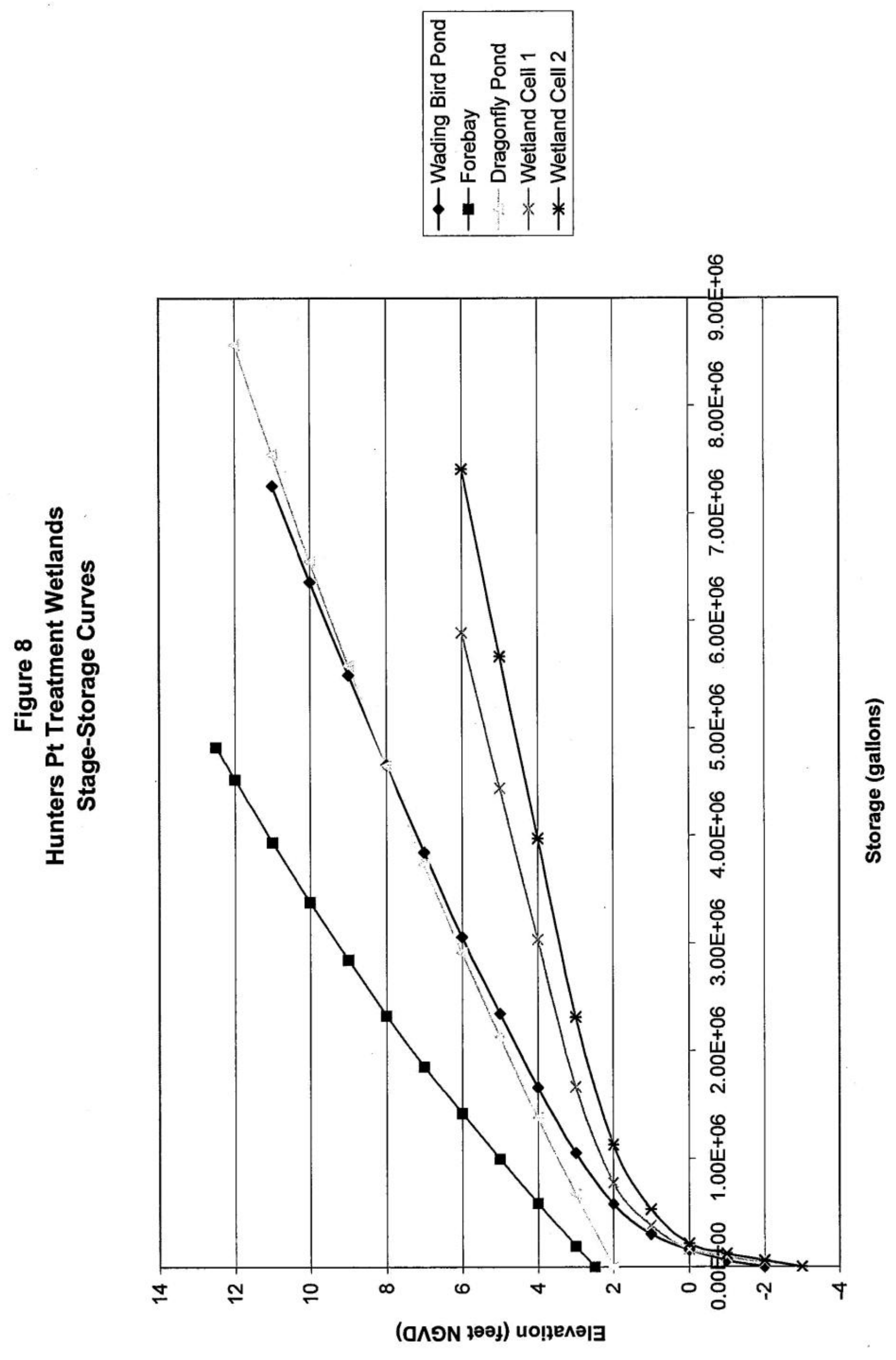


Figure 8
Hunters Pt Treatment Wetlands
Stage-Storage Curves
Wading Bird Pond
Forebay
Dragonfly Pond
Wetland Cell 1
Wetland Cell 2
Elevation (feet NGVD)
14
12
10
8
6
4
2
0
-2
-4
0.00E+00
1.00E+06
2.00E+06
3.00E+06
4.00E+06
5.00E+06
6.00E+06
7.00E+06
8.00E+06
9.00E+06
Storage (gallons)

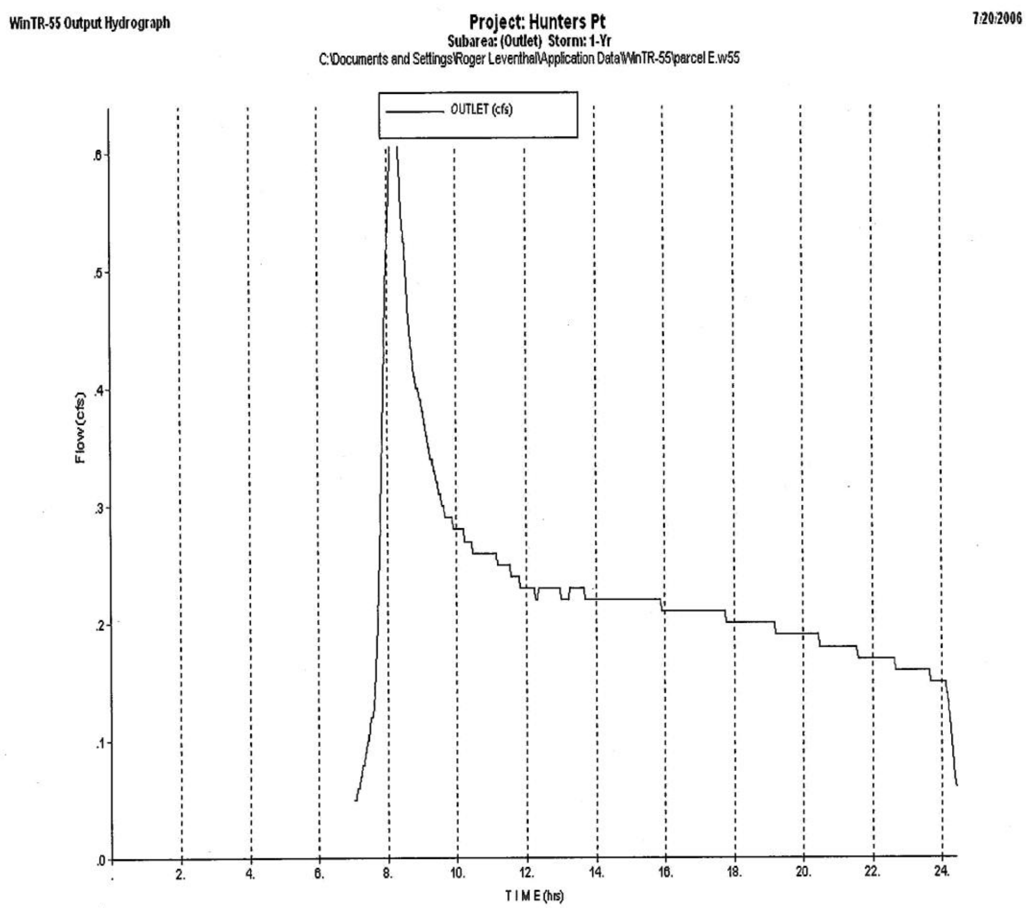


Figure 9: One-Year Storm Hydrograph from TR-55 Model

Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands

Table 1
Hunters Point Shipyard Stormwater Monitoring Data, 2004–2005
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands

	Outfall 001 Concentration (mg/l)		DP1 Concentration (mg/l)		DP2 Concentration (mg/l)	
	2/14/05 Sampling Event	*Sampling Event*	*Sampling Event*	*Sampling Event*	*Sampling Event*	*Sampling Event*
Total suspended solids	7	7	450	40	460	12
pH	7.8	7.7	8.2	7	8.1	6.8
Oil and grease	ND (<4.72)	ND (<4.72)	ND (<4.72)	ND (<4.72)	ND (<4.72)	ND (<4.72)
Aluminum	1.7	0.12	19	1	14	0.29
Arsenic	ND (<0.05)	ND (<0.005)	0.013	0.005	0.0098	0.005
Barium	0.12	0.084	0.21	0.032	0.23	0.025
Copper	0.18	0.11	0.51	0.13	0.68	0.14
Chromium	0.011	ND <0.01	0.13	0.01	0.1	ND (<0.01)
Iron	3.4	0.4	32	1.3	23	0.37
Lead	0.012	0.003	0.16	0.026	0.19	0.014
Magnesium	95	76	26	2.2	20	2
Manganese	0.45	0.28	0.77	0.07	0.75	0.048
Mercury	ND (<.0002)	ND (<.0002)	0.0023	ND (<.0002)	0.0033	0.0002
Nickel	0.023	0.02	0.23	0.02	0.19	0.02
Vanadium	ND (<0.01)	ND (<0.01)	0.055	0.001	0.055	ND (<0.01)
Zinc	0.064	0.02	0.82	0.3	0.99	0.28

Outfall 001: Entrance to existing wetlands
DP1: Pipe inlet to UCSF compound
DP2: Catch basin leading to base-wide sewer system
mg/l: milligrams per liter

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Table 2
Potential Types and Concentrations of Chemical Constituents in Site Watershed Runoff
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands

	Data for			Data Collected by the Navy at Hunters Point Shipyard 2004–2005					
				Outfall 001 (mg/l)		*DP1 (mg/l)*		*DP2 (mg/l)*	
	National[1] (mg/l)	Mean of Four Low Rainfall Areas[1] (mg/l)	Bay Area[2] (mg/l)	*2/14/05 Sampling Event*	*3/18/05 Sampling Event*	*2/14/05 Sampling Event*	*3/18/05 Sampling Event*	*2/14/05 Sampling Event*	*3/18/05 Sampling Event*
Total suspended solids	78.4	228.75		7	7	450	40	460	12
Total nitrogen	2.39	4		NA	NA	NA	NA	NA	NA
Total phosphorus	0.32	0.63		NA	NA	NA	NA	NA	NA
Oil and grease	3			ND (<4.72)	ND (<4.72)	ND (<4.72)	ND (<4.72)	ND (<4.72l)	ND (<4.72)
Cadmium	0.0007		0.00221	ND (<0.005)	ND (<0.005)	20	8.1	ND (<0.005)	ND (<0.005)
Copper	0.0134	0.0415	0.0466	0.18	0.011	0.51	0.13	0.68	0.14
Chromium	0.004		0.02345	0.011	ND (<0.01)	0.13	0.01	0.1	ND
Lead	0.0675	0.103	0.1146	0.012	ND (<0.003)	0.16	0.026	0.19	0.014
Mercury				ND (<.0002)	ND (<.0002)	0.0023	ND (<.0002)	0.0033	0.0002
Nickel			0.0469	0.023	0.02	0.23	0.02	0.19	0.02
Zinc	0.162	0.269	0.3128	0.064	0.02	0.82	0.3	0.99	0.28

Outfall 001: Entrance to existing wetlands
DP1: Pipe inlet to UCSF compound
DP2: Catch basin leading to base-wide sewer system
ND: Not detected
NA: Not analyzed
mg/l: milligrams per liter

1. Center for Watershed Protection 2003
2. Bay Area Stormwater Management Agencies Association 1996

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TABLE 3
Typical Settling Velocities and Times for Mineral Particles in Still Water
Preliminary Design for
Hunters Point Shipyard Stormwater Treatment Wetlands

Particle Size	Settling Velocity (feet/day)	Time to Settle 1 Foot
Gravel	283,000	0.3 second
Coarse sand	28,300	3.0 seconds
Fine sand	2,260	38.0 seconds
Silt	43.6	33.0 minutes
Clay	0.00436	230 days
Colloids	0.0000436	63 years

Source: Ferguson 1998

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TABLE 4
Characteristics of Proposed Treatment Wetlands
Preliminary Design for
Hunters Point Shipyard Stormwater Treatment Wetlands

	Forebay	**Dragonfly Pond**	**Wading Bird Pond**	**Wetland Cell #1**	**Wetland Cell #2**
Area at Normal Pool Level (acres)	1.5	2.7	2.6	5	5
Bottom Elevation (feet NGVD)	+2.5	+2	+2[1]	0 to 2.5[2]	0 to 2.5[2]
Normal Water Level (feet NGVD)	+8.5	+8	+7	+3	+3
Volume of Permanent Pool at Normal Water Level (gallons)	2,590,000	4,650,000	3,850,000	1,670,000	2,320,000
Elevation of Extended Detention Storage (feet NGVD)	+10.5	+10	+9	+4	+4
Volume of Extended Detention Storage (gallons)	1,075,000	1,905,000	1,655,000	1,370,000	1,655,000
Elevation of Top of Levee (feet NGVD)	+12.5	+12	+11	+6	+6

1. Excludes predator trench.
2. Excludes nondraining pool area.

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TABLE 5
Expected Treatment Effectiveness for Wet Ponds
Preliminary Design for
Hunters Point Shipyard Stormwater Treatment Wetlands

Parameter	Percentage Removal Schueler 1992	Percentage Removal Hatigan 1998
TSS	50–90	80–90
Total Phosphorus	30–90	
Soluble Nutrients	40–80	50–70
Lead	70–80	
Zinc	40–50	
BOD/COD	20–40	

Source: U.S. Environmental Protection Agency (EPA) 1999

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TABLE 6
Required Supplemental Water Volumes
Preliminary Design for
Hunters Point Shipyard Stormwater Treatment Wetlands

Month	Supplemental Water Required (acre-feet)
January	0
February	0
March	0
April	2.1
May	7.1
June	9
July	8.9
August	8.6
September	7.2
October	2.5
November	0
December	0

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Table 7
Preliminary Cost Estimate, Alternative 1
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands

CONSTRUCTION COSTS					
Description of Item	**Quantity**	**Units**	**Unit Cost ($)**	**Total Cost ($)**	**Comments**
Site survey	1	ls	$10,000	$10,000	
Equipment mobilization/demobilization	1	ls	$20,000	$20,000	
Clearing and grubbing	20	acres	$2,000	$40,000	
Earthwork[1]					
Total fill landfill cap reuse	113000	cy	$3	$339,000	Assumes Navy has stockpiled existing cap materials; assumes existing cap consists of 2-foot clay layer with 1.5-foot soil layer
Total clean import fill	295000	cy	$10	$2,950,000	Assumes Navy has removed all landfill materials; assumes site elevation at start of construction is at elevation –10 feet NGVD; assumes nearby source of clean fill
Pond and cell fine grading	20	acres	$7,000	$140,000	Fine grading and contouring of ponds
Levee road	21780	sf	$7	$152,460	Assumes 4 inches aggregate base with 3 inches of asphalt
Decomposed granite trails	91476	sf	$4	$365,904	Assumes decomposed granite pathway with aggregate base
Liner placement	69000	sy	$5	$310,500	Assumes liner placed to contour elevation +3 feet NGVD in ponds and cells
Water control structures	7	each	$20,000	$140,000	
Boardwalk in Dragonfly Pond	500	lf	$200	$100,000	
Wildlife viewing platform	1	ls	$20,000	$20,000	
Signs					
Educational signs	3	each	$250	$750	
Warning signs	8	each	$100	$800	
Wetland planting	270,000	plugs	$0.85	$229,500	
Landscaping					
Topsoil for plantings	500	cy	$12	$6,000	Soil for upland planting
Soil amendments, mulch					
Native grass hydroseeding	9	acre	$3,000	$27,000	
Native shrubs	500	each	$15	$7,500	Assumes 1-gallon shrubs
Subtotal:				$4,849,414	
10% contingency:			10 %	$484,941	
Total construction:				$5,334,355	

MAINTENANCE AND MONITORING COSTS					
Description of Item	**Quantity**	**Units**	**Unit Cost ($)**	**Total Cost ($)**	**Comments**
Landscape maintenance	1	ls	$3,000	$3,000	Assumes limited plant replacement and repair of irrigation system
Biological monitoring					
Bird surveys	1	ls	$2,400	$2,400	
Quantitative vegetation transects	1	ls	$2,500	$1,500	
Qualitative monitoring	1		$2,000		Observations, recommendations for remedial action; photo monitoring
Cleaning of pipes	1	ls	$2,000	$2,000	
Mosquito control	1	ls	$2,500	$2,500	
Weed control (hand weeding)	1	ls	$2,000	$2,000	
Litter control	1	ls	$2,000	$2,000	
Annual monitoring report	1	ls	$6,000	$6,000	
Annual subtotal:				$18,400	
Total 5-year maintenance and monitoring:				$92,000	No inflation adjustment
TOTAL COST:				**$5,426,355**	

cy: cubic yards
ls: lump sum
sf: square feet
sy: square yards
NGVD: National Geodetic Vertical Datum, mean sea level 1929

1. Total cut quantity calculated using Land Desktop Version 3

FarWest Restoration Engineering

Table 8
Preliminary Cost Estimate, Alternative 2
Preliminary Design for Hunters Point Shipyard Stormwater Treatment Wetlands

CONSTRUCTION COSTS					
Description of Item	**Quantity**	**Units**	**Unit Cost ($**	**Total Cost ($)**	**Comments**
Site survey	1	ls	$10,000	$10,000	
Equipment mobilization/demobilization	1	ls	$20,000	$20,000	
Clearing and grubbing	20	acres	$2,000	$40,000	
Earthwork[1]					
Total fill landfill cap reuse	113000	cy	$3	$339,000	Assumes Navy has stockpiled existing cap materials; assumes existing cap consists of 2-foot clay layer with 1.5-foo soil layer
Total clean import fill	2000	cy	$10	$20,000	Assumes Navy has removed and/or treated all hazardous landfill materials; assumes site elevation at start of construction is at elevation 0 feet NGVD; assumes existing landfill cap materials are reused; assumes nearby source of clean fill
Pond and cell fine grading	20	acres	$7,000	$140,000	Fine grading and contouring of ponds
Levee road	21780	sf	$7	$152,460	Assumes 6 inches aggregate base with 3 inches of asphalt
Decomposed granite trails	91476	sf	$4	$365,904	Assumes decomposed granite pathway
Liner placement	69000	sy	$5	$310,500	Assumes liner placed to contour elevation +3 feet NGVD in ponds and cells
Water control structures	7	each	$20,000	$140,000	
Boardwalk in Dragonfly Pond	500	lf	$200	$100,000	
Wildlife viewing platform	1	ls	$20,000	$20,000	
Signs					
Educational signs	3	each	$250	$750	
Warning signs	8	each	$100	$800	
Wetland planting	270,000	plugs	$0.85	$229,500	
Landscaping					
Topsoil for plantings	500	cy	$12	$6,000	Soil for upland planting
Soil amendments, mulch					
Native grass hydroseeding	9	acre	$3,000	$27,000	
Native shrubs	500	each	$15	$7,500	Assumes 1-gallon shrubs
Subtotal:				$1,919,414	
10% contingency:		10	%	$191,941	
Total construction:				$2,111,355	
MAINTENANCE AND MONITORING COSTS					
Description of Item	**Quantity**	**Units**	**Unit Cost ($**	**Total Cost ($)**	**Comments**
Landscape maintenance	1	ls	$3,000	$3,000	Assumes limited plant replacement and repair of irrigation system
Biological monitoring					
Bird surveys	1	ls	$2,400	$2,400	
Quantitative vegetation transects	1	ls	$2,500	$1,500	
Qualitative monitoring	1		$2,000		Observations, recommendations for remedial action; photo monitoring
Cleaning of pipes	1	ls	$2,000	$2,000	
Mosquito control	1	ls	$2,500	$2,500	
Weed control (hand weeding)	1	ls	$2,000	$2,000	
Litter control	1	ls	$2,000	$2,000	
Annual monitoring report	1	ls	$6,000	$6,000	
Annual subtotal:				$18,400	
tal 5-year maintenance and monitoring:				$92,000	No inflation adjustment
TOTAL COST:				**$2,203,355**	

cy: cubic yards
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NGVD: National Geodetic Vertical Datum, mean sea level 1929

1. Total cut quantity calculated using Land Desktop Version 3

FarWest Restoration Engineering

Hunters Point Constructed Storm Water Wetland Feasibility Study

Prepared for the
Golden Gate Audubon Society

Final Report - July 2004

Prepared by

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Marc Beutel, Ph.D., P.E., Brown and Caldwell
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