Appendix L ENGEO Preliminary Geotechnical Report Hunters Point Shipyard Phase II and Candlestick Point, May 21, 2009

PRELIMINARY GEOTECHNICAL REPORT

HUNTERS POINT SHIPYARD PHASE II AND CANDLESTICK POINT

SAN FRANCISCO, CALIFORNIA

SUBMITTED

TO

LENNAR URBAN

SAN FRANCISCO, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 7730.000.001

MAY 21, 2009

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Mr. Stephen Proud
Lennar Urban
49 Stevenson Street, Suite 600
San Francisco, CA 94105

Subject: Hunters Point Shipyard Phase II and Candlestick Point
San Francisco, California

PRELIMINARY GEOTECHNICAL REPORT

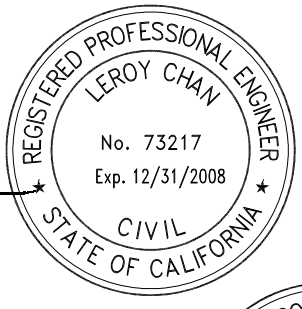
Dear Mr. Proud:

With your authorization, ENGEO is pleased to provide this preliminary geotechnical report for the planned development at Hunters Point Shipyard Phase II and Candlestick Point in San Francisco, California. This report discusses our findings based on the review of previous studies performed at the site and provides preliminary conceptual geotechnical recommendations to address the geologic constraints related to the proposed development. In addition, this report will help support the Environmental Impact Report (EIR) and planning process.

The report describes the geologic conditions based on limited field explorations performed over the past 30 years, identifies the geological and geotechnical concerns at the site, and provides a suite of potential conceptual geotechnical remediation solutions for the proposed development.

We are pleased to provide our services to you on this project and look forward to consulting further with you and your design team.

Very truly yours,



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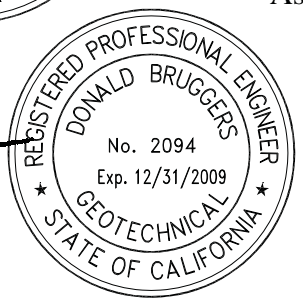

Donald E. Bruggers, GE
Principal

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INTRODUCTION

Purpose and Scope

The purpose of this Preliminary Geotechnical Report is to describe subsurface conditions anticipated within the currently planned development areas at Hunters Point Shipyard Phase II and Candlestick Point (Figure 1), identify the geotechnical hazards within the planned development areas, and identify some possible conceptual solutions to the geotechnical constraints associated with the proposed development. We have limited our discussion in this report to focus on the significant geotechnical issues that need to be addressed during the planning process as they relate to the proposed development. This report is intended for preliminary planning purposes only and for providing conceptual-level design recommendations during the EIR phase and initial phases of project planning. Design-level geotechnical studies will be required during development of construction plans.

Our scope of services included research and review of published literature, geologic maps, and previous geotechnical and environmental reports pertinent to the site. At Hunters Point, only limited shallow subsurface data was available, which did not provide sufficient information to accurately characterize the deeper stratigraphy of the site. In addition, geotechnical laboratory data for the site were limited and did not include the necessary data to fully characterize the soil properties. At Candlestick Point, pertinent geotechnical lab data and boring information were available from a limited number of borings based on the previously proposed stadium-mall development. The locations of these data points do not necessarily correspond to the critical areas of the current proposed development plan and additional subsurface exploration is required.

While generalized soil conditions for Parcels D and E at Hunter Point are presented, discussion of conceptual geotechnical solutions are briefly addressed since proposed development for this

area may either consist of the 49ers Stadium or commercial development. In addition, we have not included an evaluation of the shoreline, existing bulkhead static or seismic stability at this time due to lack of subsurface information within these areas. Also, the off-site transportation improvements are not covered in the scope of this report and will require separate study.

Due to the limitations of the available data, this report is based primarily on geologic descriptions contained in previous reports and on our experience. We have modeled the available data to interpolate the stratigraphic profile across both sites; however, significant assumptions were made to characterize the subsurface conditions. A considerable amount of additional geotechnical exploration for all portions of the site is required before design-level recommendations can be provided.

PLANNED DEVELOPMENT

Based on review of the tentative land use plan (Figure 2) prepared by IBI Group and ongoing discussions with Lennar, it is anticipated that development in Phase II of the Hunters Point Shipyard project will consist of 2,100 residential units, 60,000 square feet of neighborhood-serving retail, and 2,000,000 square feet of environmentally-sustainable light industrial and commercial facilities over a total of 495 acres. In addition, there is an NFL football stadium proposed, and the development plan includes preparation of the building pad and supporting utilities for the stadium. At Candlestick Point, the proposed development consists of 6,500 residential units, 585,000 square feet of regional retail, and a small amount of commercial facilities over a total of 276 acres. It is anticipated that building types will be a combination of low-, mid-, and high-rise buildings ranging from 2 to 40 stories for Candlestick Point and 2 to 32 stories for Hunters Point.

Significant public and recreational areas are also proposed in addition to the multi-story residential units and retail parking facilities presented in the tentative land use plan prepared by IBI Group. The development will include extensive infrastructure development including demolition of selected existing improvements, environmental remediation, geotechnical stabilization, site grading, utilities installation, transportation, and street system installation. New utility systems include low-pressure water, fire service, recycled water, sanitary sewer, storm drain, and dry utilities (gas, telephone, and telecommunications). A pedestrian and vehicular bridge is proposed to span over Yosemite Slough to provide connectivity between Hunters Point Shipyard Phase II and Candlestick Park. It is proposed that the deck of the bridge will span at an elevation ranging from approximately 12 feet to 14 feet (CCSF). Additionally, several off-site transportation improvements are not included in the scope of this report.

Development of the project is divided into various Parcels as illustrated in Figure 2. The Hunters Point Shipyard Phase II site will include Parcels 49, B, C, D, and E. Parcel B will consist of low

to high-rise residential and mixed-use; Parcel C will consist primarily of mid-rise light industrial uses; development within Parcels D and E is uncertain at the time of this report, it may include a NFL Football stadium with associated parking and recreational open space. The proposed Candlestick Point site will consist of Parcels G, H, J, K, and L. Parcel G will consist of low- to mid-rise residential; Parcel H will consist of low- to high-rise residential and mixed-use; Parcel J will consist of mid- to high-rise residential; Parcel K will consist of low- to mid-rise retail and some commercial; and Parcel L will consist of low- to high-rise residential and mixed use.

At the time of this report, the City and County of San Francisco has just become incorporated into the FEMA program and Flood Insurance Rate Maps (FIRM) are being prepared. Preliminary FIRMs of the project site based on existing site grades were available for us to review. Base Flood Elevation (BFE) as shown on preliminary FEMA flood mapping is between elevation -1.60 and +0.59 feet CCSF datum within site boundaries. Variability in BFE is based on differences in wave setup and wave run-up at each transect as calculated by FEMA. The one percent flood event usually results from a combination of astronomical tides and wave run-up, as opposed to solely a 100-yr tide or a 100-yr storm wave event. Possible impacts of sea level rise were not taken into account in the FEMA study. Based on recommendations provided by Moffatt & Nichol, an additional 36-inches was added to the BFE in establishing proposed finish grades to account for sea level rise.

DATA SOURCE AND PREVIOUS STUDIES

Numerous exploratory investigations and geological mapping were performed by various parties within the project area. Due to the previously mentioned limitations of the available data, this report is based heavily on geologic descriptions contained in the following reports:

Hunters Point

- ENGEO - In a report dated December 31, 2002, ENGEO identified the pertinent subsurface conditions and possible geotechnical constraints based on earlier reports prepared on behalf of the U.S. Navy published by various groups. Additional data relating to the subsurface conditions within the Hunters Point Shipyard Project were gathered from other studies performed at the shipyard.

- ENGEO – Hunters Point Parcel A, a comprehensive geotechnical report prepared for the project area, dated October 2004, was used to prepare the enclosed geotechnical conceptual design.

Candlestick Point

- Treadwell and Rollo – A Geotechnical Investigation Report was prepared dated March 3, 1998. The investigation included drilling 16 test borings, advancing 18 cone penetration tests (CPT), and conducting five profiles of seismic refraction survey between August 5 and September 16, 1997.

- ENGEO 2006 – Various studies related to the proposed development at Candlestick Point.

GEOLOGIC CONDITIONS

The Hunters Point Shipyard Phase II and Candlestick Point project site is situated on the shore of the San Francisco Bay in the northern portion of the San Francisco Peninsula, which is bounded by San Francisco Bay to the east, and the Pacific Ocean to the west. The present day landforms and subsurface environment within the San Francisco Peninsula are primarily the product of tectonic activities associated with the San Andreas fault system and the hydrological setting. A combination of intense erosion and fluctuation of sea level has led to the characteristic deposits of soft and unconsolidated (young Bay Mud) material within the lower-lying areas along the Bay.

The topographic setting within the project boundaries at Hunters Point Shipyard Phase II can be described as relatively level with some minor slopes in the vicinity of Parcel A, located in the center of the Shipyard. Within the lower lying areas, elevations range from sea level to approximately 20 feet. The highest point within the project boundaries is elevation 36 feet on Galvez Avenue in Parcel B. The topographic setting within the project boundaries at Candlestick Point can be described as relatively level with some localized mounding in the park area near the shoreline. There are increasingly steep slopes to the west and a large elevated mound within the area of the Alice Griffith Housing Project within the future Parcel G. Elevations at Candlestick Point vary from sea level to 230 feet at the uppermost boundary of Parcel J. Reported elevations are based on City and County of San Francisco Datum (CCSF).

The site is located within the Coast Ranges geomorphic province of California, a region of northwest-trending, folded and faulted mountain ranges. The site is situated in a portion of the Coast Ranges that is underlain by Jurassic- and Cretaceous-age Franciscan bedrock including serpentinite, greenstone, chert, sandstone, and shale. As indicated on a published geologic map of the site by Bonilla, 1998 (Figure 3), Quaternary slope wash and ravine fill, which has slope stability implications, is mapped in swales along the sloping terrain.

In general, the lower-lying area, where the majority of the proposed development is to be situated, is underlain by a varying combination of five geologic units consisting of (1) artificial fill, (2) young Bay Mud deposits, (3) undifferentiated sedimentary deposits, (4) Old Bay Mud deposits, and (5) Franciscan complex bedrock. Thickness of these units varies widely across the site, but generally increases towards the coastline. The historic mapping depicted on Figure 5 shows the 1903 shoreline and the current shoreline which was established by filling over the years. Based on interpolation of limited data, we estimate that a fill thickness of 0 to 25 feet and Young Bay Mud thickness of 0 to 40 feet should be anticipated in some locations at Hunters Point Shipyard. At Candlestick Point, fill, which typically ranges from about 20 to 30 feet feet below ground surface with localized pockets of fill that extends down to 70 feet below the ground surface. The fill is underlain by young Bay Mud ranging from approximately 0 to 50 feet in thickness. A contour map showing the anticipated relative elevation to bottom of these underlying geologic units and the depths to competent bedrock is provided in Figures 6 and 7. A description of each strata is discussed below. Localized areas of deeper fill may be present throughout the site.

Fill

The fill (Qaf) was placed in conjunction with the land reclamation which began in the mid-1800s. The fill generally includes a mixture of native soil and bedrock-derived material consisting of silty sand with gravels with lenses of gravel and clays. Based on review of the subsurface information provided, the material varies in density from loose to medium dense. In some locations concrete, asphalt, metal objects, and other solid waste can be found. In localized areas along the shoreline, the fill may extend to depths as great as Elevation -70 ft (CCSF) below ground surface (Figure 6). Review of historical aerial photos suggests these locations correspond with areas where historic shoreline failure may have occurred during placement of the fill. Some sand layers within the fill material may be susceptible to liquefaction when subject to cyclic loading. This will be further discussed in subsequent sections of this report.

Young Bay Mud

The majority of the project site is underlain by compressible young Bay Mud beneath the fill (Figure 6). With the exception of the western portion of the site, where shallow bedrock outcrops are present, the Bay Mud thickness generally increases towards the bay. The Bay Mud is normally consolidated to slightly overconsolidated. Post-construction settlement as a result of consolidation of Bay Mud subjected to construction loading may have long-term detrimental effects on buildings and infrastructure within the project area. Further discussion of the effects and mitigation is provided in this report.

Alluvial Soil

Stiff to hard clay referred to as Old Bay Clay typically underlies the young Bay Mud. The Old Bay Clay is interbedded with dense sand, silty sand, or gravel layers.

Slope Wash and Ravine Fill

Bonilla (1971) mapped Quaternary slope wash and ravine fill (Qsr) throughout portions of low-lying areas and swales along the slopes to the west of the project. The approximate limits of slope wash and ravine fill are shown on the Regional Geologic Map, Figure 3. Slope wash and ravine fill are materials transported by erosion from slopes and ridges that are typically deposited in swales. Slope wash and ravine fill in the study area generally consist of sandy clay and clayey sand that are dense and slightly cemented.

Landslides

The slopes at the site vary in steepness from 2:1 (horizontal:vertical) to 1:1. As documented in previous ENGEO studies of the project area, localized areas of slope instabilities are observed

within the project area. Many of these are deep-seated landslide complexes that have experienced numerous episodes of movement. Geologic Hazard mapping of the project area (Figure 4) shows that the slopes present at the site are susceptible to earthquake-induced landslides; furthermore, mapping by Bonilla shows areas within the project area to be underlain by landslide deposits. In addition, based on the observed debris at the toe of existing cut slopes, some of the steeper cut slopes, (steeper than 1½:1 horizontal:vertical), have experienced raveling and rock falls over a period of many years.

Bedrock

The site is underlain by Jurassic- and Cretaceous-age Franciscan bedrock, including greenstone, chert, sandstone, and shale, with serpentinite as the predominant rock type. Bedrock exposure can be found to the west of the project where the topographic elevation is higher. The depth from ground surface to bedrock can be over 200 feet towards the coastline (Figure 7).

Serpentinite – Extensive exposures of serpentinite bedrock (sp) are evident on existing cut slopes to the west of the Hunters Point project area as shown on the Regional Geologic Map, Figure 3. The friable to very strong bedrock varies from light green to black in color. Bedrock structure is somewhat chaotic with fractures and foliations in various orientations. Based on previous exploration performed in the area, localized zones of hard calcified bedrock ranging up to about 20 feet in diameter were observed.

Franciscan Sandstone and Shale – Franciscan sandstone and shale (KJs) are mapped at various locations on the western hills of the Candlestick Point and Hunters Point project area (Figure 3). The sandstone units are typically moderately strong to strong, moderately fractured and thickly bedded. The observed shale units are typically friable to weak, highly fractured to crushed, and thinly bedded.

Franciscan Greenstone – Franciscan greenstone (KJg) are mapped in various locations at Candlestick Point and Hunters Point. The greenstone units are typically moderately strong to strong, moderately fractured and thickly bedded.

Groundwater

The groundwater level in the lower-lying areas at Candlestick Point varies between 3 and 14 feet below ground surface, with an elevation of approximately -3 feet to -12 feet (Treadwell and Rollo, 1998). A series of groundwater monitoring wells were installed for environmental purposes within the Hunters Point development. Groundwater levels were reported to be within 3 to 21 feet below ground surface in the low-lying areas. Groundwater conditions are expected to vary depending on factors such as weather conditions, tides, time of year, and irrigation practices.

Data Gaps

Additional geotechnical borings will be needed in order to provide a site-specific mitigation program for the various geotechnical concerns and to develop recommendations for the design of deep and shallow foundations.

Seismic Hazards

The San Francisco Bay Area is a seismically active region; therefore, the site is expected to experience periodic minor earthquakes and a major earthquake on one of the nearby active faults during the service life of the structures. The major active faults in the area are the San Andreas and Hayward faults. For each segment of these faults, the distance from the site and estimated maximum moment magnitude, Mw, [Working Group on California Earthquake Probabilities (WGCEP) (2003) and Cao et al. (2003)] are summarized in the following table.

REGIONAL FAULTS AND SEISMICITY

Fault Segment	Approximate Distance from Site (km)	Direction from Site	Maximum Magnitude
North Hayward	18	East	6.9
Total Hayward	18	East	7.1
South Hayward	21	East	6.9
San Andreas - 1906 Rupture	12	West	7.9
San Andreas - Peninsula	12	West	7.1
San Andreas- North Coast South	22	West	7.6

Numerous earthquakes have been recorded in the San Francisco Bay area in the past. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista, approximately 470 kilometers in length. It had a maximum intensity of IX, a moment magnitude of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta Earthquake of 17 October 1989, centered in the Santa Cruz Mountains, which had a moment magnitude of 6.9.

In 2002, the Working Group on California Earthquake Probabilities (WGCEP 2003) at the U.S. Geologic Survey (USGS) predicted a 62 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area by the year 2031. More specific estimates of the probabilities for different faults in the Bay Area are presented in the following table.

WGCEP (2003) ESTIMATES OF 30-YEAR PROBABILITY (2002 TO 2031)
OF A MAGNITUDE 6.7 OR GREATER EARTHQUAKE

Fault	Probability (percent)
Hayward-Rodgers Creek	27
San Andreas	21

PRELIMINARY CONCLUSIONS AND CONCEPTUAL DESIGN RECOMMENDATIONS

Based on review of limited geotechnical data, it is our opinion that the proposed development is feasible from a geotechnical perspective provided that sound geotechnical engineering practices are incorporated in the design and construction of the project. Our preliminary conclusions are based on a review of the proposed development plan, which includes specific building types and other site constraints. Mitigation options and foundation systems discussed herein are not limited to the options provided below and may be subject to change based on future exploration and modification of the development plan.

Based on our review of the subsurface conditions and the proposed development, we conclude that the following measures may be required to address the geotechnical constraint at the site: (1) surcharging to pre-consolidate areas underlain by compressible young Bay Mud to mitigate post-construction settlement, (2) over-excavation and compaction of surface fills to create uniform building subgrade conditions for selected building foundations and infrastructure, (3) use of stiffened mat or grade-beam foundations, either with or without geogrid subgrade reinforcement to mitigate the effects of differential settlement, (4) pile-supported structures for areas where alternative methods of site mitigation are either not feasible or cannot achieve desired performance economically, (5) corrective grading in areas where slope stability may be an issue, (6) possibly some ground densification to mitigate localized areas susceptible to liquefaction; however, there is insufficient data to evaluate this risk at this time, and (7) stabilization of the bay shoreline and waterfront retaining structures, as needed. It is anticipated that a combination of the above mitigation solutions will be incorporated in the construction of the various building types and improvements within the proposed development. Remedial grading and foundation alternatives are discussed in detail below. A summary of the geologic conditions and remediation recommendations for each parcel is provided in Appendix A of this

report. However, various different types of grading and foundation alternatives may be appropriate for the proposed development. As such, Appendix A may be subject to modification upon completion of further subsurface exploration and geotechnical analyses.

Proposed Building Foundations

Selection of a foundation system for structures is dependent on: (1) the underlying soil and bedrocks ability to support the plan structure under both static and seismic loading conditions, (2) settlement of the foundation under building loads, and (3) aerial settlement due to filling to achieve minimum site finish grades. In areas where the Bay Mud and existing fill are absent or removed by remedial grading, shallow foundations on bedrock, compacted fill and stiff native soils will provide appropriate support to low- to mid-rise buildings. In areas that were reclaimed from the bay, structures that are supported on deep foundations that extend through the existing fill and Bay Mud will settle less than similar structures that are founded on shallow foundations above the Bay Mud. Alternately, ground improvement measures including surcharging and excavation and compaction of fill may be appropriate to mitigate settlement and allow for the use of shallow foundations for lighter structures as discussed below. As a result, the type of foundations to be used should be selected in consideration of the anticipated building load, new fill thicknesses, and the amount of tolerable settlement on a project-specific basis during final design.

Another consideration in the selection of the appropriate foundation system for new building is the potential to excavate and dispose of soil or groundwater that may contain hazardous materials. In addition, ground improvement such as surcharging or densification may temporarily raise groundwater levels, thereby influencing the movement of existing groundwater contaminant plumes. In areas where hazardous materials are suspected, it may be more cost effective to use a driven pile foundation, which generates less excavated soil than a shallow foundation and has less impact on existing contaminant plumes. Deep foundations will also

reduce potential liquefaction-related foundation movement. Selection of appropriate foundation types for specific building areas should be conduced in consultation with the environmental remediation team.

For areas of the site closer to the bay waterfront, vertical and lateral deformations due to lateral spreading movements may be anticipated. The magnitude of such movements will be highly dependent on the stability of existing shoreline slopes, waterfront dikes and, in the case on the former Hunters Point Shipyard, on the stability of existing bulkheads and other waterfront retaining structures. Due to the potential for shoreline and bulkhead deformation, buildings adjacent to the shoreline should be supported on deep foundations. Mitigation may include a combination of reinforcing the existing shoreline retaining structures and/or locating improvements a sufficient distance away from the shoreline so that they will not be impacted should lateral spreading occur.

Where Bay mud thicknesses are greater than about 10 feet and where more than a few feet of new fill will be placed to attain new minimum site grades, it is our opinion most future structures that are three stories or more in height should be supported on deep pile foundations that extend through the Bay Mud and derive their support capacity by skin friction in the underlying stiff soils or by end bearing in bedrock. Low-rise buildings can likely be constructed on shallow mat foundations in areas of relatively uniform Bay Mud thickness provided that: (1) settlement due to areal filling is mitigated by surcharging prior to building construction and, (2) the upper portion of the existing fill is recompacted and reinforced with geogrid to created a uniform fill pad which is capable of distributing and attenuating long-term differential settlements.

Foundation alternatives for the different areas within the project are depicted on Figure 8 and summarized in the following table. These options may be subject to change based on data collected from future exploration. A summary of foundation alternatives and proposed geotechnical mitigation methods organized by subparcel area is provided in Appendix A.

AREA	TYPICAL SUBSURFACE CONDITIONS	PLANNED DEVELOPMENT TYPE	OTHER CONSIDERATIONS	SETTLEMENT MITIGATION AND FOUNDATION ALTERNATIVES
Candlestick Point	Existing Hillside, Shallow soil over bedrock, local fill associated with existing improvements	Low-rise residential	Hillside slope stability	Remedial grading to remove and compact exiting fill. Buildings on spread footings supported on compacted fill or bedrock.
Candlestick Point	Transitional area from fill over bedrock to Fill over shallow Bay Mud	Low-rise residential and mixed mid-rise residential and commercial	Surcharge with or without wicks to mitigate aerial settlement effects on foundations and infrastructure	Remedial grading to remove and compact exiting fill. Buildings utilize spread footings supported on compacted fill or bedrock. Heavier buildings on piles.
Candlestick Point	Fill over 5 to 40 feet of Bay Mud	Mid-rise residential and commercial	Need to consider effects of existing stadium foundations	Pile foundations.
Candlestick Point	Fill over 10 to 50 feet of Bay Mud	Mixed low-rise, mid-rise and high-rise residential	Surcharging with or without wicks to mitigate aerial settlement effects on infrastructure and pile downdrag	Low rise utilize mat foundations on geogrid-reinforced fill; mid-rise to high-rise supported on piles.
Candlestick Point	Fill over 10 to 60 feet of Bay Mud	Low-rise residential	Surcharge with or without wicks to mitigate aerial settlement effects on foundations and infrastructure	Low-rise utilize mat foundations on geogrid-reinforced fill, or densified soil.
Hunters Point	Fill over thin Bay mud	Low-rise residential	Excavation and ground improvement possibly limited by environmental contamination concerns	Low-rise on mat foundations on geogrid-reinforced fill, or pile foundations if excavation and ground improvement are restricted.
Hunters Point	Shallow soil over bedrock	Commercial and Research/ Development	Possible environmental contamination concerns	Spread footings on bedrock or compacted fill, possible piles where excavation is restricted
Hunter Point	Fill over thin Bay Mud near shoreline	Low-rise residential , Commercial and Research/ Development	Possible environmental contamination concerns, close proximity to waterfront bulkheads and walls with unknown integrity	Pile foundations, upgrade of waterfront retention

Proposed Bridge Infrastructure Foundations

The location of the proposed Yosemite Slough Bridge alignment is underlain by artificial fill and compressible Young Bay Mud of variable thicknesses. To support the loading conditions of the bridge that spans over the slough, it is anticipated that the bents and abutments be supported on pile foundation deriving support from subsurface material below the Bay Mud. In addition, to minimize the affects of settlement due to new fill loads associated with the road and bridge embankments, ground improvement measures may include surcharging and excavation and compaction of undocumented fills along the alignment. Additionally, soil cement mixed columns or light weight fill may be used at the abutment embankments to mitigate settlement.

Liquefaction

The project site is identified in a zone of high liquefaction risk by the State of California Geologic Survey as shown on Figure 4. Liquefaction occurs when loose to medium-dense, coarse-grained deposits and in some cases fine-grained deposits with low plasticity undergo cyclic loading during a seismic event, causing an increase in pore pressure and a resulting loss of shear strength.

Isolated layers of relatively clean loose sand within the existing fill and some sand layers within the Bay deposits are potentially susceptible to liquefaction and settlement during moderate to large earthquakes. Without ground improvement, these materials may be susceptible to sand boils, fissuring and settlement, resulting in the differential settlement of buildings and improvements (including underground utilities) that achieve bearing on/in these materials. Based on the limited existing data, it appears that settlement of up to 3 to 6 inches may be anticipated as a result of liquefaction of the loose sandy soils within the development areas of the Hunters Point Phase II and Candlestick Point. Differential settlement over a typical building footprint may be on the order of half the total settlement. Mitigation is possible using a variety

of options including use of stiffened mat foundations that are designed to span localized zones of differential settlement or possibly by the use of ground improvement to densify susceptible soils beneath shallow foundations. Ground improvement, if required, may include Deep Dynamic Compaction (DDC) or other methods, as appropriate. Other types of ground improvement systems such as, stone columns, vibro-compaction, and ram aggregate piers may also be considered to mitigate susceptibility of structures to liquefaction. Alternatively, structures can derive support on material below the liquefiable material by the use of deep foundations. The need for and scope of liquefaction mitigation should be determined following subsequent investigation and in consultation with the environmental remediation team.

Hillside Stability

Based on geological mapping at a regional scale conducted by Bonilla, there are no mapped landslides within the project boundaries (Figure 3). However, based on our experience at an adjacent development, the slopes in the area are susceptible to deep-seated landsliding. In order to create buildable area for proposed buildings and streets, slopes on the site will be modified during site grading. The grading of proposed cut slopes could create instabilities that do not presently exist on site. In addition, earthquake-induced landsliding may occur as indicated on the USGS Geologic Hazards Map (Figure 4). To evaluate the impact of potentially unstable slopes to the proposed development, additional field mapping should be performed to gather information on the extent of the potential landslide areas. Site exploration to acquire strength characteristics may be necessary to facility slope stability analysis during future design phase studies.

- Corrective grading measures which include removal and recompaction, keying and benching engineered fill into competent materials, and installation of subdrainage.
- Appropriate site planning allowing for setbacks from possible slide areas.
- Construction of soil nail walls and rock bolting in susceptible areas.

- Construction of rockfall catch fences, rockfall mesh netting, or deflection walls.

Areas of seepage should be mitigated with appropriate subdrainage. Where complete removal and replacement of unstable slope materials are planned, the excavations should be observed by a Certified Engineering Geologist to verify removal of disturbed materials. Keyways, subexcavated benches, and locations of subdrainage should be designed in the field based on the slide plane depth and geometry. In general, graded slopes should be constructed at inclinations not exceeding 3:1 (horizontal to vertical). Slopes over 30 feet in height should be designed with intermediate surface terraces and lined v-ditches to control drainage.

Shoreline Stability

The existing shoreline consists of variable fill overlying relatively weak Bay Mud. Failures along various locations of the shoreline were observed during a recent site visit. In many areas there does not appear to be any engineered fill containment structure such as a perimeter dike. It appears that fill was progressively end-dumped or pushed with dozers over the bay deposits. This filling method has likely resulted in statically stable slopes with low factors of safety. Typical of similar fill conditions in the Bay, these bay front slopes will likely be subject to lateral deformation and subsidence during strong earthquake shaking. In many areas, the proposed structures are set back significantly from the bay shore; hence, the risk of significant movements effecting new pile-supported buildings located near the shoreline is low. However, specific geotechnical studies are required to evaluate shoreline stability and assess appropriate setbacks for improvements. Infrastructure and other facilities located along the shoreline will be subject to movement and resulting damage during a large earthquake. Where such movement is considered unacceptable, shoreline stabilization measures may be required.

There are numerous waterfront bulkheads and other retaining structures within the former Hunters Point Shipyard. Some of these structures suffered damage during the 1989 Loma Prieta

Earthquake. It is likely that analysis of the existing shoreline structures will indicate that they are susceptible to damage during future large earthquakes. The stability of the waterfront should be evaluated as part of ongoing geotechnical studies.

Consolidation Settlement of Young Bay Mud

Given the site history, we judge that primary consolidation settlement of the Young Bay Mud under the existing fill loads is essentially complete. Additional fill and/or building loads will result in a new sequence of consolidation settlements that will continue over a period of many years. These consolidation settlements can be mitigated by preloading or surcharging selected development areas. When properly implemented, the surcharge load will cause site settlement to occur prior to building and/or infrastructure construction. Prefabricated wick drains, installed prior to placement of the surcharge fill can be used to facilitate lateral drainage of the young Bay Mud, thereby accelerating the consolidation and decreasing the time required to complete the surcharge program.

Foundations and structures may be designed by the Structural Engineer to accommodate some additional movement as a result of long-term consolidation settlement. For these cases, it may be appropriate to increase surface grades to compensate for anticipated settlements. Similarly, it may be practical to increase design inverts for planned gravity utilities to accommodate potential settlements and maintain positive flow gradients.

Bedrock Rippability and Suitability

Based on field observations at the neighboring project and our experience in the area, it is our opinion in general bedrock should be rippable with conventional heavy construction equipment (such as a Caterpillar D-9). Localized well-cemented beds may be encountered that will require more ripping or rock-breaking effort. Trenching for utilities should be possible with

conventional equipment. As noted above, localized well-cemented beds may be encountered that may necessitate use of heavy equipment. If significant areas of hard rock are encountered, rock blasting should be considered as an economical means of improving efficiency of excavation subject to the approval by the San Francisco Department of Public Health.

In general, soil and bedrock materials observed on the site appear suitable for use as engineered fill if properly processed.

Future Geotechnical Studies

As the project proceeds into subsequent phases of development, additional geotechnical studies will be necessary. These studies will include but are not limited to:

1. Preparation of preliminary geotechnical exploration reports. These reports will include an evaluation of:

    a. Physical properties of the typical soil material encountered in the subject area.

    b. Seismic considerations from nearby faults and current CBC seismic design criteria including determination of the Site Class and preparation of a site-specific seismic response analysis, an appropriate.

    c. Discussion of geotechnical constraints such as, compressible, expansive and/or liquefiable soils.

    d. Discussion of ground improvement alternatives (such as surcharging, densification, etc.) to mitigate geotechnical constraints including preliminary cost estimates, as appropriate.

    e. Preliminary fill compaction recommendations and drainage considerations for estimating purposes.

    f. Preliminary analysis of foundation type(s) for the proposed development including preliminary design criteria for project estimating purposes.

g. Preliminary assessment of shoreline stability.

h. Recommendations for further design-level studies.

As land planning progresses into development of a detailed layout, refining geotechnical/geological information by obtaining additional subsurface information will be essential to keep the planning process moving forward and identify impacts and mitigation measures associated with the grading layouts. Additional services will include but are not limited to:

- Preparation of detailed corrective grading and site improvement plans.
- Development of erosion control and storm water pollution prevention plans.
- Preparation or review of construction and permanent dewatering system designs.
- A review of final construction plans and specifications, including grading plans, foundation plans and calculations for conformance with the design level recommendations.
- Geotechnical observation and testing services during construction.
- Special inspection and materials testing services during construction.

These studies are important in expediting approval by governing agencies and achieving cost-effective construction.

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LIST OF FIGURES

EXPLANATION

- APPROXIMATE LIMITS OF HUNTERS POINT SHIPYARD PHASE II
- APPROXIMATE LIMITS OF CANDLESTICK POINT
- APPROXIMATE LIMITS OF YOSEMITE SLOUGH RESTORATION AREA

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: MS STREETS AND TRIPS

ENGEO Expect Excellence

VICINITY MAP

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO. 1
DATE: MAY 2009		
DRAWN BY: RJS	CHECKED BY: DB	

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ORIGINAL FIGURE PRINTED IN COLOR

EXPLANATION

4 PROPOSED CUT (IN FEET)

2 PROPOSED FILL (IN FEET)

APPROXIMATE LIMITS OF PARCEL BOUNDARY

N

0 FEET 1000

0 METERS 500

BASE MAP SOURCE: IBI GROUP, 2009

ENGEO Expect Excellence

PROPOSED DEVELOPMENT PLAN WITH CUT & FILL DEPTHS

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE 2

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001

DATE: MAY 2009

DRAWN BY: LC CHECKED BY: BHJ

FIGURE NO 2

ORIGINAL FIGURE PRINTED IN COLOR

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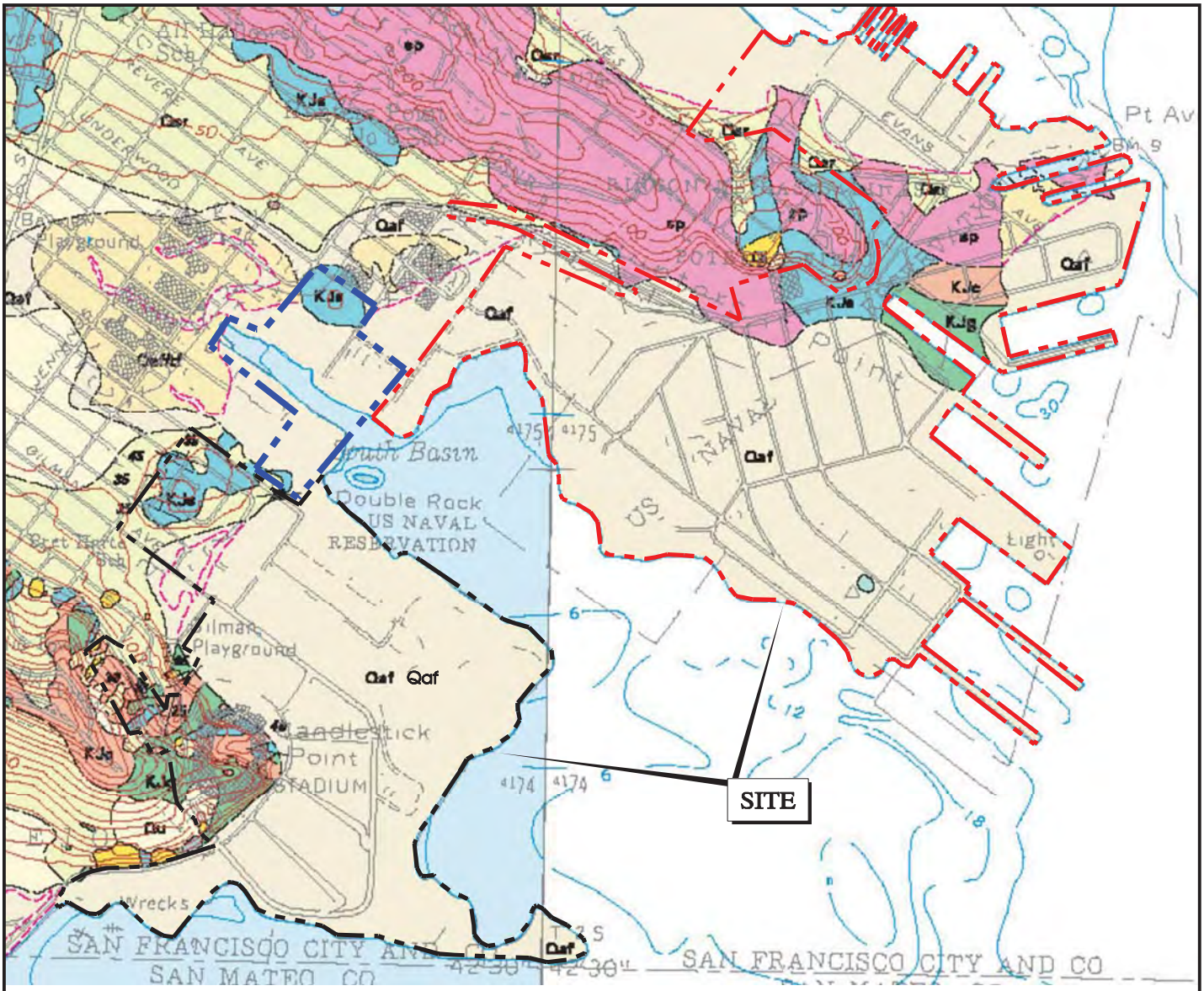

EXPLANATION

Qaf	ARTIFICIAL FILL
Qaf/tf	ARTIFICIAL FILL OVER TIDAL FLAT
Qsr	SLOPE DEBRIS AND RAVINE FILL
Qu	SEDIMENTARY DEPOSITS, UNDIFFERENTIATED
KJs	SANDSTONE AND SHALE
KJc	CHERT
KJg	GREENSTONE
sp	SERPENTINE
———	CONTACT, CERTAIN
— — —	CONTACT, APPROXIMATELY LOCATED

N

0 FEET 1500

0 METERS 750

BASE MAP SOURCE: BONILLA, 1998

ENGEO Expect Excellence

REGIONAL GEOLOGIC MAP

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO. 3
DATE: MAY 2009		
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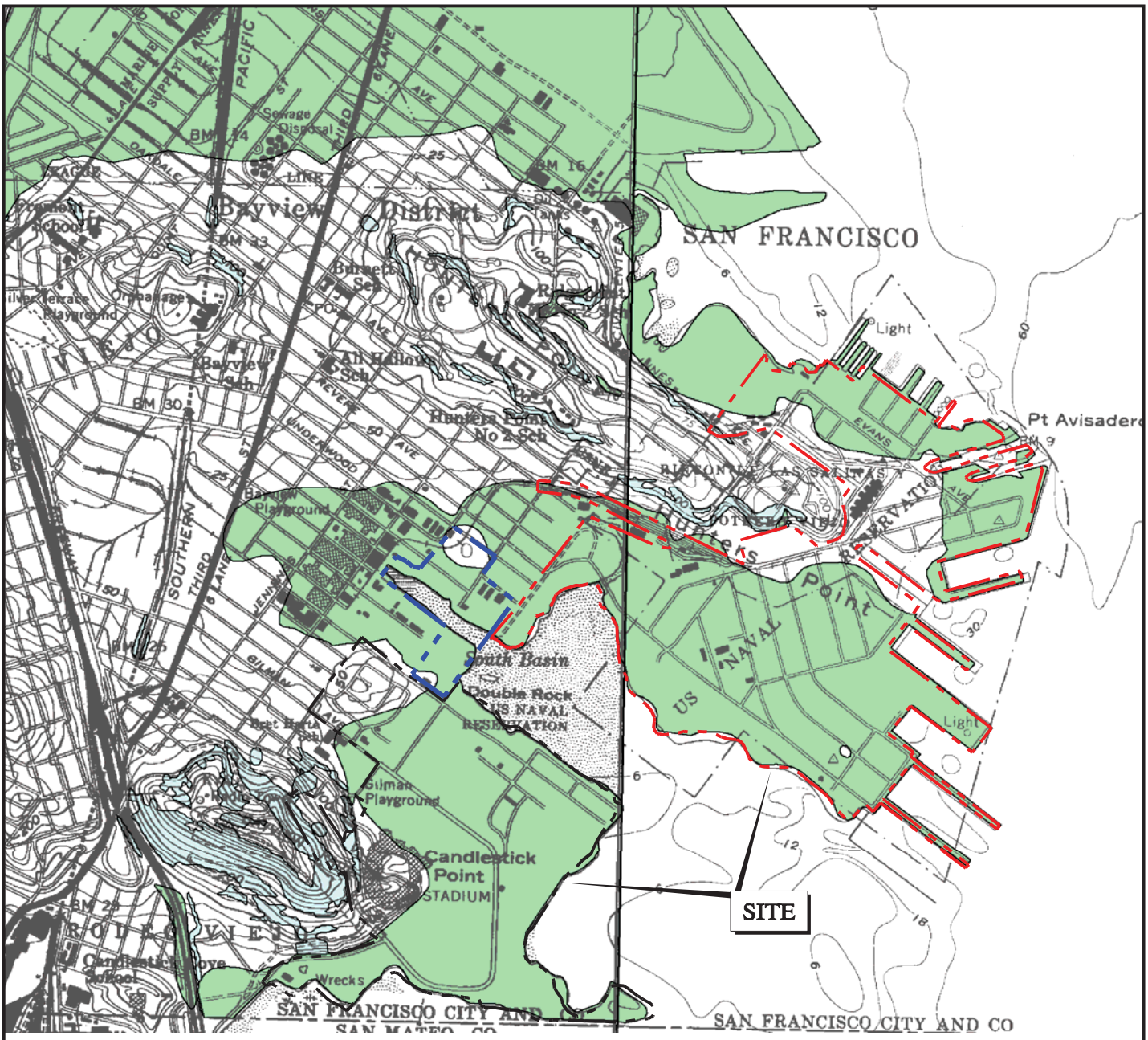

EXPLANATION

Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides

Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: DAVIS, 2001

ENGEO Expect Excellence

GEOLOGIC HAZARD MAP

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO. 4
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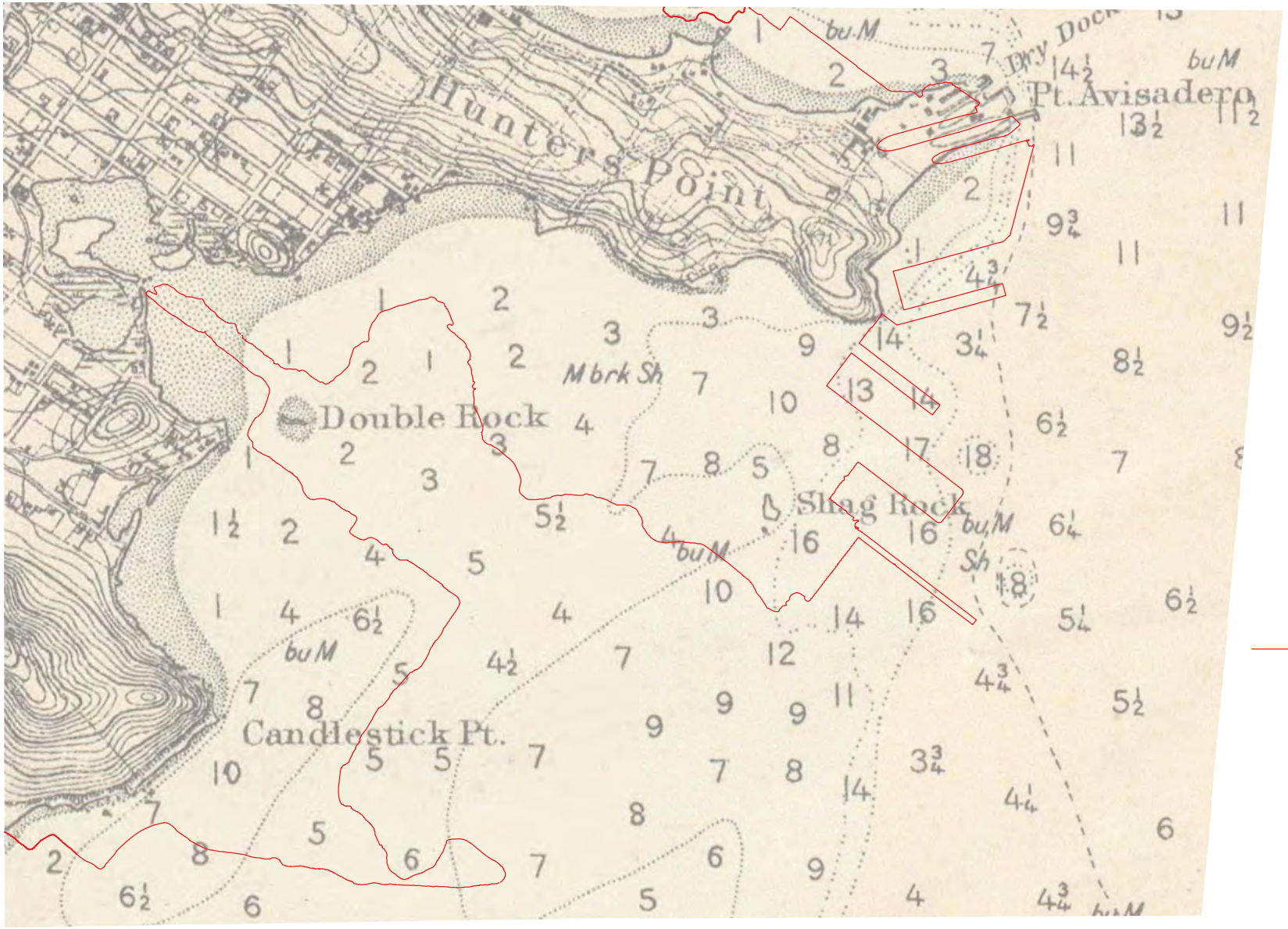

EXPLANATION

6 ORIGINAL WATER DEPTHS(IN FATHOMS)
1 FATHOM = 6 FEET

APPROXIMATE LIMIT OF EXISTING SHORELINE

N

0 FEET 1000
0 METERS 500

BASE MAP SOURCE: US COAST AND GEODETIC SURVEY, 1903

ENGEO Expect Excellence

HISTORIC MAPPING WITH EXISTING SHORELINE
CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO. 5
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EXPLANATION

- SHORELINE FROM 1903 MAPPING
- INTERTIDAL LIMIT FROM 1903 MAPPING
- -70 CONTOURS ON THE BASE OF BAY FILL DEPOSITS*
- -80 CONTOURS ON THE BASE OF THE YOUNGER BAY MUD*
- APPROXIMATE AREA OF RECLAIMED LAND
- ONSHORE AREAS, 1903
- INTERTIDAL ZONE, 1903

*ELEVATIONS BASED ON CCSF (CITY AND COUNTY OF SAN FRANCISCO DATUM)

N

0 FEET 1000

0 METERS 500

BASE MAP SOURCE: IBI GROUP

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CONTOUR OF BASE OF FILL AND BASE OF YOUNG BAY MUD

CANDLESTICK POINT AND HUNTERSPOINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.:	7730.000.001
DATE:	MAY 2009
DRAWN BY: LC	CHECKED BY: DB

FIGURE NO. 6

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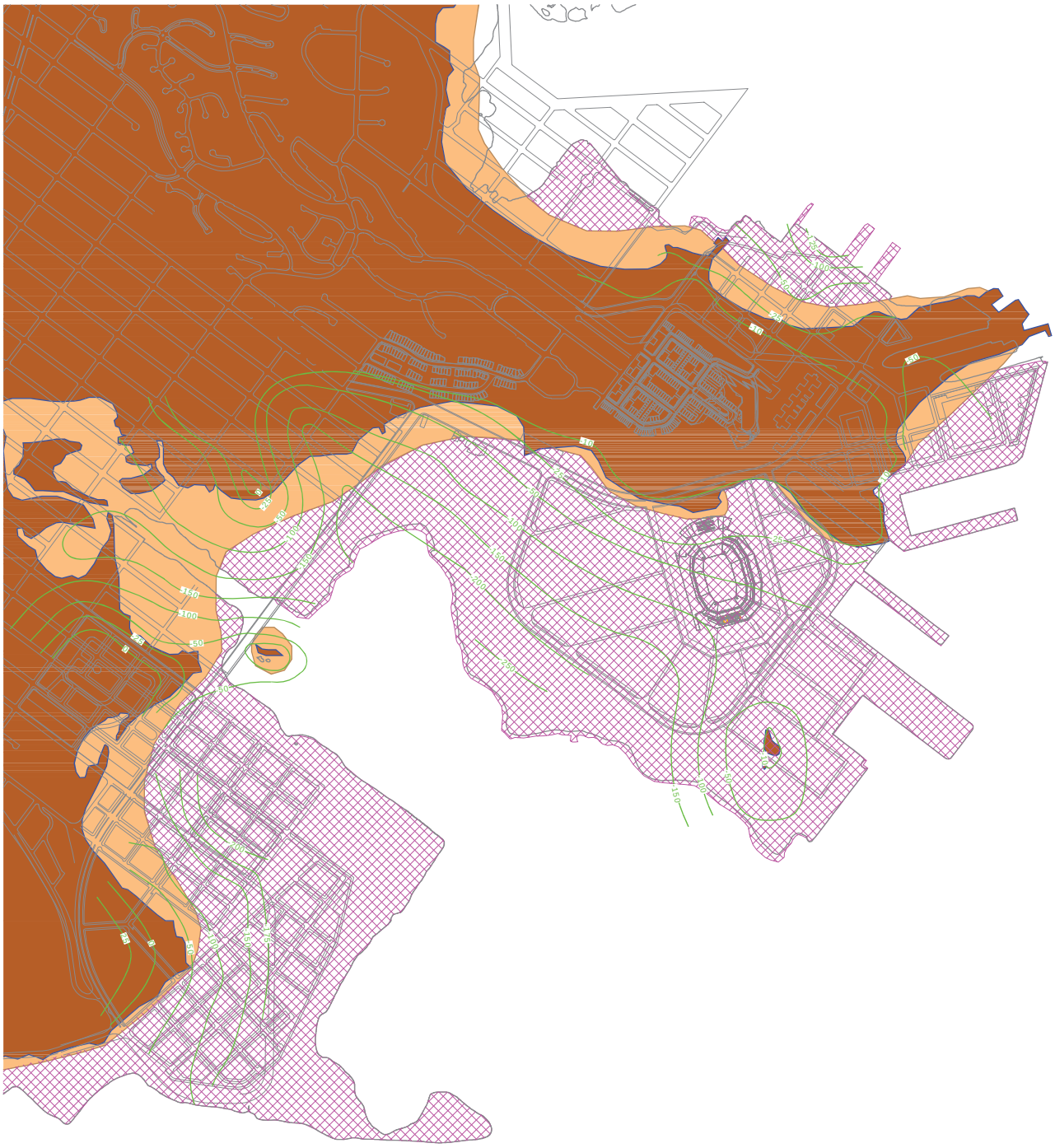

EXPLANATION

- SHORELINE FROM 1903 MAPPING
- INTERTIDAL LIMIT FROM 1903 MAPPING
- -70 BEDROCK CONTOUR*
- APPROXIMATE LIMITS OF EXISTING SHORELINE
- APPROXIMATE AREA OF RECLAIMED LAND
- ONSHORE AREAS, 1903
- INTERTIDAL ZONE, 1903

N

0 FEET 1000

0 METERS 500

*ELEVATIONS BASED ON CCSF (CITY AND COUNTY OF SAN FRANCISCO DATUM)

BASE MAP SOURCE: IBI GROUPS

ENGEO Expect Excellence

BEDROCK CONTOUR MAP

CANDLESTICK AND HUNTERS POINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001

DATE: MAY 2009

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FIGURE NO. 7

ORIGINAL FIGURE PRINTED IN COLOR

EXPLANATION

- BUILDINGS ON PILE FOUNDATIONS AND REMEDIAL GRADING
- LOW RISE BUILDINGS ON GEOGRID REINFORCED FILL, MAT FOUNDATIONS AND SOIL IMPROVEMENT. MID AND HIGH RISE BUILDINGS ON PILE FOUNDATIONS
- TRANSITIONAL AREA - REMEDIAL GRADING TO REMOVE AND COMPACT FILL. BUILDINGS ON SHALLOW FOUNDATIONS SUPPORTED ON COMPACTED FILL OR BEDROCK. HEAVIER BUILDINGS ON PILES
- BUILDINGS WITH PROPOSED SHALLOW FOUNDATIONS ON BEDROCK OR SHALLOW ENGINEERED FILL
- MAJOR UTILITIES REQUIRED TO BE DESIGN FOR ON-GOING SETTLEMENT

N

0 FEET 1000

0 METERS 500

BASE MAP SOURCE: IBI GROUP, 2009

ENGEO Expect Excellence

PRELIMINARY SITE MITIGATION AND FOUNDATION TYPES

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE 2

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO 8
DATE: MAY 2009		
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APPENDIX 1

Conceptual Geotechnical Design Summary

EXPLANATION

APPROXIMATE LIMITS OF GEOTECHNICAL SITE MITIGATION AND FOUNDATION OPTION PARCEL

N

0 FEET 1000

0 METERS 500

BASE MAP SOURCE: IBI GROUP, 2009

ENGEO Expect Excellence

CONCEPTUAL GEOTECHNICAL DESIGN PLAN

CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II

SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001		FIGURE NO. 1
DATE: MAY 2009		
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Parcel	L_1
Area	Building Area 43.7 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +5 to -5 ft (CCSF) Final grades vary from +2.5 to +5.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 30 ft to up to 70 feet. Bottom of Artificial Fill ranges from Elevation -30 ft to up to -70 (CCSF) ft in some isolated locations • Thickness of Young Bay Mud ranges from 10 ft to up to 60 feet. Bottom of Young Bay Mud ranges from Elevation -20 ft to -80 ft (CCSF) • Bedrock located at Elevation -70 ft to -220 ft (CCSF) • Groundwater Elevation between -6 ft to -9 ft (CCSF)
Proposed Development Type	Low-rise residential with ½ basement (5 ft deep) parking level. Anticipated 3 to 4 stories in building height. One high-rise building is anticipated to be located in block L6A with height of up to 38 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Surcharging to mitigate bay mud settlement due to new fill loads associated with proposed grades.
Expected Utilities Performance	• Surcharging will mitigate majority of long-term settlement and some secondary settlement • Minor settlement due to liquefaction and on-going long-term settlement may be expected • Some differential settlement of utilities between pile supported structure and external utilities may be expected • Flexible utilities connection for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Surcharging may be employed to mitigate bay mud settlement due to new building loads, design grade and secondary compression. For a duration of one year, assume surcharge of 5 ft above final grade in areas of cut and 15 ft above final grade in areas receiving fill The structures may either be supported on mat foundation underlain by over-excavated and recompacted existing fill for uniform support or on pile foundations. Foundation type will depend on surcharge effectiveness, bay mud thickness, and building loads. Assume a minimum overexcavation of 5 feet below basement slab. Building pad area utilizing shallow foundations may require reinforcement with 2 layers of geogrid. Remedial grading within building pad areas will be performed on a pad-by-pad basis and conducted during vertical construction. High-rise towers will be supported on deep foundations founded on competent material. Depth of foundation should be determined during design-level study.
Expected Geotechnical Performance	• Structures supported on mat foundations underlain by a layer of reinforced recompacted fill will experience acceptable amount of total and differential settlement due to on going bay mud consolidation, secondary compression and small amounts of possible seismic settlement. • Settlement of pile supported structures is not anticipated.
Other Considerations	• Previous exploration data shows concrete rubble maybe present within the artificial fill material. This rubble may need to be crushed on-site during grading operation if encountered within building envelopes. • Due to presences of shallow groundwater level, subgrade stabilization maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, bridging).

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	L_2
Area	Building Area 2.9 acres (90% building pad; 10% streets and parks)
Grades	Existing grades vary from -2 ft to +6 ft (CCSF) Final grades vary from +3.5 ft to +5.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 20 ft to up to 40 feet. Bottom of Artificial Fill ranges from Elevation -20 ft to -40 ft (CCSF); • Thickness of Young Bay Mud can be up to 10 feet. Bottom of Young Bay Mud ranges from Elevation -20 ft to -40 ft (CCSF); • Bedrock located at Elevation -30 ft to -70 ft (CCSF); • Groundwater Elevation between -6 ft to -7ft (CCSF)
Proposed Development Type	Mid-rise mix-use structures constructed on-grade. Anticipated 6 to 12 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial grading is anticipated.
Expected Utilities Performance	• Settlement will occur rapidly. Post-construction settlement minimal. • Flexible utilities connection required
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures can be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	• Settlement of pile supported structures is not anticipated • Some differential settlement between structures and external utilities may be expected.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	K_1
Area	Building Area 7.5 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +4 ft to +50 ft (CCSF) Final grades vary from +5 ft to +25 ft (CCSF)
Soil and Groundwater Condition	Majority of the parcel underlain by Bedrock located at Elevation +10 ft to the northeast to +50 ft to the southwest (CCSF); Groundwater not anticipated.
Proposed Development Type	Mid-rise commercial structures constructed on-grade. Anticipated building heights are 2 to 6 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is expected.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Structures may be supported on mat or spread footing foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Slope stability along steep slopes may require corrective grading or implementation of slope protection systems
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	K_2
Area	Building Area 15 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from +1 to +25 ft (CCSF) Final grades vary from +3 to +18 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 40 feet. Bottom of Artificial Fill extends to Elevation -40 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends to Elevation -55 ft (CCSF); • Bedrock located at Elevation 0 ft to -100 ft (CCSF); • Groundwater Elevation between -6 ft to -8 ft (CCSF)
Development Type	Mid-rise commercial structures constructed on-grade. Anticipated 6 to 12 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between pile supported structures and external utilities. • Settlement will occur rapidly. Post-construction settlement minimal.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• This is a transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Proposed development may require modification of current slope configuration. Depending on the proposed grading, slope rebuilt with buttress or stabilization via retaining structures may be needed.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill) • Settlement of pile supported structures is not anticipated
Other Considerations	Rippability of bedrock may require heavy equipment or blasting. In location currently occupied by the existing stadium, overexcavation maybe required to completely remove foundation elements.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	J
Area	Building Area 4 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +113 ft to +150 ft (CCSF) Final grades vary from +100 ft to +135 ft (CCSF)
Soil and Groundwater Condition	Majority of the parcel underlain by Bedrock located at Elevation +100 ft to the northeast to +150 ft to the southwest (CCSF); Groundwater not anticipated.
Proposed Development Type	Mid-rise residential structures constructed on-grade. Anticipated building heights are 6 to 18 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is expected.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Structures may be supported on mat or spread footing foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Slope stability along steep slopes may require corrective grading or implementation of slope protection systems
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Rippability of rock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	H
Area	Building Area 56 acres (60% building pad; 40% streets and parks)
Grades	Existing grades vary from -5 ft to +7 ft (CCSF) Final grades vary from +3 ft to +5.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 20 ft to up to 40 feet. Bottom of Artificial Fill ranges from Elevation -20 ft to -40 ft (CCSF); • Thickness of Young Bay Mud ranges from 10 ft to up to 50 feet. Bottom of Bay Mud ranges from Elevation -15 ft to -70 ft (CCSF); • Bedrock located at Elevation -50 ft to -220 ft (CCSF); • Groundwater Elevation between -6 ft to -9 ft (CCSF)
Proposed Development Type	Low-rise residential structures with basement parking level (10ft deep). Anticipated 3 to 4 stories in building height. Mid-rise and High-rise towers on podium with basement (10ft deep). Anticipated 6 to 12 stories in height for mid-rise buildings and up to 38 stories in height for high-rise towers. Basement under full blocks. Fill required locally within street footprint.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	• In general no remedial measures are required for infrastructure and utilities • May consider some surcharging or placement of lightweight fill in local deep mud areas where 3 or more feet of new fill is proposed
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Accommodate utility and infrastructure settlement in as-built design grades • Some differential settlement between structure supported on pile foundation and external utilities • Flexible utility connections may be required • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• In general no remedial measures are required for structures • Structures will be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Structures will be supported on pile foundations. Settlement of the structures is not anticipated. Some differential settlement between structure and external utilities may be expected
Other Considerations	• Previous exploration data shows concrete rubble maybe present within the artificial fill material. Rubble may need to be crushed on-site or off-hauled during grading operation if encountered within building envelopes. • Due to presences of shallow groundwater level, subgrade stabilization maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, bridging).

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	G_1
Area	Building Area 11.6 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +0 to +15 ft (CCSF) Final grades vary from +5 to +16 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 20 feet. Bottom of Artificial Fill ranges from Elevation -10 to -20 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); • Bedrock located at Elevation -25 ft to -50 ft (CCSF); • Groundwater Elevation between -6 to -7 ft (CCSF)
Proposed Development Type	Low-rise residential structures constructed on-grade. Anticipated 3 to 4 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between structures and external utilities is expected • Settlement will occur rapidly. Post-construction settlement minimal. • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	This is a transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Existing pile supported utility requires special consideration. Civil designers should consider minimizing fill proposed in proximity of existing utility. • Reconditioning of bay mud required for reuse. • Rippability of rock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	G_2
Area	Building Area 25.6 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +10 to the east and +45 ft to the west(CCSF) Final grades vary from +16 to the east and +45 ft to the west (CCSF)
Soil and Groundwater Condition	• Majority of site consists of thin fill over bedrock. Lower portion of site consists of Artificial Fill underlain by Young Bay Mud over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF)Minimal Bay Mud up to 5 feet thick is expected Bedrock located at Elevation +45 ft to -10 ft (CCSF)
Proposed Development Type	Low-rise residential structures constructed on-grade. Anticipated 3 to 4 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	Minimal infrastructure settlement
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures may be supported on spread footing or mat foundations on compacted fill. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform building material (i.e. recompacted engineered fill)
Other Considerations	Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_1
Area	Building Area 36 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from 0 to +5 ft (CCSF) over majority of the site; increases to 35 ft (CCSF) along the southwestern boundary. Final grades vary from +3.5 to +7.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 5 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); • Bedrock located at Elevation 0 to -50 ft (CCSF) • Groundwater Elevation between -3 to -7 ft (CCSF)
Proposed Development Type	Low-rise and mid-rise residential and mid-rise mix-use structures constructed on-grade. Anticipated 3 to 4 stories for low-rise and 6 to 8 stories for mid-rise.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Some differential settlement between structure on piles and external utilities may be expected • Flexible utility connections required • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Low-rise structures can be supported on mat. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase. • Mid-rise structures can be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study. • Proposed development may require modification of current slope configuration. Depending on the proposed grading, slope rebuilt with buttress or stabilization via retaining structures may be needed.
Expected Geotechnical Performance	• Structure on mat foundation will experience acceptable amount of total and differential settlement due to on-going bay mud consolidation, secondary compression and small amounts of possible seismic settlement. • Settlement of the structure supported on pile foundation is not anticipated.
Other Considerations	• Due to environmental constraints, overexcavation in this area may not be feasible. Consider pile foundation as an alternative to overexcavation • Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_2
Area	Building Area 8 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +2.0 to +3.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends to Elevation -30 ft (CCSF); • Bedrock located at Elevation of -25 to -100 ft (CCSF); • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Low-rise and one high-rise building at the east corner constructed on-grade. Anticipated 3 to 4 stories for low-rise and 20 to 60 stories for high-rise.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Some differential settlement between structure and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures will be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Settlement of the structure is not anticipated.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_3
Area	Building Area 11 acres (100% streets and parks)
Grades	Existing grades vary from +1.5 to +20 ft (CCSF) Final grades will be result of minor cut and fill to achieve drainage
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 20 feet. Bottom of Artificial Fill extends to Elevation -20 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); Bedrock located at Elevation of 0 to -50 ft (CCSF) Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Openspace and supporting facilities constructed on-grade.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Expect minor settlement due to on-going long term settlement from design fill load, liquefaction, secondary compression, and small amounts of possible seismic settlement. • Flexible utility connections required.
Probable Remedial Grading Related to Foundation/Vertical Construction*	No structures are planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	RAD impact area may restrict construction activities

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	C_1
Area	Building Area 13.6 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +1.5 to +4.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -10 ft (CCSF); • Bedrock located at Elevation ranging from 0 to -15 ft (CCSF); • Groundwater Elevation between -1 to -9ft (CCSF)
Proposed Development Type	Mid-rise commercial structures constructed on-grade approximately 6 to 8 stories in height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between structures and external utilities is expected. • Settlement will occur rapidly. Post-construction settlement minimal. • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	This is a highly transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems. • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Due to presences of shallow groundwater level, subgrade stability maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, shoring). • Environmental impacted zones located within this area. Environmental remediation of subsurface soils maybe required or alternatively buildings may be founded on deep foundations to avoid soil disturbance. • Reconditioning of bay mud required for reuse.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	C_2
Area	Building Area 25.8 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from -1 to +2 ft (CCSF) Final grades vary from 0 to +2.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 20 feet. Bottom of Artificial Fill extends to Elevation -20 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends beyond Elevation -20 ft (CCSF); • Bedrock located at Elevation ranging from -15 to -60 ft (CCSF) • Groundwater Elevation between -6 to -10 ft (CCSF)
Proposed Development Type	Mid-rise commercial structures constructed on-grade approximately 6 to 8 stories in height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Settlement in areas of new fill will occur rapidly. Post-construction settlement minimal • Some differential settlement between structure and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures may be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Settlement of the structure is not anticipated.
Other Considerations	Environmental impacted zones located within this area, environmental remediation of subsurface soils maybe required or alternatively buildings may be founded on deep foundations to avoid soil disturbance.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	49 Stadium
Area	Building Area 33 acres (100% stadium)
Grades	Existing grades vary from -2.5 to +1.5 ft (CCSF) Final grades vary from +3.5 to +7.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 30 feet. Bottom of Artificial Fill ranges from Elevation -10 to -30 ft (CCSF); • Thickness of Young Bay Mud up to 30 feet. Bottom of Bay Mud ranges from Elevation -30 to -50 ft (CCSF); • Bedrock located at Elevations of -15 to -125 ft (CCSF) • Groundwater Elevation between -5 to -10 ft (CCSF)
Proposed Development Type	Professional level sport facility with playing field.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Some differential settlement between stadium on piles and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Foundation design and criteria to be provide by others. Assume structure and playing field supported on deep foundations.
Expected Geotechnical Performance	Settlement on the orders of 6 inches is anticipated due to new design fill loads. This amount of settlement should be accounted for when selecting construction grades.
Other Considerations	• For purpose of construction estimate, assume stadium graded as relatively level building pad suitable to support temporary construction equipment and drain surface water. • Site grade needs to be adjusted to compensate for long-term settlement.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	**49 Parking**
Area	Building Area 87 acres (100% streets and parking)
Grades	Existing grades vary from 0 to +3.0 ft (CCSF) Final grades vary from +2.0 to +9.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 50 feet. Bottom of Artificial Fill ranges from Elevation -10 to -50 ft (CCSF); • Thickness of Bay Mud ranges up to 40 feet. Bottom of Bay Mud extends to elevation -55 ft (CCSF); • Bedrock located at Elevation of -20 ft to -200 ft (CCSF) • Groundwater Elevation between -5 to -10 ft (CCSF)
Proposed Development Type	Turf and/or permeable pavement area for stadium parking with dual-use recreational and sports fields.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Flexible utilities connection may be required for external utilities that enter stadium from transition area • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial measures are required for the parking area.
Expected Geotechnical Performance	Settlement on the order of 8 inches is anticipated due to new design fill loads. This amount of settlement should be accounted for when selecting construction grades.
Other Considerations	• For purpose of construction estimate, assume parking area graded at relatively level building pad suitable to support temporary construction equipment and drain surface water. • Site grade needs to be adjusted to compensate for long-term settlement.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	UC_1
Area	Building Area 6 acres (100% streets)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +5.0 to +10.0 ft (CCSF)
Soil and Groundwater Condition	• Thickness of Artificial Fill up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Bedrock located at Elevation of -10 to -30 ft (CCSF) • Groundwater Elevation between -10 to -15 ft (CCSF)
Proposed Development Type	Utility Corridor
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Flexible utilities connection may be required for external utilities that transition to any pile supported structures
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	No other considerations

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	UC_2
Area	Building Area 7 acres (100% streets and parks)
Grades	Existing grades vary from 0 to +50 ft (CCSF) Final grades vary from +5.0 to +50 ft (CCSF)
Soil and Groundwater Condition	• Thickness of Artificial Fill may range up to 5 feet. Bottom of Artificial Fill extends to Elevation -5 ft (CCSF) • Bedrock located at Elevation of at least 0 to +50 ft (CCSF) • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Utility Corridor
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is anticipated
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	• Rippability of rock may require heavy equipment. • Presence of Serpentinite may require air quality monitoring during grading.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	YB
Area	Building Area 7 acres (100% bridge and street)
Grades	Existing grades vary from -3.0 to +5.5 ft (CCSF) Final grades a result of minor cuts and fills of up to 5 feet to achieve grades for drainage.
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 20 feet. Bottom of Artificial Fill ranges from Elevation -10 ft to -20 ft (CCSF) • Thickness of Artificial Fill ranges from 10 ft to up to 40 feet. Bottom of Bay Mud ranges from Elevation -20 ft to -60 ft (CCSF); • Bedrock located at Elevation of at least -50 to -150 ft (CCSF) • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Bridge and roadway corridor

Probable Remedial Grading Related to Infrastructure and Utilities Phase*	• Surcharging may be employed to mitigate bay mud settlement due to new fill loads associated with proposed grades.
	• Bridge abutments and bents may be supported on pile foundations
	• Abutment embankment stability and settlement will need to be addressed,
	  ○ Possible use of cement deep mixed columns to stabilize abutment embankment foundation soils
	  ○ Possible use of light weight fill to mitigate settlement
	  ○ Possible use of surcharge and wick drains to mitigate embankment settlement

Expected Utilities Performance	• Some on-going settlement expected on the approaches and abutments • Differential settlement between utilities and pile supported bridge deck on-grade bridge abutment embankments need will require flexible utility connections
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading for pile supported structures is planned for this area.
Expected Geotechnical Performance of Foundations	Pile supported bridge structure will have limited settlement. Bridge approach and embankment may experience tolerable amounts of differential settlement.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Appendix M1 PBS&J and Baseline Stormwater Runoff Calculations, November 2009

Appendix M1: Stormwater Runoff Calculations

RUNOFF QUANTITY

Stormwater Runoff

Runoff is affected by physical characteristics such as the amount of impervious area, roughness of land surface, routing of flows, distance for flow to travel, and amount/intensity of precipitation. Runoff is typically calculated based on the Rational Method:

Flow Rate:

$Q = CiA$, where [1]

Q = the runoff rate (cubic feet per second, cfs)

C = the runoff coefficient

i = the rainfall intensity (inches per hour)

A = the drainage area (acres)

Runoff Coefficient

The runoff coefficient, C, is a factor representing the fraction of rainfall falling on the drainage area that will contribute to stormwater runoff instead of on-site storage or infiltration. It is directly related to the amount of impervious surface and can be calculated based on[1]:

$C = 0.05+0.9Ia$, where [2]

Ia = Impervious fraction (proportion of the drainage area that is impervious)

The runoff coefficient can also be determined from technical references for typical runoff coefficients based on land use types and characteristics. Runoff coefficients used in this report are based on both standard engineering references for land use types, as reported by Winzler and Kelly, and Equation 2, based on GIS estimates of impervious area. Winzler and Kelly values were used where possible and GIS impervious areas and Equation 2 were used only if necessary to characterize the drainage area.

For this analysis, the more detailed land use categories were combined into general categories as depicted in Table M1 (Land Use Categories Consolidation for Water Quality Analysis).

[1] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm. Accessed September 26, 2009

Table M1 Land Use Categories Consolidation for Water Quality Analysis

Existing Conditions	*Project*
Residential	Residential
■ RV Park	■ Residential Density I
■ Residential	■ Residential Density II
Commercial	■ Residential Density III
■ Artist Community	■ Residential Density IV
■ Public Institution	Commercial
■ Candlestick Park	■ Regional Retail
■ Parking	■ Neighborhood Retail
■ Transportation	■ Office
Open Space	■ Hotel
■ Open Space	■ Stadium
Industrial	■ Arena
■ Former Naval facilities	■ Parking
■	■ Community Facility
	■ Hotel / Parking
	■ Office / Regional Retail
	■ Arena / Regional Retail
	■ Community Facility / Neighborhood Retail
	■ Residential Density I / Neighborhood Retail
	■ Residential Density I / Parking
	■ Residential Density I / Regional Retail
	■ Residential Density II / Neighborhood Retail
	■ Residential Density II / Research & Development
	■ Residential Density III / Neighborhood Retail
	■ Residential Density IV / Neighborhood Retail
	Industrial
	■ Research & Development
	Open Space
	■ Parks & Open Space

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

Table M2 (Estimated Project Site Characteristics for Runoff Calculations) lists the estimated existing and Project general land use, runoff coefficients, and drainage areas used in this analysis. Land use areas draining to the combined sewer and separate sewer systems were derived from GIS overlays of Figure III.M-1 (Combined and Separate Storm Sewer System and Receiving Water Bodies) of this EIR, aerial photographs, and Figure III.G-1 from the Candlestick Point Stadium and Retail/Entertainment Center EIR, prepared by ESA, Clement Designs, and Orion Environmental Associates.

Table M2 Estimated Project Site Characteristics for Runoff Calculations					
		Existing		*Project*	
Drainage	*Land Use*	*Area (acres)[a]*	*Runoff Coefficient*	*Area (acres)[h]*	*Runoff Coefficient*
Candlestick Park					
Combined Sewer	Residential	28	0.70[b]		
	Commercial	42	0.90[d]		
	Open Space	28	0.20[b]		
	Total	***98***	***0.64***	***0***	
Separate Sewer	Commercial	114	0.90[c]	26	0.70[h]
	Residential	3	0.85[d]	84	0.77[h]
	Open Space	8[e]	0.20[c]	107	0.20[h]
	Total	***183***	***0.68***	***217***	***0.48***
Sheet Flow to Bay	Open Space	58[c]	0.30[c]	50[h]	0.20[h]
Hunters Point Shipyard					
Separate Sewer	Industrial	358	0.79[d]	27	0.75[h]
	Commercial	28	0.74[d]	56	0.77[h]
	Residential	0[f]		61	0.70[h]
	Subtotal	*421*	*0.79*	*257*	*0.53*
	Off-site Residential[g]	75	0.70[b]	75	0.70[h]
	Total	***496***	***0.73***	***332***	***0.57***
Sheet Flow to Bay	Open Space	35[i]	0.30[i]	164	0.20[h]

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. PBS&J GIS estimated area
b. Winzler & Kelly, HPS_CP_subarea_runoff.xlsx; runoff coefficients for land use
c. Winzler & Kelly, flow calculations for existing conditions HPS_CP_runoff_existing.xlsx
d. PBS&J GIS estimated based on estimated impervious area and C=0.05+0.9*Ia
e. Existing sheet flow to Lower Bay about 58 acres
f. Artist community and police facility were included in the "Commercial" fraction
g. Runoff calculations include off-site residential, Parcel A
h. Winzler & Kelly, HPS_CP_subarea_runoff.xlsx; areas and weighted average runoff coefficients for land use
i. Estimates of sheet flow directly to the Lower Bay are about 10 percent of the HPS Phase II site. This area has not been delineated and cannot be exactly determined. Therefore, the open space area was assumed to be the fraction contributing to sheet flow to the Lower Bay to provide a reasonable estimate since the sheet flow area is primarily the existing open space area. The same runoff coefficient for the HPS Phase II sheet flow area was assumed to be the same as for the Candlestick Point sheet flow area as determined by Winzler & Kelly 2009

Rainfall Intensity

Rainfall intensities during storm events vary with time since the beginning of the rainfall event and how big of a storm it is. The rainfall intensity (i) to use in calculations is typically derived from Intensity/Duration/Frequency (IDF) curves for rainfall events in the geographical region of interest. These IDF curves describe the rainfall intensity for various lengths of time in a storm event (e.g., 5 minutes, 15 minutes, 1 hour, and others), for specific design storm events (e.g., the 2-year storm event, 10-year storm event, and others); a different curve is used for the different design storm events. The length of time (duration) to use is the is usually equivalent to the "time of concentration" (t_c) for the

drainage area; the t_c is the time it takes a drop of water at the top of the drainage area to make its way down to the bottom outlet.

Winzler and Kelly analyzed rainfall data from the Department of Water Resources gage #E70 7772 00 to determine the coefficients to describe the IDF curve to be used at the Project site. The rainfall intensity is therefore determined by:

$i = B / (D+t_c)^C$, where [3]

i = the intensity (inches per hour)

B, C, and D are coefficients fitted to monitoring data (see Table M3, below)

t_c = the time of concentration (minutes)

These values for the fitted coefficients identified by Winzler and Kelly are presented in Table M3 (Intensity/Duration/Frequency Curve Coefficients).

Table M3 Intensity/Duration/Frequency Curve Coefficients

	IDF Coefficient		
Design Storm	***B***	***D***	***E***
2 yr*	6.109	0.8	0.54174
5 yr	8.025	1.1	0.5637
10 yr	8.527	0.5	0.548078
100 yr	13.217	1	0.567912

SOURCE: Winzler & Kelly 2009

* Adjusted for partial duration series (see Handbook of Applied Hydrology , Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44).

The time of concentration, used in Equation 4, was estimated for each drainage area based on best professional judgment by Winzler & Kelly and listed in Table M4 (Overall Estimated Time of Concentration).

Table M4 Overall Estimated Time of Concentration

Drainage Area	*Existing (minutes)*	*Project (minutes)*
Candlestick Point		
Combined Sewer	10	--
Separate Storm	7	9.4[a]
Sheet Flow	8	6
Hunters Point Shipyard		
Separate Storm	15	11.4[a]
Sheet flow	8[b]	8
Offsite Residential	10	10

SOURCE: Winzler & Kelly 2009

a. Area weighted-average of Winzler & Kelly selected values

b. Sheet flow time of concentration estimated as same as for Candlestick Point existing conditions

- = not applicable

Runoff Volume

Calculation of storm runoff volume is similar to calculation of flow rate, except the entire storm depth is used instead of a rainfall intensity:

V = CAd, where [5]

V = Volume of water (acre-feet)

A = drainage area (acres)

C = composite runoff coefficient for drainage area

d = design rainfall depth (feet)

The design rainfall depth for the storm events evaluated is listed in Table M5 (Design Storm Rainfall Depths).

Table M5 Design Storm Rainfall Depths

Storm Event	*Design Rainfall Depth (inches)*
2-year	2.09
5-year	2.94
10-year	3.6
100-year	5.23
Annual Average	20.0[a]

SOURCE: Winzler & Kelly 2009

a. Western Regional Climate Center. No date, San Francisco WSO AP, California (047769) Period of Record Monthly Climate Summary Period of Record : 7/ 1/1948 to 4/30/2009, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7769, Accessed September 26, 2009

RESULTS

Table M6 lists the estimated Project site flow rates calculated using Equations 1, 2, and 3 and data in Table M1 through Table M4. For Hunters Point Shipyard, flow rates in Table M6 (Estimated Peak Flow Rates for Existing and Project Conditions) do not include off-site flow from Parcel A (hilltop). The City has required the HPS Phase II development to treat and convey the 5-year storm event from Parcel A in the Project storm drain system, or 108 cfs of flow (5-year storm event) in addition to Project flows. However, the Parcel A flows are existing flows, currently draining to the separate storm system. Therefore, although the offsite flows (108 cfs) must be accounted for in the Project storm drain infrastructure design and must be treated as required, they are not included in this Table M6 because they are not Project site flows and are not affected by development of the Project.

Table M6	Estimated Peak Flow Rates for Existing and Project Conditions		
	Peak Flow Rate		
Storm Event	*Existing (cfs)*	*Project (cfs)*	*Project Increase (cfs [%])[a]*
Candlestick Point			
5-Year	477 (130)[c]	249 (0)[c]	-228 (-48%)
10-Year	545	284	-261 (-48%)
100-Year	783	408	-375 (-48%)
Hunters Point Shipyard[b]			
5-Year	644	448	-196 (-30%)
10-Year	730	509	-221 (-30%)
100-Year	1052	733	-319 (-30%)
Total[c]			
5-Year	1121	697	-424 (-38%)
10-Year	1275	793	-482 (-38%)
100-Year	1835	1141	-694 (-38%)

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. A negative increase denotes a reduction in flow
b. Off-site flow from Parcel A is not included in these runoff calculations. Required Parcel A diversions into the HPS Phase II separate storm drain system would be 108 cfs.
c. Values in parenthesis denote the amount of total Candlestick Point site runoff flowing to the combined sewer system.

Table M7 (Estimated Storm Flow Volumes for Existing and Project Conditions) lists the storm flow volumes based on Equation 5 and Table M1, Table M2, and Table M5. Although the offsite flows (15.4 acre-feet) must be accounted for in the Project storm drain infrastructure design and must be treated as required, they are not included in this Table M7 because they are not Project site flows and are not affected by development of the Project.

LEED® Credit Flows

LEED® Credit 6.1. In accordance with LEED® Credit 6.1, the Project must reduce the 2-year 24-hour flow volume by 25 percent compared to existing conditions. As can be seen in Table M7, the Project would reduce the 2-year 24-hour storm volume by 41 percent. Although these calculations are based on estimated site characteristics, it is not likely that more detailed data would indicate a substantially lower reduction in 2-year 24-hour storm event flows. Therefore, it is expected that the Project would meet LEED® Credit 6.1 requirements.

LEED® Credit 6.2. In accordance with LEED® Credit 6.2, the Project must implement water quality BMPs to treat runoff from 0.75 inch of rainfall, or a rainfall intensity of 0.2 inch per hour, depending upon whether a volume-based treatment BMPs is used or a flow-rate-based treatment BMP is used.

Table M7 Estimated Storm Flow Volumes for Existing and Project Conditions

Storm Event	Flow Volume: Existing (acre-feet)	Flow Volume: Project (acre-feet)	Project Increase (acre-feet [%])[a]
Candlestick Point			
2-year	36	20	-16 (-44%)
5-Year	50	28	-22 (-44%)
10-Year	61	34	-27 (-44%)
100-Year	89	50	-39 (-44%)
Hunters Point Shipyard[b]			
2-year	64	39	-25 (-39%)
5-Year	90	54	-36 (-40%)
10-Year	110	66	-44 (-40%)
100-Year	160	97	-63 (-39%)
Total			
2-year	100	59	-41 (-41%)
5-Year	140	82	-58 (-41%)
10-Year	171	100	-71 (-42%)
100-Year	249	147	-102 (-41%)

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. A negative number denotes a reduction in flow; slight differences (1 %) in percent reductions for different storm events for each site are because of rounding factors

b. Off-site flow from Parcel A is not included in these runoff calculations. Required Parcel A diversions into the HPS Phase II separate storm drain system would be 108 cfs.

Volume-based BMP design standards apply to BMPs whose primary mode of pollutant removal depends on the volumetric capacity of the BMP. Examples of BMPs in this category include detention basins, retention basins, and infiltration. Flow-based BMP design standards apply to BMPs whose primary mode of pollutant removal depends on the rate of flow of runoff through the BMP. Examples of BMPs in this category include swales, sand filters, screening devices, and many proprietary products.

For volume-based BMPs, the volume requirement for capturing and treating a 0.75-inch design storm is calculated by the using the Equation 5 and using 0.75 inch for the design rainfall depth.

For flow-based BMPs, the required flow rate BMPs must be designed to treat is runoff from a rain event equal to an intensity of 0.2 inch per hour of rainfall. The Rational Method (Equation 1 and Table 1 and Table 2) is used to determine the treatment flow rate, with the rainfall intensity of 0.2 inch per hour.

As such, if volume-based treatment BMPs are used, they must be designed to treat at least:

- 7 acre-feet from Candlestick Park, and
- 11 acre-feet from HPS Phase II
- 4 acre-feet from off-site area (Parcel A)

If flow rate BMPs are used, they must be designed to treat at least:

- 23 cfs from Candlestick Park, and
- 34 cfs from HPS Phase II
- 10 cfs from off-site area (Parcel A)

It should be noted that although the City requires conveyance of the 5-year storm event runoff from the off-site from Parcel A and treatment to LEED® Credit 6.2 requirements, this off-site area is not affected by the Project and would not included in the impacts analysis because this area is not part of the Project.

CSOs

Development of the Project would reduce the amount of stormwater runoff to the combined sewer system by diverting the 5-year storm event runoff from the portion of Candlestick Point flowing to the combined sewer system to a separate sewer system (130 cfs or 58,348 gallons per minute [gpm]) (Table M6). CSO events occur when the instantaneous flow rate in the combined sewer system exceeds 110 million gallons per day (mgd) with about 94 percent consisting of stormwater flows (refer to Section III.Q [Utilities] of this EIR). Eliminating the 5-year storm event flow, from the area draining to the combined sewer system, from combined sewer system flows would therefore reduce the potential for CSO events in the combined sewer system because CSOs occur primarily as a result of stormwater runoff. Development of the Project would also increase peak sewage flows to the combined system by up to 1,479 gpm from Candlestick Point and 979 gpm from HPS Phase II for a total of 2,458 gpm (Table III.Q-7 [Sewer Trunk Capacity and Project Maximum Peak Flows]). Therefore, even with the increased peak sewage flows with development of the Project, the Project would result in a net reduction of 55,890 gpm of flow to the combined sewer system during storm events. Given this large reduction in flow during the critical times when CSOs may occur (storm events), there would be no impact from Project sewage discharges to the combined sewer system CSOs and violation of the Wastewater Discharge Permit.

WATER QUALITY

In order to evaluate the Project effect on stormwater quality, annual pollutant loads were estimated for existing and Project conditions. The amount of runoff, along with the expected pollutant concentrations in stormwater runoff, as related to land use, can be used provide a relative measure of Project effects on stormwater pollutants following conversion from one land use type to another. Different land uses will have different average pollutant concentrations in stormwater runoff, along with a different amount runoff each year. For instance, according to the national median total suspended solids concentration in runoff from residential lands is 49 mg/L and the median concentration in industrial runoff is 81 mg/L.[2] In general, the annual amount of runoff can be calculated or modeled based on simple site characteristics. Pollutant concentrations in stormwater runoff are required for each land use category to provide the relative comparison criteria.

[2] Maester, A. and R. Pitt. 2005. The National Stormwater Quality Database, Version 1.1 A Compilation and Analysis of NPDES Stormwater Monitoring Information. Prepared for the U.S. EPA Office of Water, Septebmer 4, 2005. p. 7-12

Land use pollutant concentrations will vary, depending upon local or regional conditions and the precipitation regime.[3] Therefore, using a national average (e.g., NSQD v. 1.1) or many other reported values would not be appropriate for local/regional scale analyses because the Project area is in a semi-arid/Mediterranean climate regime. Unfortunately, stormwater monitoring studies typically do not measure or report stormwater runoff pollutant concentrations by land use and data is very limited. While the limited data can be used to address ***relative*** changes in land use (Project) effects on annual pollutant loads, it would not be suitable to use these values to identify specific effects on pollutant concentrations. Consequently, this analysis does not address potential land use change effects on pollutant concentrations but makes use of literature values for stormwater pollutant concentrations to estimate the ***relative*** effect on pollutant loads; it would not be suitable to use generalized numbers to estimate effects on concentrations that water quality objectives are based on.

The Simple Method

Stormwater pollutant loads are calculated based on the Simple Method.[4] The Simple Method was developed based on empirical relationships observed in data collected in the Washington, D.C. area for the Nationwide Urban Runoff Program (NURP) studies published by U.S. EPA in 1983. The Simple Method estimates pollutant loads for chemical constituents as a product of the annual runoff volume and pollutant concentration, as[5]:

$L = 0.226 * R * C * A$, where [5]

L = Annual load (pounds [lbs])

R = Annual runoff (inches [in])

C = Pollutant concentration (milligrams per liter [mg/L])

A = Area (acres)

0.226 = Unit conversion factor

For bacteria, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is[6]:

$L = 1.03 *10\text{-}3 * R * C * A$, where [6]

L = Annual load (Billion Colonies)

R = Annual runoff (in)

C = Bacteria concentration (#/100 ml)

A = Area (acres)

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[3] Maester, A. and R. Pitt. 2005. The National Stormwater Quality Database, Version 1.1 A Compilation and Analysis of NPDES Stormwater Monitoring Information. Prepared for the U.S. EPA Office of Water, Septebmer 4, 2005. p. 34

[4] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

[5] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

[6] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

1.03 * 10-3 = Unit conversion factor

The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as[7]:

R = P * Pj * Rv, where [7]

R = Annual runoff (inches)

P = Annual rainfall depth (inches)

Pj = Fraction of annual rainfall events that produce runoff (usually 0.9)

Rv = Runoff coefficient (identified as 'C' in Equations 1 and 2)

The annual precipitation at the Project site is 20.0 inches per year.[8] The runoff coefficient can be estimated from look-up tables or based on the amount of impervious surface using Equation 2 (identified as "C" in Equations 1 and 2). Areas and runoff coefficients for each drainage area and land use type analyzed are presented in Table M2.

Pollutant Concentrations

Pollutant concentrations used in this analysis were derived from a combination of Los Angeles County Department of Public Works (LACDPW) monitoring data and Bay Area Stormwater Management Agencies Association (BASMAA) data; the best available data for the area. As mentioned above, stormwater pollutant concentrations can vary as a function of climate regime and local/regional conditions. Therefore, it is important to use data that was generated from a study geographically close to the site of interest or otherwise similar in Project site/pollutant concentration site characteristics. The BASMAA data includes measurements from Alameda and Santa Clara County (Alameda County data were used for this assessment). However, this data is limited to only a few constituents. The LACDPW data includes more parameters to compare, but is not as geographically similar to the Project site. The National Stormwater Quality Database v. 1.1 was mined to see if sufficient data was available in EPA Rain Zone 6, the rain zone California is in, which could provide a more robust dataset that was not too limited by coming from a very different precipitation regime. However, this data was not used because insufficient information was available for the 'Open Space' land use category in U.S. EPA Rain Zone 6 (the U.S. EPR Rain Zone for California). For each parameter assessed, the same data set (either LACDPW or BASMAA) was used for all land use categories for that parameter. Therefore, even though the absolute pollutant loads may not be reflective of Project site conditions, the relative differences caused by changes in land use should reasonably reflect the Project changes in land use effect on stormwater quality. Table M8 (Pollutant Event Mean Concentrations in Stormwater Runoff by Land Use) lists the pollutant concentrations and data sources used in this analysis. It should be noted that not all constituents of concern were analyzed because of insufficient data (e.g., pesticides, inorganic

[7] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm. Accessed September 26, 2009

[8] Western Regional Climate Center. No date, San Francisco WSO AP, California (047769) Period of Record Monthly Climate Summary Period of Record : 7/ 1/1948 to 4/30/2009, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7769, Accessed September 26, 2009.

compounds, trash and debris, oil and gas, and PCBs). However, reasonable data was available to assess sediment, nutrients, metals, and bacteria (pathogens) pollution potential.

Table M8 Pollutant Event Mean Concentrations in Stormwater Runoff by Land Use

Pollutant	*Data Source*	*Units*[a]	*Industrial*	*Commercial*	*High Density Single Family Residential*	*Open Space*
Sediment						
Total Suspended Solids	LACDPW	mg/L	229.4	67.4	104.6	164.7
Nutrients						
Ammonia	LACDPW	mg/L	0.48	0.09	0.36	0.08
Nitrate+Nitrite as N	LACDPW	mg/L	0.95	0.72	1.13	1.16
Total Kjeldahl Nitrogen	LACDPW	mg/L	3.07	0.81	2.08	0.81
Total Nitrogen	LACDPW	mg/L	4.02	1.53	3.21	1.97
Dissolved Phosphorous	LACDPW	mg/L	0.28	0.3	0.29	0.006
Total Phosphorous	LACDPW	mg/L	0.44	0.41	0.39	0.11
Metals						
Total Cadmium	BASMAA	ug/L	1.4	0.85	0.85	0.15
Total Chromium	BASMAA	ug/L	20	14	14	1.8
Total Copper	LACDPW	ug/L	31	34.8	15.3	3.4
Total Lead	BASMAA	ug/L	77	73	73	3.5
Total Nickel	LACDPW	ug/L	13	20	20	0.65
Total Zinc	BASMAA	ug/L	358	397	188	34
Pathogens						
Fecal Coliforms	LACDPW	MPN/100mL	653070	1071656	1085354	2175

SOURCE: Los Angeles County Department of Public Works (LACDPW), Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report, Table 4-9. Cumulative Event Mean Concentrations 1994-2000 Storm Season, http://dpw.lacounty.gov/wmd/NPDES/Int_report/Tables/Table_4-9.pdf , Accessed September 25, 2009; Woodward-Clyde Consultants, 1996, Monitoring Data Analysis Draft Final Report, prepared for the Bay Area Stormwater Management Agencies Association (BASMAA)

a. Where mg/L = milligrams per liter, ug/L = micrograms per liter, and MPN/100mL = most probable number (of colonies) per 100 milliliters.

ANNUAL POLLUTANT LOADS

Using Equations 5, 6, and 7 and data in Table M2 and Table M8, annual pollutant load from the Project site under existing land use conditions and Project conditions were calculated.

Candlestick Point

Table M9 (Potential Project Effect on Annual Pollutant Load from Candlestick Point) lists the Project effects on pollutants in stormwater runoff from Candlestick Point and annual runoff volume to each system. Runoff to the separate sewer system in Table M9 includes sheet flow runoff to the Bay.

Table M9 Potential Project Effect on Annual Pollutant Load from Candlestick Point

	Existing			*Project*		
					Overall Difference from Existing[a]	
Pollutant	*Combined (lbs)*	*Separate (lbs)*	*Total (lbs)*	*Total (lbs)*	*(lbs)*	*(%)*
Total Suspended Solids	*24,951*	*42,289*	67,240	59,500	-7,740	-12%
Ammonia	*49.5*	*51.1*	101	124	23.5	23%
Nitrate+Nitrite as N	*252*	*416*	669	554	-114	-17%
Total Kjeldahl Nitrogen	*343*	*448*	791	790	-1.42	0%
Total Nitrogen	*596*	*864*	1,460	1,344	-116	-8%
Dissovled Phosphorous	*77.1*	*143*	220	110	-110	-50%
Total Phosphorous	*107*	*201*	309	163	-145	-47%
Total Cadmium	*0.224*	*0.413*	0.637	0.340	-0.298	-47%
Total Chromium	*3.68*	*6.76*	10.4	5.50	-4.94	-47%
Total Copper	*7.38*	*16.50*	23.9	7.82	-16.1	-67%
Total Lead	*19.0*	*34.9*	53.9	27.8	-26.1	-48%
Total Nickel	*5.21*	*9.54*	14.7	7.58	-7.17	-49%
Total Zinc	*85.3*	*188*	274	92.4	-181	-66%
Fecal Coliforms (billions of colonies)	*1,272,951*	*2,322,614*	3,595,565	1,849,326	-1,746,238	-49%
Stormwater Volume (acre-feet)	94.5	177.5	272.0	171.4	-100.6	-37%

SOURCE: PBS&J 2009

a. The 'Difference' columns denote the difference between Project and Existing annual pollutant loads; a negative number indicates that pollutant loads are lower with development of the Project compared to existing conditions.

Overall, except for ammonia, development of Candlestick Point, without considering BMP effects or removal of pollutants by the combined sewer system, would result in a reduction in annual stormwater pollutant load. However, because a portion of existing runoff flows to the water treatment plant (SWPCP), this portion of existing flows are treated prior to discharge to the Lower Bay. Comparison of Candlestick Point pollutant loads and existing pollutant loads from only the areas currently not receiving any treatment (flow to the separate sewer system and sheet flow to the Lower Bay) provides a better indication of potential Candlestick Point 'worst case' effects on water quality. Table M10 (Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay from Candlestick) lists these potential 'worst case' effects by comparing only those flows that currently receiving no treatment.

Table M10	Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay from Candlestick			
			Project Difference from Existing	
Pollutant	*Existing (lbs)*	*Project (lbs)*	*(lbs)*	*(%)*
Total Suspended Solids	42,289	59,500	17,211	41%
Ammonia	51.1	124	73.0	143%
Nitrate+Nitrite as N	416	554	138	33%
Total Kjeldahl Nitrogen	448	790	342	76%
Total Nitrogen	864	1,344	480	56%
Dissolved Phosphorous	143	110	-32.5	-23%
Total Phosphorous	201	163	-37.8	-19%
Total Cadmium	0.413	0.340	-0.073	-18%
Total Chromium	6.76	5.50	-1.26	-19%
Total Copper	16.5	7.82	-8.69	-53%
Total Lead	34.9	27.8	-7.06	-20%
Total Nickel	9.54	7.58	-1.96	-21%
Total Zinc	188	92.4	-95.9	-51%
Fecal Coliforms (billions of colonies)	2,322,614	1,849,326	-473,288	-20%
Stormwater Volume (acre-feet)	177.5	171.4	-6.1	-3

SOURCE: PBS&J 2009
Loads directly to the Lower Bay

Therefore, considering just the Project effect on pollutants being discharged to a separate storm drain system or sheet flow to the Lower Bay, development at Candlestick Point, without BMPs, would increase the pollutant load for several pollutants including total suspended solids (+41 percent), ammonia (+143 percent), nitrate + nitrite (+33 percent), and total nitrogen (+56 percent) (Table M10). If BMPs are incorporated, they could further reduce stormwater pollutants. There is no information on BMP effectiveness for removing ammonia, however, several BMPs are effective at removing nitrogen sources. Table M11 (Expected BMP Pollutant Removal Rates) lists potential BMP pollution removal effectiveness for some potential Project BMPs

This increase is partially because the total amount of stormwater currently diverted to the combined system would be diverted to the storm drain system or sheet flow to the Lower Bay with development at Candlestick Point, resulting in about the same amount of runoff directly to the Lower Bay but with higher total suspended solids and total kjeldahl nitrogen (organic nitrogen) concentrations from the increased amount of open space land and higher nitrogen concentrations from the increased amount residential lands with development of Candlestick Point, compared to the mostly commercial land under existing conditions.

Unlike the HPS Phase II site, which is greatly constrained for use of infiltration BMPs because of shallow depth to groundwater, existing groundwater plumes, and extensive fill material, infiltration BMPs may be possible at the Candlestick Point site. Infiltration BMP effectiveness depends on many factors including

the soil characteristics and type of infiltration BMP used and should not be used in areas where the depth to shallow groundwater is within 10 feet of the bottom of the infiltration device[9] or where infiltration rates are to low (not enough infiltration) or too fast (not enough filtration before reaching groundwater).

Even though the overall Candlestick development reduces total suspended solids (TSS) loads by about 12 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) the Project would still have to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would still have to treat 7 acre-feet (or 23 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at Candlestick Point. This could be met a variety of BMPs including vegetated swales or BMPs that use infiltration (where infiltration is not constrained by site characteristics).

Some of the types of BMPs being considered for implementation at the Project site include:

- **Dry Detention Ponds/Dry Ponds.** Dry detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain stormwater runoff for some minimum time (e.g., 24 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool of water. However, they are often designed with small pools at the inlet and outlet of the basin. They can also be used to provide flood control by including additional flood detention storage.
- **Infiltration Basin.** An infiltration basin is a shallow impoundment which is designed to infiltrate stormwater into the soil and use soils on the site as a filter media. Such a system collects the stormwater and allows it to percolate through the soils and back into the groundwater This practice is believed to have a high pollutant removal efficiency and can also help recharge the ground water. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices. Because it depends on the native soils to filter and discharge the water, an infiltration system is not feasible for every site. The soil types, underlying geology, slopes, and hydrology of the site must be considered when designing an infiltration system.
- **Wetland Basins.** Stormwater wetlands (a.k.a. constructed wetlands) are structural practices similar to wet ponds that incorporate wetland plants into the design. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the practice. Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic and habitat value. Although natural wetlands can sometimes be used to treat stormwater runoff that has been properly pretreated, stormwater wetlands are fundamentally different from natural wetland systems. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands in terms of both plant and animal life. Several design variations of the stormwater wetland exist, each design differing in the relative amounts of shallow and deep water, and dry storage above the wetland.

[9] SWRCB, 2003, Water Quality Order No. 2003-0005-DWQ, National Pollutant Discharge Elimination system (NPDES) General Permit No. CAS000004, Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (General Permit), Attachment 4, p 10.

- **Biofilter.** Bioswales, vegetative buffers, constructed wetlands, bioretention devices and other types of stormwater filters that use biological components to treat and filter pollutants in stormwater runoff.
- **Vegetated Filter Strips.** Vegetated filter strips (grassed filter strips, filter strips, and grassed filters) are a type of biofilter. They consist of vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. One challenge associated with filter strips, however, is that it is difficult to maintain sheet flow, so the practice may be "short circuited" by concentrated flows, receiving little or no treatment.
- **Grassed Channels.** Grassed channels are a type of biofilter. Grassed channels are the most similar to a conventional drainage ditch, with the major differences being flatter side slopes and longitudinal slopes, and a slower design velocity for water quality treatment of small storm events. Of all of the options, grassed channels are the least expensive but also provide the least reliable pollutant removal. An excellent application of a grassed channel is as pretreatment to other structural stormwater practices. A major difference between the grassed channel and many other structural practices is the method used to size the practice. Most stormwater management water quality practices are sized by volume. This method sets the volume available in the practice equal to the water quality volume, or the volume of water to be treated in the practice. However, the grassed channel, is a flow-rate-based design. Based on the peak flow from the water quality storm, the channel should be designed so that runoff takes, on average, 10 minutes to flow from the top to the bottom of the channel.
- **Bioretention.** Bioretention devices are a type of biofilter. Bioretention areas are landscaping features adapted to provide on-site treatment of stormwater runoff. They are commonly located in parking lot islands or within small pockets of residential land uses. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, runoff ponds above the mulch and soil in the system. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix. The filtered runoff can be collected in a perforated underdrain and returned to the storm drain system
- **Dry Swales.** Dry swales are a type of biofilter Dry swales are similar in design to bioretention areas. These designs incorporate a fabricated soil bed into their design. The native soil is replaced with a sand/soil mix that meets minimum permeability requirements. An underdrain system is installed at the bottom of the soil bed. This underdrain is a gravel layer that encases a perforated pipe. Stormwater treated in the soil bed flows into the underdrain, which routes this treated stormwater to the storm drain system or receiving waters. Dry swales are a relatively new design, but studies of swales with a native soil similar to the man-made soil bed of dry swales suggest high pollutant removal.
- **Media Filters.** Stormwater filters collect the water and pass it through a bed of sand or other media to remove contaminants from the water. Media filter devices typically include a sedimentation chamber and a filtering chamber containing the filter media. The media is housed in cartridge filters enclosed in concrete vaults, or in fixed beds such as sand filters. An assortment of filter media are available, including leaf compost, pleated fabric, activated charcoal, perlite,

amended sand and perlite, and zeolite. The most common type of stormwater filter is a sand filter, which may be constructed in a concrete structure or designed into a small detention area. The system functions by routing the stormwater through the filtering or sorbing medium, which traps particulates and/or soluble pollutants. While they are capable of excellent pollutant removal, filters are also susceptible to clogging and are costly to maintain.

- **Hydrodynamic Separators.** Hydrodynamic separators are structures designed to remove suspended sediments, oils, and floatable debris by physical processes. Usually installed as an underground structure, a hydrodynamic separator is most often used on sites with large paved areas where space is at a premium. This type of installation relies on sedimentation and flotation to remove and retain pollutants, and often includes proprietary flow controls and pollutant removal effectiveness is highly dependent upon the stormwater flow rate being similar to the device design treatment flow rate.
- **Pervious Pavement.** Permeable pavement is open graded asphalt or concrete with reduced fines and a special binder that allows for the rapid flow of water. Water is able to pass through the pavement by flowing through voids between the aggregate. Another way to construct a permeable paving surface is to use paver blocks. The paver blocks themselves are not permeable, but are installed with gaps between the pavers to allow stormwater to penetrate into the subsurface. The gap is integrated into the interlocking design of the paver blocks. Grid systems made of plastic grids filled with soil or aggregate are also used.

  Beneath the porous surface is an aggregate subbase underlain with geotextile fabric. The aggregate subbase is typically divided into an upper filter course comprised of fine aggregate, and a lower reservoir course comprised of larger aggregate. The geotextile fabric provides separation between the aggregate and soil beneath and structural stability. Stormwater runoff from the paved surface and adjacent impervious areas passes through the porous pavement to the aggregate reservoir where it is filtered and stored. The aggregate also serves as the road or parking area's support base and must be sufficiently thick to support traffic loads. Permeable pavement decreases runoff volume and peak discharge, filters pollutants, and may be used to recharge groundwater. Porous pavements reduce stormwater runoff volume and peak discharge by providing a storage reservoir and an opportunity for subsurface infiltration.

Table M11 lists pollutant removal rates by these various BMPs that are being considered for implementation.

Removal rates were calculated based on the difference between the median influent and effluent concentrations as reported in the International Stormwater Best Management Practices (BMP) Database, except where noted. It should be noted that these values are reported by general category of BMP. Exact type of BMP within each category, influent concentration, BMP sizing, and BMP siting will make a difference in actual BMP performance. However, from Table M11 it can be seen that implementation of BMPs or a suite of BMPs would be effective at removing pollutants in stormwater runoff sufficient to meet LEED® Credit 6.2 requirements. However, some BMPs that may be effective at removing TSS may actually increase other constituents of concern, such as nitrogen.

Table M11 Expected BMP Pollutant Removal Rates

Pollutant	*Detention Pond (%)*	*Dry Pond (%)*	*Infiltration Basin[a] (%)*	*Wetland Basin (%)*	*Biofilter (%)*	*Vegetated Filter Strip (75 feet)[a] (%)*	*Grassed Channel[a] (%)*	*Bioretention[a] (%)*	*Dry Swale[a] (%)*	*Media Filter (%)*	*Hydrodynamic Device (%)*	*Pervious Pavement[a] (%)*
Total Suspended Solids	57	47–61[c]	75	53	54	75	60–83	NA	80–99	63	5	71–99
Total Nitrogen	-118	25–31[c]	55–60	46	17	NA	NA	49	84–99	42	-61	83[b]
Nitrate-Nitrogen	17	3.5–39[c]	NA	41	-2	-27	-25–31.4	15–16	45–99	-95	-25	67
Total Kjeldahl Nitrogen	-30	NA	NA	9	16	NA	32[b]	52–67	70[b]	3	-36	35–53
Dissolved Phosphorous	-33	NA	NA	-70	-389	NA	4.5–45	NA	83[b]	0	-50	10 b
Total Phosphorous	0	19[a]	60–70	48	-36	NA	NA	65–87	18–99	30	-8	42–65
Total Cadmium	34	NA	NA	33	44	NA	NA	NA	NA	24	23	NA
Total Copper	40	26[b]	NA	25	67	NA	42[b]	43–97	NA	30	8	13–79
Total Chromium	57	NA	NA	NA	18	NA	NA	NA	70b	32	14	NA
Total Lead	37	NA	NA	29	66	-16	NA	70–95	NA	62	82	NA
Total Zinc	46	26[b]	NA	35	77	NA	45[b]	64–95	86[b]	59	33	72–99
Ammonia	NA	NA	NA	NA	NA	47	NA	92	NA	NA	NA	72
General Metals	NA	26–54[a]	85–90	NA	NA	NA	2–73	NA	37–90	NA	NA	NA
Bacteria	NA	NA	90	NA	NA	NA	-25–100	NA	NA	NA	NA	NA

SOURCE: Except where noted, PBS&J and Geosyntec Consultants and Wright Water Engineers, Inc., June 2008, Overview of Performance by BMP Category and Common Pollutant Type, International Stormwater Best Management Practices (BMP) Database Overview of Performance by BMP Category and Common Pollutant Type [1999-2008], Prepared for: Water Environment Research Foundation, American Society of Civil Engineers (Environmental and Water Resources Institute/Urban Water Resources Research Council), U.S. Environmental Protection Agency, Federal Highway Administration, American Public Works Association

NA = not available

a. U.S. EPA, National Pollutant Discharge Elimination System (NPDES) Menu of Stormwater BMPs. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=137&minmeasure=5, updated May 24, 2006 except for Pervious Pavement, updated September 10, 2009 (accessed October 1, 2009).

b. U.S. EPA Office of Water , November 2005, National Management Measures to Control Nonpoint Source Pollution from Urban Areas EPA-841-B-05-004, Table 5.8: Effectiveness of management practices for runoff control p 5-59

c. Combination of sources a and b

HPS Phase II

Table M12 (Potential Project Effect on Annual Pollutant Load From HPS Phase II) lists the effect of development at HPS Phase II on pollutants in stormwater runoff to the Lower Bay and annual runoff volumes. At HPS Phase II, all stormwater is currently discharged to the storm drain system and does not receive treatment prior to discharge.

Table M12 Potential Project Effect on Annual Pollutant Load From HPS Phase II

Pollutant	*Existing (lbs)*	*Project (lbs)*	*Project Difference from Existing (%)*	*Off-site Residential (lbs)*
Total Suspended Solids	304,776	113,803	-63%	*24,822*
Ammonia	625	160	-74%	*85.4*
Nitrate+Nitrite as N	1,319	864	-34%	*268*
Total Kjeldahl Nitrogen	4,026	1,133	-72%	*494*
Total Nitrogen	5,345	1,997	-63%	*762*
Dissovled Phosphorous	386	142	-63%	*68.8*
Total Phosphorous	604	235	-61%	*92.5*
Total Cadmium	1.87	0.512	-73%	*0.202*
Total Chromium	26.9	7.91	-71%	*3.32*
Total Copper	43.0	13.8	-68%	*3.63*
Total Lead	105	36.6	-65%	*17.3*
Total Nickel	18.5	9.18	-50%	*4.75*
Total Zinc	496	159	-68%	*44.6*
Fecal Coliforms (billions of colonies)	4,262,577	2,182,629	-49%	*1,173,810*
Stormwater Volume (acre-feet)	465.8	229.8	-40%	*78.7*

SOURCE: PBS&J 2009

Development of HPS Phase II would substantially reduce the amount of stormwater runoff and pollution from the HPS Phase II site, for the parameters listed (assuming no residual contamination from prior Navy operations). Overall, development of HPS Phase II would reduce pollutants in stormwater runoff and impacts on water quality would not be substantial.

Additionally, Lennar Urban would have to divert stormwater runoff (up to the peak 5-year storm event) from the off-site Parcel A area through the Project storm drain system (Off-site Residential column in Table M12) and treat in accordance with LEED® Credit 6.2 requirements. Consequently, the Project storm drain system would have to be designed to convey and treat flow from this off-site area, which would improve stormwater quality conditions not associated with development of the project. The last column in Table M12 listed the current annual pollutant load from this off-site area. Any treatment of these flows would be a beneficial effect of the Project.

Even though the HPS Phase II reduces TSS by about 63 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) development at HPS Phase II would still have

to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would have to treat 11 acre-feet (or 34 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. Additionally, in accordance with City requirements, the Project would have to treat 4 acre-feet (10 cfs) of off-site flows from Parcel A with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. This could be met a variety of BMPs, however, infiltration BMPs will likely be constrained over the majority of the HPS Phase II site.

Project

Table M13 (Potential Project Effect on Annual Stormwater Pollutant Load) lists the overall effect of development at the Project site on pollutants in stormwater runoff and annual runoff (combination of Table M9 and Table M12).

Table M13 Potential Project Effect on Annual Stormwater Pollutant Load

			Project Difference From Existing	
Pollutant	*Existing (lbs)*	*Project (lbs)*	*(lbs)*	*(%)*
Total Suspended Solids	372,017	173,303	-198,714	-53%
Ammonia	725	284	-441	-61%
Nitrate+Nitrite as N	1987	1419	-569	-29%
Total Kjeldahl Nitrogen	4817	1923	-2,895	-60%
Total Nitrogen	6,804	3,341	-3,463	-51%
Dissovled Phosphorous	606	253	-354	-58%
Total Phosphorous	913	399	-514	-56%
Total Cadmium	2.128	0.824	-1.30	-61%
Total Chromium	37.4	13.4	-24.0	-64%
Total Copper	66.9	21.6	-45.3	-68%
Total Lead	159.3	64.5	-94.8	-60%
Total Nickel	33.3	16.8	-16.5	-50%
Total Zinc	770	251	-518	-67%
Fecal Coliforms (billions of colonies)	7,858,141	4,031,956	-3,826,186	-49%
Stormwater Volume (acre-feet)	737.8	450.3	-287.4	-39%

SOURCE: PBS&J 2009

Development of Project would substantially reduce the amount of stormwater runoff and pollution from the Project site for the parameters listed (assuming no residual contamination from prior Navy operations). However, because a portion of existing runoff from Candlestick Point flows to the water treatment plant (SWPCP), this portion of existing flows are treated prior to discharge to the Lower Bay. Comparison of Project pollutant loads and existing pollutant loads from only the areas currently not receiving any treatment (flow to the separate sewer system and sheet flow to the Lower Bay) provides a better indication of potential Project 'worst case' effects on water quality. Table M14 (Annual Pollutant

Loads Piped and Sheet Flow Direct to the Lower Bay From the Project) lists these potential 'worst case' effects by comparing only those flows that currently receiving no treatment.

Table M14 Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay From the Project

			Project Difference from Existing	
Pollutant	*Existing (cfs)*	*Project (cfs)*	*(cfs)*	*(%)*
Total Suspended Solids	347,065	173,303	-173,762	-50%
Ammonia	676	284	-392	-58%
Nitrate+Nitrite as N	1,735	1,419	-316	-18%
Total Kjeldahl Nitrogen	4,474	1,923	-2,551	-57%
Total Nitrogen	6,209	3,341	-2,868	-46%
Dissovled Phosphorous	529	253	-276	-52%
Total Phosphorous	806	399	-407	-51%
Total Cadmium	2.29	0.85	-1.44	-63%
Total Chromium	33.7	13.4	-20.3	-60%
Total Copper	59.5	21.6	-37.9	-64%
Total Lead	140	64	-75.8	-54%
Total Nickel	28.1	16.8	-11.3	-40%
Total Zinc	684	251	-433	-63%
Fecal Coliforms (billions of colonies)	6,585,191	4,031,956	-2,553,235	-39%
Stormwater Volume (acre-feet)	643	450	-193	-30%

SOURCE: PBS&J 2009

From Table M14, it can be seen that even when considering just the Project effect on pollutants being discharged to a separate storm drain system or sheet flow to the Lower Bay, development of the Project, without BMPs, would reduce pollutant loads for all assessed parameters and impacts on water quality would not be substantial. If BMPs are incorporated, they could further reduce stormwater pollutants. Table M11 lists potential BMP pollution removal effectiveness for some potential Project BMPs.

Even though the Project reduces TSS by about 50 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) the Project would still have to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would have to treat 30 acre-feet (or 45 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. Additionally, in accordance with City requirements, the Project would have to treat 4 acre-feet (10 cfs) of off-site flows from Parcel A with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. This could be met a variety of BMPs, however, infiltration BMPs will likely be constrained over the majority of the HPS Phase II site. As noted above, some BMPs that may be effective at meeting the LEED® Credit 6.2 requirements may also result in higher discharges of other

constituents of concern, such as nitrogen. Care must be taken to select BMPs that maximize pollutant removal of TSS and minimize increases in loads of other pollutants.

RECOMENDATIONS

Incorporate stormwater quality BMPs into the Storm Water Quality Management Plan to achieve 80 percent TSS annual load reduction from the 0.75 inch (or 0.2 inch per hour) runoff from the Project and off-site Parcel A, without increasing loads of nitrogen, metals, or bacteria compared to existing loads to the separate sewer system and sheet flow to the Lower Bay. Document that the selected BMPs, do not increase nitrogen, metals, or bacteria loads compared to existing loads to the separate sewer system and sheet flow to the Lower Bay (including off-site Parcel A). Calculations can be performed by modeling water quality runoff concentrations as affected by BMPs using the International Stormwater Best Management Practices (BMP) Database data, or by performing load calculations as presented in this document and BMP removal rates in Table M11. Additional BMPs and BMP removal rates can be used where supported by effectiveness studies as approved by the City.

Limit use of infiltration BMPs on the HPS Phase II site to areas where groundwater constraints are minimal and areas without fill material.

ATTACHMENT A1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS (PBS&J Revised areas and C-factors)

					Peak 5yr Q	5yr Volume	Peak 10yr Q	10yr Volume	Peak 100yr Q	100yr Volume	LEED (2-year 24-hr)		BMPs		Load Calcs
	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	(cfs)	(AF/yr)	(cfs)	(AF/yr)	(cfs)	(AF/yr)	Peak (cfs)	Volume (AF)	Flow-based (cfs)	Volume-based (AF)	Annual Runoff (AF)
CANDLESTICK															
	98	Combined Sewer	0.64	10	130	15.4	147	18.8	212	27	105.56	10.9	12.5	3.9	105
	183	Separate Storm	0.68	7	307	30.5	352	37.3	505	54	250	21.7	24.9	7.8	207
	58	Sheet Flow	0.30	8	40	4.3	46	5.2	66	8	33	3.0	3.5	1.1	29
TOTAL	281				477	50	545	61	783	89	388	36	41	13	341
HUNTERS POINT															
	386	Separate Storm	0.79	15.0	511	74.7	579	91	835	133	418	53.1	61.0	19.1	508
	35	Sheet flow	0.30	8.0	24	2.6	28	3	40	5	20	1.8	2.1	0.7	18
	75	Offsite	0.70	10.0	108	12.9	123	16	178	23	88	9.1	10.5	3.3	88
TOTAL	386				644	90	730	110	1052	160	526	64	74	23	613

RAINFALL INPUT: (DWR gage #E70 7772 00)

	IDF curve cnstants			
	B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				20 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Values in yellow cell blocks equal corrected areas and C factors based on PBS&J GIS analysis and weighted average runoff coefficient

Values in pink cells denote estimated sheet flow characteristics; GIS measured open space areas, using the same runoff coefficient and time of concentration identified for Candlestick Point sheet flow areas by Winzler & Kell

ATTACHMENT A2

WINZLER & KELLY 2009 RUNOFF CALCULATIONS (PBS&J Re-summarized)

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
Separate Storm	217.0	Bay	0.48	9.4	222	25.5	253	31.2	364	45.4	181	18.1	20.8	6.5	173.6
open space (sheet flow)	50.3	Bay	0.20	6	27	2.5	31	3.0	44	4.4	22	1.8	2.0	0.6	17
TOTAL	267				249	28	284	34	408	50	203	20	23	7	190
HUNTERS POINT															
Separate Storm	257.0	Bay	0.53	11.4	263	33.4	299	40.9	431	59.4	215	23.7	27.2	8.5	227.0
Off-site	75.0	Bay	0.70	10.0	108	12.9	123	15.8	178	22.9	88	9.1	10.5	3.3	87.5
open space (sheet flow)	164	Bay	0.20	8.0	76	8.0	87	10	125	14	62	6	7	2.1	55
TOTAL	496				448	54	509	66	733	97	365	39	44	14	369
without off-site flows					*339*		*385*		*555*		*276*		*34*	*11*	*282*

RAINFALL INPUT: (DWR gage #E70 7772 00)

	IDF curve cnstants B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				20 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology, Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Values in yellow cell blocks equal PBS&J summaries from Winzler & Kelly HPS_CP_subarea_runoff.xlsx

Values in blue cell blocks equal area-weighted average time of concentration from Winzler & Kelly HPS_CP_subarea_runoff.xlsx

ATTACHMENT B1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS:

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
	162	Combined Sewer	0.74	10	248	20.9	282	36.0	406	52	201.77	20.9	24.0	7.5	213
	47	Separate Storm	0.90	7	104	7.4	120	12.7	172	18	85	7.4	8.5	2.6	75
	58	Sheet Flow	0.30	8	40	3.0	46	5.2	66	7.6	33	3.0	3.5	1.1	31
TOTAL	267				392	31	447	54	644	78	319	31	36	11	319
HUNTERS POINT															
	496	Separate Storm	0.85	15.0	706	73.4	800	126	1154	184	577	73.4	84.3	26.4	748
TOTAL	496				706	73	800	126	1154	184	577	73	84	26	748

RAINFALL INPUT: (DWR gage #E70 7772 00)

	IDF curve cnstants B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				21.3 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

ATTACHMENT B2.1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS:

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
1	45.1	Bay	0.54	10	51	4.3	57	7.3	83	11	41.17	4.3	4.9	1.5	43
2	37.0	Bay	0.31	7	28	2.0	32	3.4	46	5	23	2.0	2.3	0.7	20
3	13.9	Bay	0.52	8	17	1.2	19	2.2	27	3.1	13	1.2	1.4	0.4	13
4	18.7	Bay	0.40	8	17	1.3	20	2.2	28	3.3	14	1.3	1.5	0.5	13
5	35.1	Bay	0.48	10	35	2.9	40	5.0	57	7.3	28	2.9	3.4	1.1	30
6	51.4	Bay	0.48	12	47	4.3	53	7.5	76	10.8	38	4.3	5.0	1.6	44
7	6.2	Bay	0.47	6	8	0.5	9	0.9	13	1.3	6	0.5	0.6	0.2	5.1
11	4.8	Bay	0.49	5	7	0.4	8	0.7	11	1.0	6	0.4	0.5	0.1	4.1
21	4.5	Bay	0.56	6	7	0.4	8	0.8	11	1.1	5	0.4	0.5	0.2	4.5
open space (sheet flow)	50.3	Bay	0.20	6	27	1.8	31	3.0	44	4.4	22	1.8	2.0	0.6	18
TOTAL	267				242	19	276	33	397	48	197	19	22	7	195
HUNTERS POINT															
8	89.8	Bay	0.26	15.0	39	4.1	45	7	64	10	32	4.1	4.7	1.5	42
9	45.0	Bay	0.64	10.0	60	5.0	68	9	98	13	49	5.0	5.8	1.8	51
10	13.4	Bay	0.20	8.0	6	0.5	7	0.8	10	1.2	5	0.5	0.5	0.2	4.7
12	23.8	Bay	0.54	10.0	27	2.2	30	3.9	44	5.6	22	2.2	2.6	0.8	23
13	8.5	Bay	0.51	5.0	13	0.8	15	1.3	21	1.9	10	0.8	0.9	0.3	7.7
14	30.2	Bay	0.57	12.0	32	3.0	37	5.1	53	7.5	26	3.0	3.4	1.1	30
15 (Hilltop)	75.0	???	0.70	10.0	108	9.1	123	15.8	178	23	88	9.1	10.5	3.3	93
16	5.5	Bay	0.57	6.0	8	0.5	10	0.9	14	1.4	7	0.5	0.6	0.2	5.6
17	12.7	Bay	0.51	8.0	15	1.1	17	1.9	24	2.8	12	1.1	1.3	0.4	11
18	13.4	Bay	0.56	8.0	17	1.3	20	2.3	29	3.3	14	1.3	1.5	0.5	13
19	8.4	Bay	0.48	7.0	10	0.7	11	1.2	16	1.7	8	0.7	0.8	0.2	7.1
22	6.3	Bay	0.20	10.0	3	0.2	3	0.4	4	0.5	2	0.2	0.3	0.1	2.2
open space (sheet flow)	164	Bay	0.20	8.0	76	6	87	10	125	14	62	6	7	2.1	58
TOTAL	496				414	34	472	59	679	86	337	34	39	12	350

RAINFALL INPUT: (DWR gage #E70 7772 00)

	IDF curve cnstants B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				21.3 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III	Residential Density IV	Regional Retail	Neighborhood Retail	Office	Research & Development	Hotel	Stadium	Arena	Parking	Community Facility	Arena / Regional Retail	Community Facility / Neighborhood Retail	Hotel / Parking
CANDLESTICK																		
1	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), ouftall to Bay with high flow channel	45.1	4.1	5.1		5.5	3.4							3.3		1.0		
2	untreated stormdrains, wetland/wetpond, sheet flow to Bay	37.0	3.3	4.0										0.4				
3	onstreet BMPs, small open space BMPs, some sheet flow to Bay, some outfall to Bay	13.9	3.2	0.3	3.4		1.8											
4	onstreet BMPs, large openspace BMPs, larege swales and naturalized channel to wetlands	18.7			3.4	0.2										0.6		
5	onstreet BMPs, treated stormdrains and swales/filterstrips, 2 outfalls and 2 high flow channels to Bay	35.1	4.6	8.0	6.4													
6	onstreet BMPs, large ope sapce BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland	51.4	4.8	15.6	0.2		1.9							1.8	1.0		0.3	0.7
7	onstreet BMPs, large open space BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland	6.2		3.3														
11	on street BMPs, drains offsite	4.8		2.8														
21	onstreet BMPs, swales/filterstrips, sheet flow to Bay with high flow channel	4.5	3.3															
	OPEN SPACE (not delineated)	50.3																
	TOTAL	**267.0**	**23.3**	**39.2**	**13.5**	**7.5**	**5.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.5**	**1.0**	**1.6**	**0.3**	**0.7**
HUNTERS POINT																		
8	swales and treated stormdrains, outfall to Bay with high flow channel	89.8										6.1			3.8			
9	swales and treated stormdrains, outfall to Bay with high flow channel	45.0										33.3						
10	swales and treated stormdrains, outfall to Bay, high flow sheet flow to bay	13.4																
12	on street BMPs, treated stormdrain, outfall to Bay	23.8							5.6		6.5	0.5			1.1			

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III	Residential Density IV	Regional Retail	Neighborhood Retail	Office	Research & Development	Hotel	Stadium	Arena	Parking	Community Facility	Arena / Regional Retail	Community Facility / Neighborhood Retail	Hotel / Parking
13	swales/filterstrips, outfall to Bay, high flow sheet flow to Bay	8.5	0.2							4.6								
14	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), cistern/underground detention, ouftall to Bay	30.2	0.2	1.3					0.7	16.1								
15 (Hilltop)	to City system???	75			75.0													
16	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel	5.5	1.5	1.2	0.1	0.6												
17	onstreet BMPs , treated stormdrain, naturalized channel, swale/filterstrip, outfall to Bay with high flow channel	12.7	2.3	3.3	2.1				0.1									
18	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel, high flow sheet flow to Bay	13.4	4.0	5.5	0.2													
19	onstreet BMPs , treated stormdrain, outfall to Bay with high flow channel	8.4	1.1	3.5														
22	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay, high flow sheet flow to Bay	6.3																
	OPEN SPACE (not delineated)	164.1																
	TOTAL	496.0	9.3	14.9	77.3	0.6	0.0	6.4	0.0	27.3	0.0	39.9	0.0	0.0	5.0	0.0	0.0	0.0

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs

Drainage Area[1]	Sumary of SW Management Approach[1]	Office / Regional Retail	Residential Density I / Neighborhood Retail	Residential Density I / Parking	Residential Density I / Regional Retail	Residential Density II / Neighborhood Retail	Residential Density II / Research & Development	Residential Density III / Neighborhood Retail	Residential Density IV / Neighborhood Retail	Parks & Open Space	Composite C Factor
CANDLESTICK											
1	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), ouftall to Bay with high flow channel	2.6		0.4	1.4	2.0				16.4	0.54
2	untreated stormdrains, wetland/wetpond, sheet flow to Bay			0.1	0.0	0.1				29.0	0.31
3	onstreet BMPs, small open space BMPs, some sheet flow to Bay, some outfall to Bay									5.1	0.52
4	onstreet BMPs, large openspace BMPs, larege swales and naturalized channel to wetlands	2.5				0.1		0.4		11.3	0.40
5	onstreet BMPs, treated stormdrains and swales/filterstrips, 2 outfalls and 2 high flow channels to Bay					0.6		0.0		15.5	0.48
6	onstreet BMPs, large ope sapce BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland				1.4	0.1				23.5	0.48
7	onstreet BMPs, large open space BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland									2.9	0.47
11	on street BMPs, drains offsite									2.1	0.49
21	onstreet BMPs, swales/filterstrips, sheet flow to Bay with high flow channel									1.3	0.56
	OPEN SPACE (not delineated)									50.3	0.20
	TOTAL	**5.1**	**0.0**	**0.5**	**2.8**	**2.8**	**0.0**	**0.4**	**0.0**	**157.4**	
HUNTERS POINT											
8	swales and treated stormdrains, outfall to Bay with high flow channel									79.8	0.26
9	swales and treated stormdrains, outfall to Bay with high flow channel									11.7	0.64
10	swales and treated stormdrains, outfall to Bay, high flow sheet flow to bay									13.4	0.20
12	on street BMPs, treated stormdrain, outfall to Bay		1.8							8.2	0.54

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs

Drainage Area[1]	Sumary of SW Management Approach[1]	Office / Regional Retail	Residential Density I / Neighborhood Retail	Residential Density I / Parking	Residential Density I / Regional Retail	Residential Density II / Neighborhood Retail	Residential Density II / Research & Development	Residential Density III / Neighborhood Retail	Residential Density IV / Neighborhood Retail	Parks & Open Space	Composite C Factor
13	swales/filterstrips, outfall to Bay, high flow sheet flow to Bay									3.7	0.51
14	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), cistern/underground detention, ouftall to Bay		1.0			0.8	0.3			9.7	0.57
15 (Hilltop)	to City system???									0.0	0.70
16	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel					0.1			0.6	1.4	0.57
17	onstreet BMPs , treated stormdrain, naturalized channel, swale/filterstrip, outfall to Bay with high flow channel									4.9	0.51
18	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel, high flow sheet flow to Bay									3.8	0.56
19	onstreet BMPs , treated stormdrain, outfall to Bay with high flow channel									3.7	0.48
22	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay, high flow sheet flow to Bay									6.3	0.20
	OPEN SPACE (not delineated)									164.1	0.20
	TOTAL	0.0	2.8	0.0	0.0	0.9	0.3	0.0	0.6	310.8	

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III

ATTACHMENT B2.3
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed
Assumptions:

Land Use	Cfactor
Residential Density I	0.70
Residential Density II	0.70
Residential Density III	0.70
Residential Density IV	0.70
Regional Retail	0.75
Neighborhood Retail	0.70
Office	0.70
Research & Development	0.75
Hotel	0.85
Stadium	0.80
Arena	0.90
Parking	0.90
Community Facility	0.70
Arena / Regional Retail	0.83
Community Facility / Neighborhood Retail	0.70
Hotel / Parking	0.88
Office / Regional Retail	0.70
Residential Density I / Neighborhood Retail	0.70
Residential Density I / Parking	0.80
Residential Density I / Regional Retail	0.73
Residential Density II / Neighborhood Retail	0.70
Residential Density II / Research & Development	0.73
Residential Density III / Neighborhood Retail	0.70
Residential Density IV / Neighborhood Retail	0.70
Parks & Open Space	0.20

References:

1 Arup, LID Stormwater Opportunities Study, Figures 15 &16
Subarea land use breakdown from W&K GIS analysis

RAINFALL INPUT: (DWR gage #E70 7772 00)

	5-minute peak intensity		depth (24 hour)	
2 yr*	2.35	inches/hour	2.09	inches
5 yr	2.90	inches/hour	2.94	inches
10 yr	3.32	inches/hour	3.6	inches
100 yr	4.83	inches/hour	5.23	inches
average annual rainfall			21.3	inches

* adjusted for partial duration series (see Handbook of Applied Hydrology Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Appendix M2 BASELINE Water Quality Data Analysis, November 2009

Appendix M2 Water Quality Data Analysis

This Appendix is an evaluation of in-Bay pathogen indicator[1] quality data collected in the vicinity of the Project site as part of the City's Beach Water Quality Monitoring Program, and stormwater runoff data collected by the Navy and its tenants at the Hunters Point Shipyard in accordance with the requirements of the Industrial General Permit.

Beach Water Quality

Table M-1 through Table M-3 summarize the shoreline beach water quality monitoring data collected by the San Francisco Public Utilities Commission (SFPUC) and San Francisco Department of Public Health for the Beach Water Quality Monitoring Program[2] in the vicinity of the Project site. BASELINE obtained the data for this analysis from the SFPUC. The three sampling locations discussed in this Appendix are Jack Rabbit Beach (Station No. 301.2), Windsurfer Circle (Station No. 301.1), and Sunnydale Cove (Station No. 300.1). The sampling locations are shown on Figure III M-1. The sampling locations are in the proximity of combined sewer overflow outfall 043 (Candlestick Cove) and are south of outfall 042 (South Basin) (see Figure III.M-2).

Table M-1 through Table M-3 summarize the pathogen indicator data collected from 2004-2008 for total coliform, *Escherichia* coli (E. coli), and enterococcus bacteria. For this analysis, BASELINE separated the data into wet and dry weather samples, with wet weather samples defined as samples collected when the sum of the daily and 24-hour antecedent rainfall depths was greater than or equal to 0.1 inch (because generally smaller rain events are not likely to produce stormwater runoff). Dry weather samples represent data collected when the sum of the daily and 24-hour antecedent rainfall depths was less than 0.1 inch. Each table shows the number of samples, the number of non-detect results, the number of samples that exceeded the quantification range of the analysis (and were not diluted and reanalyzed; therefore the reported values are lower than actual concentrations and give the results a low bias), the average and median concentrations, and the coefficient of variation (CV) (i.e., the standard deviation divided by the average concentration; the CV provides an indication of data variability).

Generally among the three sampling locations, Jack Rabbit Beach has the lowest total coliform, E. coli, and enterococcus bacteria concentrations for both wet and dry weather, and Windsurfer Circle has the highest pathogen concentrations. Generally pathogen indicator concentrations are significantly higher in wet weather than in dry weather for all three stations.

The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) includes water quality objectives for total coliform (and fecal coliform, which was not monitored as part of the Beach Water Quality Monitoring Program), but not for E. coli or enterococcus bacteria. For total coliform, the Basin

1 Although they are not generally harmful themselves, pathogen indicators indicate the possible presence of disease-causing bacteria, viruses, and protozoa.

2 San Francisco Public Utilities Commission, website: http://sfwater.org/detail.cfm/MC_ID/20/MSC_ID/198/MTO_ID/515/C_ID/3554, accessed August 3, 2009.

Plan objective states that the median concentration should be less than 240 Most Probable Number [MPN] per 100 milliliters [mL]. The wet weather median concentrations for total coliform at all three stations exceeded the Basin Plan objective; however the dry weather median concentrations did not exceed the objective. The Basin Plan also has a single sample objective, which is that no sample should exceed 10,000 MPN/100 mL. As indicated in Table M-1, 20 wet weather samples exceeded the Basin Plan objective for total coliform at Sunnydale Cove, 42 wet weather samples exceeded at Windsurfer Circle, and no wet weather samples exceeded the Basin Plan single sample objective at Jack Rabbit Beach. Eleven dry weather samples exceeded the single sample standard at Windsurfer Circle, two dry weather samples exceeded at Jack Rabbit Beach, and no dry weather samples exceeded the Basin Plan single sample standard for total coliform at Sunnydale Cove.

TABLE M-1
SUMMARY OF TOTAL COLIFORM DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	8	1	10	0	18	1
No. Samples that Exceeded Quantification Range of the Analysis(1)	0	11	5	30	1	0
Average [MPN/100 mL]	413	5,772	1,729	10,010	350	947
Coefficient of Variation (CV)(2)	2.1	1.5	2.7	1.0	5.1	1.4
Median [MPN/100 mL] (Basin Plan Standard median < 240)(3)	134	1,296	193	5,794	63	345
No. samples > 10,000 MPN/100 mL (Basin Plan Standard)(4)	0	20	11	42	2	0

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission.

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

"Wet" and "Dry" samples were defined based on rainfall amounts. A "Wet "sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 0.1 inch. A "Dry" sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis of the sample was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

(3) The Basin Plan objective is based on a minimum of five consecutive samples equally spaced over a 30-day period. This analysis compares the objective to the median of all data collected from 2004-2008.

(4) The Basin Plan objective states that no single sample should exceed 10,000 MPN/ml.

TABLE M-2
SUMMARY OF E. COLI DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	71	8	58	4	76	13
No. Samples that Exceeded Quantification Range of the Analysis(1)	0	3	0	2	0	0
Average [MPN/mL]	96	1,649	137	2,215	77	147
Median [MPN/mL]	20	121	20	245	10	41
Coefficient of Variation (CV)(2)	2.9	3.0	5.3	2.1	3.4	1.7

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

"Wet" and "Dry" samples were defined based on rainfall amounts. A "Wet "sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 0.1 inch. A "Dry" sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

The Basin Plan does not include water quality objectives for E. Coli.

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

TABLE M-3
SUMMARY OF ENTEROCOCCUS DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	107	12	100	9	131	15
No. Samples that Exceeded Quantification Range of the Analysis[1]	0	2	0	2	0	0
Average [MPN/mL]	55	1,352	80	1,672	24	152
Median [MPN/mL]	10	98	10	217	10	31
Coefficient of Variation (CV)[2]	2.7	3.2	4.7	2.6	1.9	2.3

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

"Wet" and "Dry" samples were defined based on rainfall amounts. A "Wet "sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 1.0 inch. A "Dry" sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

The Basin Plan does not include water quality objectives for Enterococcus bacteria.

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

Hunters Point Shipyard Industrial Stormwater Discharge Quality

The Navy and tenants at the Hunters Point Shipyard (HPS) collect stormwater runoff water quality data in accordance with the Industrial General Permit (Water Quality Order No. 97-03-DWQ, NPDES General Permit No. CAS000001). The Industrial General Permit requires implementation of a stormwater monitoring program. In accordance with the General Permit, the discharger must:

- Collect samples from two storm events per year including the first storm of the wet season (from all outfalls producing a discharge), and any additional storm event (in the case of a deviation, the discharger must report why the first qualifying storm was not sampled and/or why a second storm was not sampled). Stormwater runoff samples must be collected within the first hour of discharge, and "qualifying" events must be preceded by three working days with no precipitation that causes a discharge.
- Analyze samples for total suspended solids (TSS), pH, conductivity, and total organic carbon (TOC); oil and grease may be substituted for TOC. Additional parameters, which are identified in Table D of the Industrial General Permit, may be required based on the facility's Standard Industrial Classification (SIC).
- Document and report the monitoring data in the Annual Report for Storm Water Discharges Associated with Industrial Activities, which must be submitted to the State Water Resources Control Board (if submitting electronically) or San Francisco Regional Water Quality Control Board (SFRWQCB) (if submitting a hardcopy report) by July 1 of each year.

The Draft Final 2005 Industrial General Permit (Draft Final Permit) contains parameter benchmark concentrations for certain constituents, which are derived from US EPA's Multi-Sector General Permit[3]. For this analysis, US EPA benchmarks[4] are compared to the HPS stormwater monitoring data to evaluate the magnitude of the concentrations, and average concentrations above benchmarks are considered to be elevated. However, the benchmarks will not take effect until Draft Final Permit is adopted.

Six Annual Reports for Storm Water Discharges Associated with Industrial Activity[5,6,7,8,9,10] representing the 2002-2003 through 2007-2008 reporting periods were available at the SFRWQCB for

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[3] The Multi-Sector General Permit is the industrial stormwater permit in areas where US EPA is the NPDES permit authority.

[4] The Draft Final 2005 Industrial General Permit contains parameter benchmark concentrations for certain constituents that are derived from US EPA's Multi-Sector General Permit. The benchmarks will take effect when the Draft Final Permit is adopted. The benchmarks are not numeric discharge limits, but are used to assess if site Best Management Practices (BMPs) are effective for reducing concentrations of pollutants of concern. The Draft Permit requires that if runoff concentrations are above one or more benchmarks, the discharger must revise its Storm Water Pollution Prevention Plan (SWPPP) to include more effective BMPs, and collect samples from the next two consecutive qualifying storms.

[5] Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

[6] Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

[7] Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

review (including the inactive industrial landfill). The HPS includes many parcels that are leased to other entities and the Annual Reports identify the industrial tenants associated with each outfall. The industrial facilities have various SICs; therefore, the list of additional parameters monitored at each outfall depends on the SIC of the facilities discharging to the outfall. Table M-4 summarizes the eleven discharge locations sampled at the HPS and identifies which discharge locations are associated with the industrial landfill.

Stormwater runoff data from each outfall are summarized in Table A.M-5 through Table III.M-15. The tables include the number of samples collected, the number of non-detects, the average concentration, and the parameter benchmark from the 2005 Draft Final Permit. Data from one or more outfalls exceeded parameter benchmarks for conductivity, TSS, total copper, total zinc, and total lead. The benchmarks for conductivity and TSS were exceeded most frequently.

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[8] Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

[9] Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

[10] Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

TABLE M-4
SUMMARY OF DISCHARGE LOCATIONS SAMPLED AT THE HPS FOR THE INDUSTIRAL GENERAL PERMIT

Outfall	Location
1	39-inch diameter pipe located east of Building 144 and west of Building 145. In 2007-02008, the location was changed to a gravel swale east of Building 144 and north of Building 146. The drainage area and associated industrial activities did not change.
7	33-inch diameter pipe east of Building 130 and northwest of Building 133, near Berth 55
16	30-inch diameter pipe east of Building 236 and west of the North Berthing Slip
19	24-inch diameter pipe southeast of Building 368, at Berth 14
20	42-inch diameter pipe southeast of Building 306, at Berth 15
33	72-inch diameter pipe west of the base of Pier 3
OLF1	Overland flow from parking lot west of Building 916 and the unpaved area north of Building 916
OF101/OLF101	Swale by entrance of wetland west of landfill cap (associated with Parcel E-2 and Landfill)
DP1	Catch basin downstream of UCSF Compound pipe inlet to the underground storm drain (associated with Parcel E-2 and Landfill)
DP2	Catch basin north of landfill cap and east of USCF Compound (associated with Parcel E-2 and Landfill)
DP4	18-inch diameter pipe south of landfill cap (associated with Parcel E-2 and Landfill)

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

TABLE M-5
STORMWATER RUNOFF DATA FROM HPS OUTFALL 1

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	9	0	12,057	200
Total Suspended Solids [mg/L]	9	0	433	100
Oil & Grease [mg/L]	9	6	5.2	15
pH [Standard Units]	9	0	7.5	6.0 – 9.0
Total Organic Carbon [mg/L]	9	0	7.7	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-6
STORMWATER RUNOFF DATA FROM HPS OUTFALL 7

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	2	0	9,295	200
Total Suspended Solids [mg/L]	2	0	41	100
Oil & Grease [mg/L]	2	2	5.0	15
pH [Standard Units]	2	0	7.6	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-7
STORMWATER RUNOFF DATA FROM HPS OUTFALL 16

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	8	0	8,993	200

TABLE M-7
STORMWATER RUNOFF DATA FROM HPS OUTFALL 16

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Total Suspended Solids [mg/L]	8	0	154	100
Oil & Grease [mg/L]	8	7	4.9	15
pH [Standard Units]	8	0	7.5	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	2	0	3.3	168.54
Total Cadmium [µg/L]	2	2	1.0	15.9
Total Chromium [µg/L]	2	0	4.5	None
Total Copper [µg/L]	8	0	72	63.6
Total Lead [µg/L]	2	0	21	81.6
Total Mercury [µg/L]	2	2	0.2	2.4
Total Nickel [µg/L]	2	0	6.8	1,417
Total Selenium [µg/L]	2	0	6.3	238.5
Total Zinc [µg/L]	8	0	267	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

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Source: Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-8
STORMWATER RUNOFF DATA FROM HPS OUTFALL 19

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	8	0	976	200
Total Suspended Solids [mg/L]	8	1	65	100
Oil & Grease [mg/L]	8	5	5.0	15
pH [Standard Units]	8	0	6.0	6.0 – 9.0
Total Organic Carbon [mg/L]	2	0	13.2	110
Total Arsenic [µg/L]	2	0	1.3	168.54
Total Cadmium [µg/L]	2	1	1.4	15.9
Total Chromium [µg/L]	2	0	7.7	None
Total Copper [µg/L]	8	0	66	63.6
Total Lead [µg/L]	2	0	73	81.6
Total Mercury [µg/L]	2	2	0.20	2.4
Total Nickel [µg/L]	2	0	8.2	1,417
Total Selenium [µg/L]	2	2	1.0	238.5
Total Zinc [µg/L]	8	0	188	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOC/PAH = Semi-volatile organic compound/polynuclear aromatic hydrocarbon

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-9
STORMWATER RUNOFF DATA FROM HPS OUTFALL 20

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	8	0	2,600	200
Total Suspended Solids [mg/L]	7	0	97	100
Oil & Grease [mg/L]	8	5	5.3	15
pH [Standard Units]	8	0	6.2	6.0 – 9.0
Total Organic Carbon [mg/L]	8	0	13.7	110
Total Arsenic [µg/L]	2	1	1.1	168.54
Total Cadmium [µg/L]	2	1	1.1	15.9
Total Chromium [µg/L]	2	0	14.8	None
Total Copper [µg/L]	8	0	43	63.6
Total Lead [µg/L]	2	0	130	81.6
Total Mercury [µg/L]	2	2	0.20	2.4
Total Nickel [µg/L]	2	0	11.7	1,417
Total Selenium [µg/L]	2	2	1.0	238.5
Total Zinc [µg/L]	2	0	195	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the mean concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-10
STORMWATER RUNOFF DATA FROM HPS OUTFALL 33

Parameter	No. Samples	No. NDs[1]	Mean	Parameter Benchmark[2]
Conductivity [µmhos/cm]	10	0	920	200
Total Suspended Solids [mg/L]	9	0	620	100
Oil & Grease [mg/L]	10	6	5.5	15
pH [Standard Units]	10	0	7.3	6.0 – 9.0
Total Organic Carbon [mg/L]	7	0	25.3	110
Total Arsenic [µg/L]	2	0	2.2	168.54
Total Cadmium [µg/L]	2	2	1.0	15.9
Total Chromium [µg/L]	2	0	3.2	None
Total Copper [µg/L]	9	0	148	63.6
Total Lead [µg/L]	2	0	15	81.6
Total Mercury [µg/L]	2	1	0.25	2.4
Total Nickel [µg/L]	2	0	6.8	1,417
Total Selenium [µg/L]	2	2	1.0	238.5
Total Zinc [µg/L]	2	0	61	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source: Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

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Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-11
STORMWATER RUNOFF DATA FROM HPS OUTFALL OLF1

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	2	0	435	200
Total Suspended Solids [mg/L]	2	0	357	100
Oil & Grease [mg/L]	2	1	5.4	15
pH [Standard Units]	2	0	7.6	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE A. M-12
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP1

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	5	0	248	200
Total Suspended Solids [mg/L]	5	0	149	100
Oil & Grease [mg/L]	5	2	4.3	15
pH [Standard Units]	5	0	7.7	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	5	3	6.1	168.54
Total Cadmium [µg/L]	5	4	4.1	15.9
Total Chromium [µg/L]	5	2	39.7	None
Total Copper [µg/L]	5	0	158	63.6
Total Lead [µg/L]	5	1	45	81.6
Total Mercury [µg/L]	5	3	0.63	2.4
Total Nickel [µg/L]	5	1	74.1	1,417
Total Selenium [µg/L]	5	4	6.0	238.5
Total Zinc [µg/L]	5	0	314	117
PCB Aroclors [µg/L]	3	3	Note (3)	None
SVOCs/PAHs [µg/L]	4	Note (4)	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All results were ND and ranged from < 0.3 - < 1.3 µg/L.

(4) Three parameters were detected just above the Practical Quantitation Limit for one sampling event. All other results were ND and ranged from < 9.4 - < 49 µg/L.

TABLE M-13
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP2

Parameter	No. Samples	No. NDs[(1)]	Average	Parameter Benchmark[(2)]
Conductivity [µmhos/cm]	4	0	160	200
Total Suspended Solids [mg/L]	4	0	138	100
Oil & Grease [mg/L]	4	2	4.8	15
pH [Standard Units]	4	0	7.3	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	4	4	6.2	168.54
Total Cadmium [µg/L]	4	4	5.0	15.9
Total Chromium [µg/L]	4	2	30.1	None
Total Copper [µg/L]	4	0	222	63.6
Total Lead [µg/L]	4	3	53	81.6
Total Mercury [µg/L]	4	4	0.98	2.4
Total Nickel [µg/L]	4	1	58.2	1,417
Total Selenium [µg/L]	4	2	7.5	238.5
Total Zinc [µg/L]	4	3	339	117
PCB Aroclors [µg/L]	2	Note (3)	Note (3)	None
SVOCs/PAHs [µg/L]	4	4	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All Aroclors were detected in the first sampling event at concentrations ranging from 0.57 – 1.10 µg/L. Only Aroclor 1221 was detected in the second sampling event at 0.94 µg/L.

(4) All results were ND and ranged from < 9.4 - < 50 µg/L.

TABLE M-15
STORMWATER RUNOFF DATA FROM HPS OUTFALL OF101/OLF101

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [µmhos/cm]	4	0	1,340	200
Total Suspended Solids [mg/L]	4	0	6	100
Oil & Grease [mg/L]	4	2	4.8	15
pH [Standard Units]	4	0	7.8	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	4	4	16.3	168.54
Total Cadmium [µg/L]	4	4	5.0	15.9
Total Chromium [µg/L]	4	2	8.2	None
Total Copper [µg/L]	4	0	71	63.6
Total Lead [µg/L]	4	3	5	81.6
Total Mercury [µg/L]	4	4	0.20	2.4
Total Nickel [µg/L]	4	1	15.6	1,417
Total Selenium [µg/L]	4	2	10.0	238.5
Total Zinc [µg/L]	4	3	31	117
PCB Aroclors [µg/L]	2	2	Note (3)	None
SVOCs/PAHs [µg/L]	4	Note (4)	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and Mactec Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All results were ND and ranged from < 0.5 - < 0.99 µg/L.

(4) Only one parameter was detected just above the Practical Quantitation Limit for one sampling event. The other results were ND and ranged from < 9.4 - < 50 µg/L.

TABLE M-15
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP4

Parameter	No. Samples	No. NDs	Result	Parameter Benchmark[(1)]
Conductivity [µmhos/cm]	1	0	590	200
Total Suspended Solids [mg/L]	1	0	73	100
Oil & Grease [mg/L]	1	0	5	15
pH [Standard Units]	1	0	7	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	0	110
Total Arsenic [µg/L]	1	1	< 5	168.54
Total Cadmium [µg/L]	1	1	< 5	15.9
Total Chromium [µg/L]	1	0	8	None
Total Copper [µg/L]	1	0	39	63.6
Total Lead [µg/L]	1	0	20	81.6
Total Mercury [µg/L]	1	1	< 0.2	2.4
Total Nickel [µg/L]	1	0	14	1,417
Total Selenium [µg/L]	1	1	< 10	238.5
Total Zinc [µg/L]	1	0	46	117
PCB Aroclors [µg/L]	1	1	< 0.49 - < 0.98	None
SVOCs/PAHs [µg/L]	1	1	< 9.9 - < 50	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

Appendix N1 PBS&J Candlestick Point/Hunters Point Shipyard Project Biological Resources Technical Report, December 2008, Updated November 2009

Candlestick Point/ Hunters Point Shipyard Project Biological Technical Report

San Francisco County, California

Prepared for:

San Francisco Redevelopment Agency
San Francisco Planning Department

Prepared by:

PBS&J

December 11, 2008

(Updated November 2, 2009)

Candlestick Point/Hunters Point Shipyard Project
Biological Technical Report

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EXECUTIVE SUMMARY

The Candlestick Point–Hunters Point Shipyard Phase II (CPHPS) Development Plan (Project) is located on approximately 702-acre area east of US 101 in the southeast area of the City and County of San Francisco (City). It occupies the waterfront area from south of India Basin to Candlestick Cove. The Project proposed by Lennar Urban includes a mixed-use community with a wide range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers National Football League (NFL) team. Additionally, new transportation and utility infrastructure would serve the Project including a bridge across Yosemite Slough. The description of the Project is organized under two major sub-components: Candlestick Point and Hunters Point Shipyard (HPS) Phase II.

For the purpose of this biological study, PBS&J reviewed conditions in the Project Site, as shown in Figure 1, Study Area. In addition, the study includes a more general review of conditions and in aquatic areas adjacent to the Project Site shoreline. The Project Site and the aquatic areas, including Yosemite Slough, are referred to as the "Study Area" in this report. PBS&J completed a biological study of the Project during the summer of 2007 and during 2008. This study included a field survey of the parcels, documenting existing habitats, the plants and animals occurring in those habitats, and any significant habitat types that may be protected by state and federal law. Additional studies reviewed by PBS&J for this project included a delineation of wetlands and other waters of the U.S. and a tree survey prepared by H. T. Harvey & Associates, and information on biological resources of the area described in other reports.

As shown in Figure 2, the Study Area supports six vegetation communities, in addition to urban/developed areas:

1. landscaped areas/ornamental plants;
2. non-native grassland;
3. freshwater wetland;
4. tidal salt marsh
5. nontidal salt marsh; and
6. mudflats/open water.

Landscaped/ornamental and non-native annual grassland habitats occupy much of Candlestick Point, while HPS Phase II and much of Candlestick Point consist largely of urban/developed areas. Small areas of freshwater wetlands and nontidal salt marsh are present on HPS Phase II, and

narrow strips of tidal salt marsh are present along the shoreline at scattered places on Candlestick Point and portions of HPS Phase II.

Although the vegetation of the Project area is largely dominated by non-native plants, native plants and a number of native wildlife species are present on the site. No special-status plants have been recorded, and none are expected to occur, on the site, although several species of special-status animals are present.

Jurisdictional wetlands and other waters of the U.S./State are present on the site, including the tidal and non-tidal wetlands and the aquatic habitats that surround the site. Eelgrass beds and Essential Fish Habitat, both sensitive biological habitats, are also present on/adjacent to the site.

INTRODUCTION

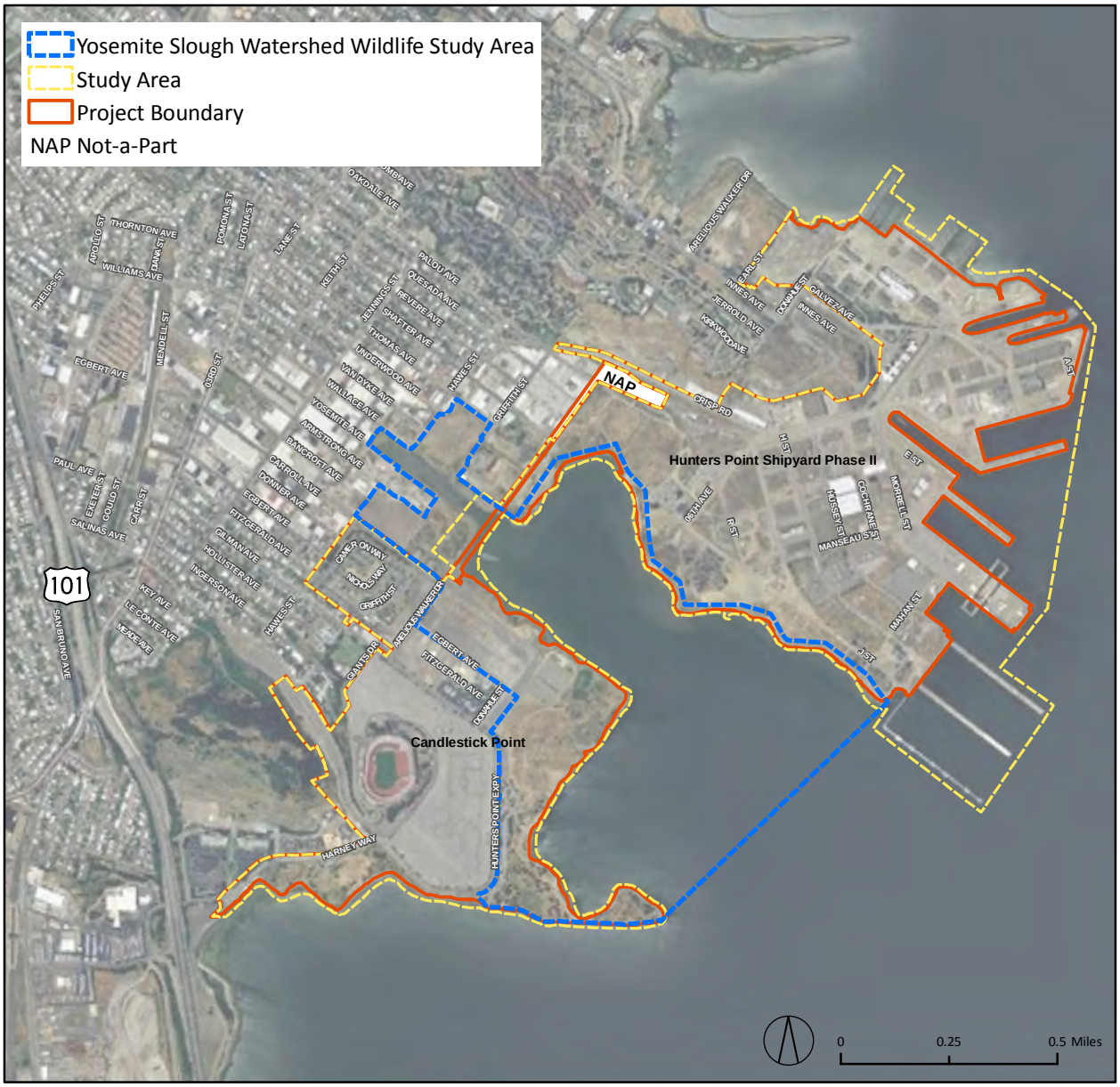
The Candlestick Point–Hunters Point Shipyard Phase II (CPHPS) Development Plan (Project) is located on approximately 702-acre area east of US 101 in the southeast area of the City and County of San Francisco (City; see Figure 1). It occupies the waterfront area from south of India Basin to Candlestick Cove. The Project proposed by Lennar Urban includes a mixed-use community with a wide range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers National Football League (NFL) team. Additionally, new transportation and utility infrastructure would serve the Project including a bridge across Yosemite Slough. The description of the Project is organized under two major sub-components: Candlestick Point and Hunters Point Shipyard (HPS) Phase II.

This report discusses biological resources present on and potentially affected by the proposed Project. Biological resources surveys were conducted to identify existing biological resources present on the site and to determine if habitats present on the site could support any special-status plant or wildlife species present in the region, and to document any occurrences of those species, if observed during the field survey. In addition, this report includes a summary of the applicable laws and regulations related to biological resources and the resource agencies responsible for their implementation.

METHODOLOGY

BIOLOGICAL RESOURCES STUDY

In order to assess existing conditions and potential Project-related impacts, PBS&J staff biologists conducted reconnaissance-level surveys of the Project site on August 9, 2007, May 5, 2008, and July 8, 2008. The Study Area for this biological resources analysis includes both developed and undeveloped portions of HPS Phase II and Candlestick Point, including the entire Candlestick Point State Recreation Area (CPSRA), as well as off-site open waters adjacent to the Project site that could be impacted by Project components (Figures 1 and 2). The off-site aquatic resources discussed include Yosemite Slough, the open water area between Candlestick Point and HPS Phase II (known as South Basin), and adjacent open waters that could be impacted by Project components. For purposes of the evaluation of sensitive species, the Study Area is defined as the Project site and a radius of up to 5 miles beyond the Project site. Surveys of Candlestick Point included the Candlestick Park stadium, Alice Griffith housing, the Candlestick Park State Recreation Area (including Yosemite Slough), Jamestown Avenue, and 16 acres near Gilman Avenue and Aurelious Walker Drive. Surveys of HPS Phase II included the Hunters Point Shipyard (Parcels A-E).

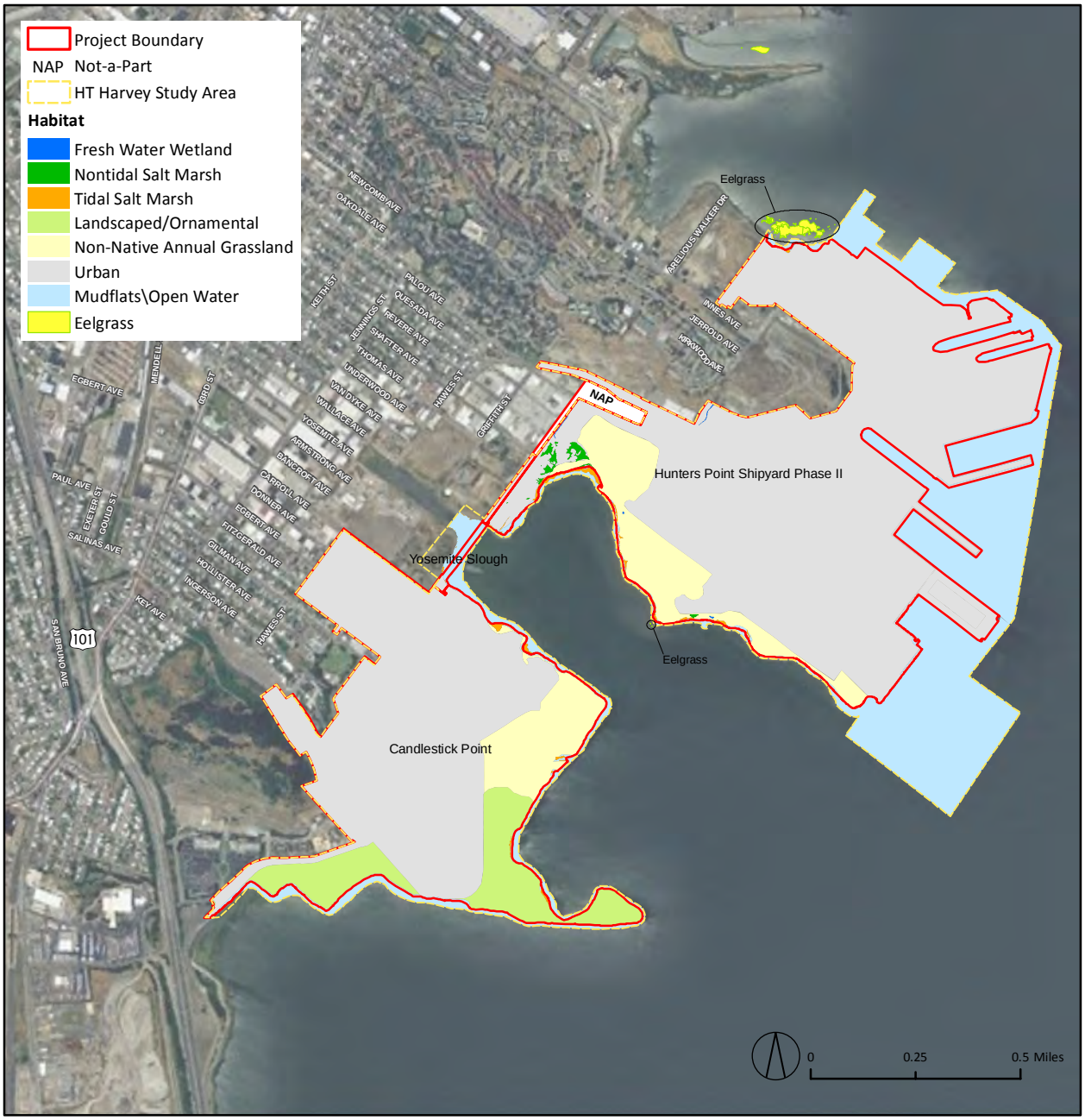


HT Harvey, 2009; LSA Associates, 2004.

PBS&J 10.27.09

FIGURE 1 Candlestick Point - Hunters Point Shipyard Phase II EIR

BIOLOGICAL RESOURCES STUDY AREA



SOURCE: Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007. Golden Gate Audubon Society, Final Report Yosemite Slough Watershed Wildlife Survey, H.T. Harvey & Associates, Hunters Point Shipyard and Candlestick Point State Recreation Areas Final Delineation of Wetlands and other Waters, February 2009 and revised July and October 2009. LSA, July 2004, PBS&J Field Survey, August 2007 and May 2008, Merkel and Associates, 2003 SF Bay eelgrass survey.

PBS&J 10.19.09

FIGURE 2 Candlestick Point - Hunters Point Shipyard Phase II EIR

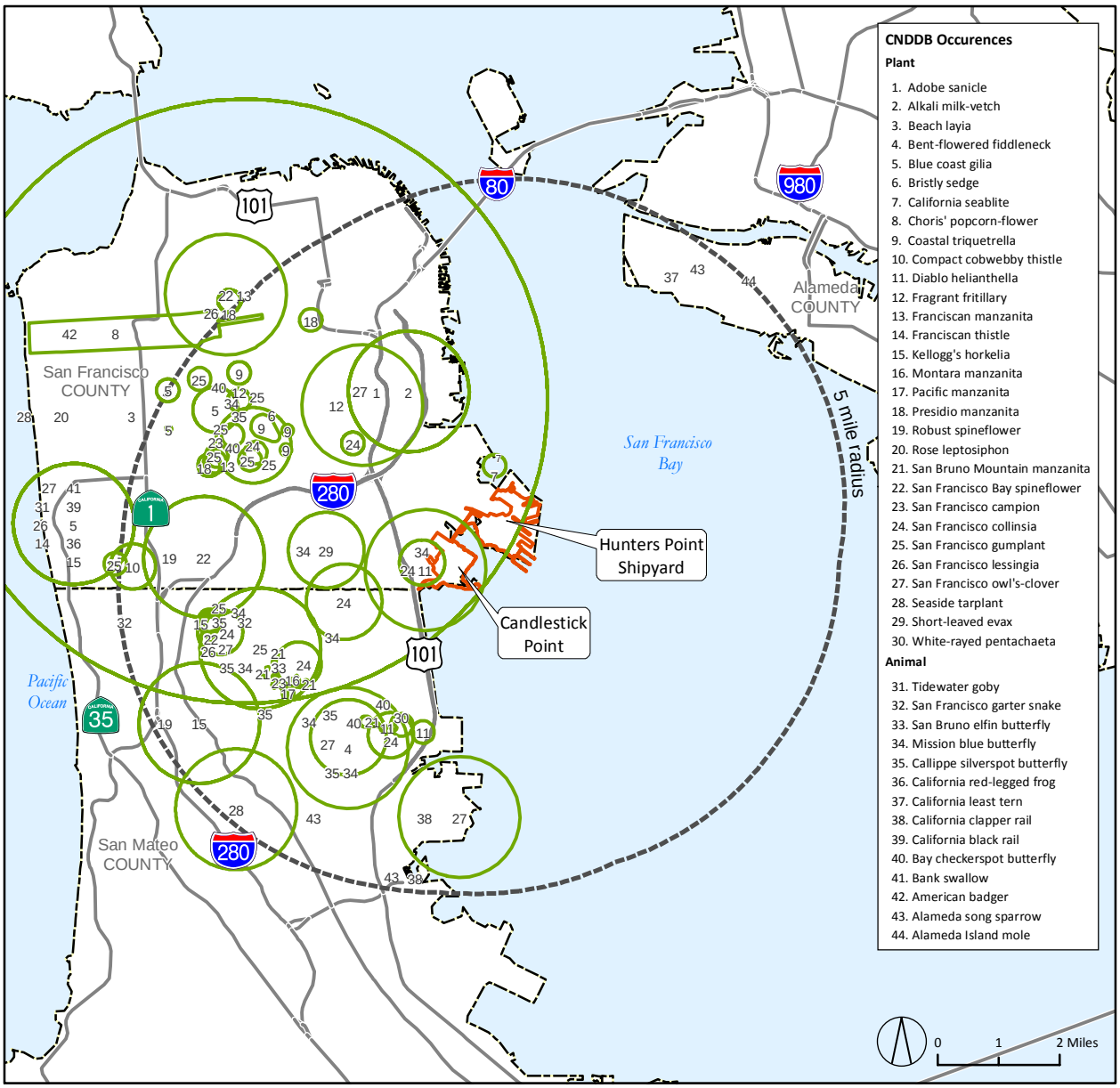
STUDY AREA HABITATS

Prior to visiting the Study Area, PBS&J biologists compiled a list of special-status plant and wildlife species that have the potential to occur in the vicinity of the Study Area. Sources consulted include the California Department of Fish and Game's (CDFG) Natural Diversity Database (CNDDB) for the US Geological Survey's (USGS) 7.5-minute San Francisco South and Hunters Point quadrangles; the California Native Plant Society (CNPS) electronic inventory for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles; the US Fish and Wildlife Service (USFWS) Endangered and Threatened Species list for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles; the *Final Report Yosemite Slough Watershed Wildlife Survey*, LSA, July 2004; the *Final Draft Significant Natural Resource Areas Management Plan*, Sections 6.17 and 6.18, San Francisco Recreation And Park Department, February 2006; the *Draft Wetlands Mitigation and Monitoring Plan*, Navy Base Realignment and Closure Program, November 2006; the *Hunters Point Shipyard and Candlestick Point State Recreation Area*, *Natural Environment Study Report for the Bayview Transportation Improvements Project*, Jones & Stokes, July 2007; the *Final Delineation of Wetlands and Other Waters*, H.T. Harvey & Associates, Revised 13 July 2009 and October 13, 2009; the *Draft Sustainability Plan* for the Project, Arup North America Ltd, March 2009; and Project plans and graphic renderings.

The CNDDB was re-checked in July 2009, and CNDDB records were mapped (Figure 3). Special-status species lists from the CNDDB, USFWS, and CNPS were re-checked on November 2, 2009 to determine whether any species that could potentially occur on the site were added to these databases between the date of initial consultation of these lists and the preparation of the updated report on November 2, 2009.

SURVEY METHODOLOGY

Surveys focused on identification of vegetation communities, special-status species or their potential habitat, and other biotic resources (i.e., potential wetlands or "other waters" of the US). During surveys, biologists walked transects through each habitat type while recording plant and wildlife species observed in field notes. On July 8, 2008, Navy personnel escorted a PBS&J staff biologist through HPS Phase II. The August 2007 and July 2008 surveys were in the dry season, when most annual, biennial, and perennial herbaceous plant species were dormant or had already died back, leaving only dried plant parts (i.e., leaves, stems, fruits) for identification. Lastly, a rare plant survey was conducted in May 2008. The survey was conducted by walking representative transects through the survey area while recording every plant species observed. Although the survey was conducted within the flowering window for the special-status species that could occur within the Project site, the unusually dry weather resulted in a shorter flowering period and thus, most annual, biennial, and perennial herbaceous plant species were dormant or had already died back for the growing season, leaving only dried plant parts (i.e., leaves, stems, fruits) for identification. If a plant species could not be identified in the field, diagnostic plant structures (i.e., fruits or morphology)



SOURCE: California Department of Fish & Game, California Natural Diversity Database, July 2009. **PBS&J 8.04.09**

FIGURE 3 Candlestick Point - Hunters Point Shipyard Phase II EIR

SPECIAL-STATUS SPECIES OCCURENCES WITHIN 5 MILE RADIUS

were collected for further analysis. Some plants observed during the survey could only be identified to the Genus level.[1] Floristic references for identification included *The Jepson Manual: Higher Plants of California*[2], *Plants of the San Francisco Region*[3], and specimens documented during previous CNPS surveys.[4]

Information from the sources listed above and from PBS&J's reconnaissance-level surveys was used to identify and characterize existing conditions at the Project site, and accordingly, was substantially relied upon for this analysis. In particular, LSA's Yosemite Slough Watershed Wildlife Survey (2004) and the Final Delineation of Wetlands and Other Waters conducted by H.T. Harvey & Associates (2009) provided specific information about the Study Area. LSA coordinated a wildlife survey of the Yosemite Slough Watershed between January 2003 and April 2004.[5] The survey of the Yosemite Slough Watershed included both the entire CPSRA and adjacent open water areas between HPS Phase II and the peninsula that forms the eastern extension of CPSRA.[6] From north to south, the Yosemite Slough Watershed Wildlife Survey Study Area is roughly bordered by Thomas Avenue, Ingalls Street, Carroll Avenue, Fitch Street, Arelious Walker Drive, and the Hunters Point Expressway (Figure 1). Although this survey covered only a portion of the Project site, it provides the most comprehensive data set available regarding the occurrence of wildlife in the area, and is thus cited heavily in the descriptions of existing conditions in this section. Also, because the majority of the Project site that was not covered by the Yosemite Slough Watershed Wildlife Survey is developed, we expect wildlife communities elsewhere on the Project site to be similar or depauperate in comparison to, those documented within the Yosemite Slough Survey's study area.

H.T. Harvey & Associates prepared a delineation of wetlands and other jurisdictional waters potentially meeting the regulatory definition of Waters of the United States within a majority of the Project site (February 2009 and revised on July 13 and October 13, 2009).[7] Surveys were conducted in 2008 on September 25 and 26; November 5 and 6; and December 4, 5, and 19; and in 2009 on

[1] Plants that were identified to the Genus level are not special-status or rare plants, and, therefore, this taxonomic unit of classification does not affect the findings of this report.

[2] Hickman, J. (ed.). *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley, 1993.

[3] Beidleman, L.H. and Kozloff, E.N. *Plants of the San Francisco Bay Region: Mendocino to Monterey*. University of California Press, Berkeley, 2003.

[4] California Native Plant Society (CNPS), *Electronic plant list; Hunters Point Serpentine Hillside*, R. Hunter and J. Sigg, 2005.

[5] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[6] Ibid.

[7] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009

January 29 and 30 and May 20. The delineation included the examination of the above-mentioned areas for wetlands using the routine determination method outlined in the US Army Corps of Engineers (USACE) Wetlands Delineation Manual. H.T. Harvey assessed topographic features, drainages, potential alterations to site hydrology, and areas of significant recent disturbance, and mapped the High Tide Line (HTL). The USACE verified the findings of the delineation with a Jurisdictional Determination dated August 31, 2009. The study area for H.T. Harvey's original wetland delineation did not include several limited areas that are now considered part of the Project site. As a result, H.T. Harvey expanded its original delineation by inspecting these additional areas in the field on October 8, 2009. H.T. Harvey & Associates has amended its wetland delineation report, and verification of jurisdictional boundaries in these additional areas by the USACE is pending. In addition, a tree survey[8] was conducted for the Project by H. T. Harvey & Associates within all of the Project site except the portion of CPSRA that is not subject to the land transfer and is not expected to be substantially modified.

Existing conditions are described with respect to observed plant species, vegetation communities, common aquatic habitats (i.e., mud flats, open water, and eelgrass (*Zostera marina*) beds), common wildlife (i.e.,. invertebrates, reptiles and amphibians, birds, and mammals), common aquatic resources (i.e., fish, shellfish, and mollusks), and sensitive species and habitats (sensitive plants, sensitive vegetation communities, sensitive wildlife [invertebrates, birds, terrestrial mammals, and marine mammals], and sensitive aquatic resources [mollusks, fish, and Essential Fish Habitat (see Sensitive Aquatic Resources)]).

RESULTS

OBSERVED PLANT SPECIES

As listed in Appendix D, a total of 187 vascular plant species were observed within the Project site during all of the biological surveys listed in the Setting section above, 103 of which are non-native. In addition, 66 of the non-native vascular plant species are considered to be invasive plant species.[9] Invasive plants are defined as those that were "moved by humans to another region." These invasive plants have a competitive advantage because they are no longer controlled by their natural predators, and can quickly spread out of control.[10] Widely scattered trees are present and appear to either be horticultural plantings associated with landscaping or represent locally naturalized

[8] H.T. Harvey & Associates, *Candlestick Point/Hunters Point Shipyard Tree Survey*. October 16, 2009.

[9] California Invasive Plant Council (Cal-IPC) Invasive plant definitions 2009. Website: http://www.cal-ipc.org/ip/definitions/index.php. Accessed July 2009.

[10] California Invasive Plant Council (Cal-IPC) Invasive plant definitions 2009. Website: http://www.cal-ipc.org/ip/definitions/index.php. Accessed July 2009.

specimens. Calflora's on-line Plant Name Library was used for the scientific nomenclature for plant names in this section.[11]

VEGETATION COMMUNITIES

For purposes of the biological resources analysis, the Study Area is first described in terms of the vegetation communities it supports, as reflected by Table 1 (Vegetation Communities within the Study Area) and further discussed below. The vegetation communities are defined according to CDFG Wildlife and Habitat Data Analysis Branch List of California Terrestrial Natural Communities[12] and H.T. Harvey & Associates' wetland delineation for HPS Phase II and Candlestick Point.[13]

Figure 2, Study Area Habitats, presents a summary of the vegetation communities observed in the Study Area. This map is a compilation of previously prepared figures for the Study Area and field surveys conducted by PBS&J.[14,15] As depicted on Figure 2, the Study Area contains four non-aquatic vegetation communities: non-native annual grassland, landscaped areas/ornamental plants, salt marsh, and seasonal freshwater wetland. In addition, approximately 568.80 acres of the Study Area is "urban." This habitat is not classified as a "vegetation community" and is thus not included in the "vegetation communities" table. Urban habitat includes developed or paved areas. The Study Area also contains three aquatic habitats: mud flats, eelgrass beds, and open waters. Table 1 provides the total acreages of each vegetation community within the Study Area. A description of each of the vegetation communities follows this table.

In some cases, vegetation communities may also be considered sensitive vegetation communities. In those cases, and there are three such cases in this analysis, they are also discussed under Sensitive Vegetation Communities, which follows this discussion. The three sensitive communities within the Study Area include salt marsh, eelgrass beds, and seasonal freshwater wetland habitats (also discussed under Sensitive Vegetation Communities).

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[11] Calflora, 2009. Website: http://www.calflora.org/index.html. Accessed July 2009.

[12] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database,* Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[13] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[14] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[15] Golden Gate Audubon Society, Final Report Yosemite Slough Watershed Wildlife Survey, LSA, July 2004.

TABLE 1 VEGETATION COMMUNITIES WITHIN THE STUDY AREA

Habitat Type	Candlestick Point	Hunters Point Shipyard	Yosemite Slough	Total Acreage
Non-native Annual Grassland	30.53	44.19	—	74.72
Landscaped Areas/Ornamental Plants[a]	44.67	—	—	44.67
Salt Marsh[a]	0.93	3.56	0.06	4.55
Seasonal Freshwater Wetland[b]	—	0.20		0.20
Mud Flats/ Open Water*	21.82	169.29	4.43	195.54
Totals	***97.95***	***217.24***	***4.49***	***319.68***

SOURCES:

a. H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California*, February 2009 and revised July 13 and October 13, 2009.

Acreage discrepancies between the data contained herein and the total approximate acreage of the Study Area are due to the conversion of data from non-GIS to GIS data.

This table does not include the acreage for developed/urban areas (568.80 acres) because this classification is not a recognized vegetation community for purposes of this EIR.

* The open waters located outside of the Project boundary include those adjacent to Candlestick Point, Hunters Point Shipyard, and Yosemite Slough.

Non-native Annual Grassland

Patches of non-native annual grassland habitat are found throughout the Project site and comprise 74.72 acres. Invasive, non-native grasses characterize this community, particularly at HPS Phase II due to the intensive disturbance associated with the Navy's ongoing remediation efforts. The vegetation within this grassland consists of a mixture of invasive annuals such as wild oat (*Avena fatua*), rip-gut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), rat-tail fescue (*Vulpia myuros*), and hare barley (*Hordeum murinum var. leporinum*). Broad-leaf species occurring within the grasslands consist of wild radish (*Raphanus sativus*), painted charlock (*R. raphanistrum*), black mustard (*Brassica nigra*), Mediterranean linseed (*Bellardia trixago*), cut-leaf plantain (*Plantago coronopus*), spring vetch (*Vicia sativa*), red valerian (*Centranthus ruber*), and Italian thistle (*Carduus pycnocephalus*). Additionally, garland chrysanthemum (*Chrysanthemum coronarium*) has naturalized across much of the grasslands and showy stands of these flowers are present throughout the entire CPSRA.

Small distinct colonies of native perennial bunch grasses grow in a few areas at HPS Phase II. Clusters of single species or a combination of species including purple needle grass (*Nassella pulchra*), blue wild rye (*Elymus glaucus*), and red fescue (*Festuca rubra*) grow sporadically throughout the Project site. These small isolated occurrences of native grasses are not large enough to warrant identification as a separate vegetation community. Portions of the Study Area, including uplands along Yosemite Slough, include ruderal vegetation such as fennel (*Foeniculum vulgare*) intermixed with non-native grasses such as wild oats and Italian rye (*Lolium multiflorum*). Shrubs, mainly coyote brush (*Baccharis pilularis*), are scattered throughout the upland surrounding Yosemite Slough area.

Landscaped Areas/Ornamental Plants

Landscaped areas make up about 44.67 acres of Candlestick Point and include areas landscaped with native and non-native ornamental shrubs and trees, particularly near the walking paths along the shoreline of Candlestick Point. The tree survey[16] was conducted for the Project identified trees primarily in areas mapped as "Landscaped/Ornamental", "Urban", and "Non-Native Annual Grassland" on Figure 2. For the purpose of this survey, a "tree" was defined as any stem of a woody plant with a tree-like (as opposed to shrubby) growth habit measuring at least 2 inches in diameter at a height of 4.5 feet above the ground. As a result, single trees with multiple stems measuring at least 2 inches in diameter were represented as multiple "trees," and the high number of trees recorded during this survey was driven largely by such multi-stemmed individuals. The tree survey recorded approximately 1,876 tree stems at least 2 inches in diameter on 1,027 individual plants on Candlestick Point and 724 tree stems at least 2 inches in diameter on 283 individual plants on HPS Phase II.

On Candlestick Point, the vast majority of these trees consisted of multi-stemmed lollypop trees (*Myoporum laetum*); eucalyptus (*Eucalyptus* spp.), pines (*Pinus* spp.), and olives (*Olea europeaea*) were also well represented on Candlestick Point. All four of these species are non-natives. The most common native trees on Candlestick Point are California live oak (*Quercus agrifolia*), flannel bush (*Fremontodendron californicum*), and California buckeye (*Aesculus californica*). Monterey pine (*Pinus radiata*) and ornamental cypress (*Cupressus* spp.) are also common, although neither is native to San Francisco. There are several specimens of the native California bay (*Umbellularia californica*) and blue elderberry (*Sambucus nigra* ssp. *caerulea*) as well. Non-native, ornamental lollypop trees (*Myoporum laetum*) grow along the northwestern edge of Candlestick Point, and Australian tea trees (*Leptospermum laevigatum*) are scattered along the trails of the CPSRA. Native shrubs include coyote bush, ornamental buckbrush (*Ceanothus* spp.), firethorn (*Pyracantha* spp.), coffeeberry (*Rhamnus californica*), hummingbird sage (*Salvia spathacea*), and black sage (*S. mellifera*) which grow along the paths in clusters that are a combination of planted and volunteer specimens. Non-native evergreen shrubs such as rockrose (*Cistus* spp.) are common throughout the Project site and in some locations have naturalized.[17]

On HPS Phase II, trees recorded during the tree survey were dominated by small, multi-stemmed toyon (*Heteromeles arbutifolia*; a native species, though the trees on HPS appear to be of an ornamental variety) and several non-natives, including London planetree (*Platanus* x *acerifolia*) and acacia (*Acacia* spp.).

[16] H.T. Harvey & Associates, *Candlestick Point/Hunters Point Shipyard Tree Survey*. October 16, 2009.

[17] Naturalized plants are those that were originally installed as ornamental plantings but are now found growing 'naturally' in a variety of habitats.

Salt Marsh

Salt marsh habitat forms along the margins of estuaries and bays whose shorelines are shallow and protected. In the Study Area, it totals approximately 4.50 acres on site and 0.05 acre in areas of off-site (i.e., areas of Yosemite Slough outside of the Project boundary) Project work.[18] It occurs in limited areas along the shoreline where riprap does not extend to the waterline and prohibit the growth of vegetation, and in several nontidal areas in the southwestern portion of HPS. Narrow patches of salt marsh habitat, varying in length from 20 to 100 feet, occur sporadically along the shoreline of the Project site, and throughout Yosemite Slough.[19]

Salt marshes are often subject to tidal influences, and species composition of tidal salt marsh vegetation varies along gradients based on elevation. The amount of time an area is inundated determines the primary species of plants found there. The highest elevations typically support almost pure stands of pickleweed (*Salicornia virginica*), which also dominates the patches of nontidal salt marsh on HPS. Associated species that occur in the zone around the high tide elevation include salt grass (*Distichlis spicata*), European sea rocket (*Cakile maritima*), coastal gumweed (*Grindelia stricta*), and sea lavender (*Limonium californicum*). Slightly lower areas above the Mean High Water (MHW) elevation support cord grass (*Spartina* spp.). In the area above the HTL, common iceplant (*Carpobrotus edulis*) grows in some locations, carpeting the upland margins in a dense monoculture. The low growing shrub silver beach bur (*Ambrosia chamissonis*) also grows in the upland areas along the shoreline.

Seasonal Freshwater Wetland

Seasonal freshwater wetland habitat occupies 0.20 acre in two linear features at the southern and west-central margins of HPS Phase II. These wetlands are characterized by the presence of annual wetland grasses and forbs in depressions that hold water for a short to medium duration during the rainy season. One of these wetlands, in the southwestern portion of HPS Phase II, consists of pools that pools are shallow basins that lack drainage outlets. Seasonal water inundation in these pools creates a condition favoring hydrophytic (water-loving) plants such as spearscale (*Atriplex triangularis*), salt grass, bird's-foot trefoil (*Lotus corniculatus*), prickly ox-tongue (*Picris echioides*), saltmarsh bulrush (*Bolboschoenus robustus*), Italian ryegrass (*Lolium multiflorum*), rabbit's foot grass (*Polypogon monspeliensis*), and willow dock (*Rumex salicifolius*), as observed in HPS Phase II. The

[18] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[19] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

second seasonal freshwater wetland, in the west-central part of HPS Phase II, consists of a narrow swale/ditch that is apparently fed by groundwater seepage.

COMMON AQUATIC HABITATS

Mudflats

Mud flats are the broad expanses of the San Francisco Bay bottom that are exposed during low tides. These areas are comprised of very soft sediments and do not support any vegetation other than eelgrass beds, which may occur within mud flats. Mud flats are an important habitat because they support a vast array of crustaceans, worms, and other invertebrates that are important food sources for resident and migratory shorebirds and waterfowl. Mud flats are exposed at low tides once or twice a day along the shore south of CPSRA and along the shorelines of Yosemite Slough and South Basin. These mud flats are relatively limited in extent compared to the vast mud flats present in other parts of San Francisco Bay, and as a result, numbers of shorebirds using these mud flats are low except for occasional, brief migratory pulses of birds.

Open Water (San Francisco Bay)

San Francisco Bay (also referred to as "the Bay" in this section) is the largest estuary on the California Coast, covering between 400 and 1,600 square miles depending on which bays are included.[20] Fresh water enters primarily through the Sacramento-San Joaquin Delta and mixes with seawater that enters via the Golden Gate. Tidal action and freshwater runoff determine the salinity of the Bay. For the purpose of this assessment, the term "open water" refers to unvegetated tidal areas located below the MHW elevation, which in this area is approximately 5.87 feet relative to the North American Vertical Datum of 1988 (NAVD88)[21] or 11.80 relative to the San Francisco City Datum (SFCD).[22] This is the same area regulated by the USACE under Section 10 of the *Rivers and Harbors Act*. These areas are subject to the normal ebb and flood of the tide. For example, mud flat habitats described above are a subset of open water aquatic habitats since these areas are inundated for at least half the tidal cycle; for this reason, acreages of mud flat and open water habitats are not distinguished in Table 1. Open water habitats support an array of relatively common estuarine/marine species from encrusting tunicates, sponges, and algae to bottom-dwelling fish such

[20] The Bay Institute, *About the Bay*. 2008. Website: http://www.bay.org/about_the_bay.htm. Accessed October 28, 2008.

[21] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[22] San Francisco City Datum (SFCD) is a local vertical geodetic reference system specific to the City and County of San Francisco and formally established in 1964 as 8.616 feet above the National Geodetic Vertical Datum of 1929 (NGVD29), making it about 8.13 feet above mean sea level. The North American Vertical Datum was established in 1988 (NAVD88) and generally has replaced NGVD29 as a standard reference. Elevations expressed in NGVD29 may be converted to NAVD88 by adding 2.69 feet.

as the Pacific halibut (*Hippoglossus stenolepis*), flounder, and sole, to more open water fish such as the Pacific herring (*Clupea pallasi*), Pacific sardine (*Sardinops sagax*), and anchovies (*Anchoa* spp.). The on-site open waters are those nearshore areas below the MHW elevation where Project work could occur (i.e., sea wall enhancements and marina improvements). Off-site open waters within a 5-mile radius of the Project site were also considered for their potential to support sensitive species (as described under "Sensitive Species and Habitats" below). These areas are considered here because most of the sensitive species potentially occurring there have the ability to move to and from the Study Area at any time.

Eelgrass Beds

Eelgrass is an aquatic plant found on soft mud-bottom bays and estuaries along the Pacific coast. It occurs in both subtidal and intertidal areas of San Francisco Bay and approximately 1.99 acres of it occur within the Study Area.[23] Eelgrass beds are considered a sensitive resource and, therefore, are discussed in detail under Sensitive Species and Habitats.[24]

COMMON WILDLIFE

Invertebrates

Fourteen butterfly species were observed during the Yosemite Slough Watershed Wildlife Survey.[25] Common butterflies observed during that survey included cabbage whites (*Pieris rapae*), anise swallowtails (*Papilio zelicaon*), and common checkered skippers (*Pyrgus communis*). Other butterflies observed include mustard white (*Pieris napi*), orange sulphur (*Colias eurytheme*), California hairstreak (*Satyrium californicum*), gray hairstreak (*Strymon melinus*), western pygmy-blue (*Brephidium exile*), spring azure (*Celastrina ladon*), west coast lady (*Vanessa annabella*), red admiral (*Vanessa atalanta*), common buckeye (*Junonia coenia*), and common ringlet (*Coenonympha tullia*). Numerous other invertebrate species, including insects, crustaceans, worms, and other taxa, occur on the site as well.

Reptiles and Amphibians

The Yosemite Slough Watershed Wildlife Survey recorded three snake species, two lizard species, and one amphibian.[26] Reptiles and amphibians observed included California slender salamander

[23] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database,* Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[24] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database,* Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[25] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004,* prepared by LSA, July 27, 2004.

[26] Ibid.

(*Batrachoseps attenuatus*), southern alligator lizard (*Elgaria multicarinata*), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), ring-necked snake (*Diadophis punctatus*), and western garter snake (*Thamnophis elegans*). The western fence lizard, California slender salamander, and southern alligator lizard were found in relatively high numbers, with survey maxima (i.e., the maximum number of individuals observed on a single survey) of 49, 43, and 21 individuals, respectively. However, the other species were represented by few individuals, suggesting that populations of these other species are sparse in the area.

Amphibians had the lowest diversity within the Yosemite Slough Watershed Survey area, with only one species observed (the California slender salamander).[27] The California slender salamander frequents grassland, chaparral, woodland, forest, and yards and vacant lots in some suburban areas. It takes refuge under logs, boards, bark, and in damp leaf litter and rotting logs. It lays its eggs in late fall and winter, often in communal nests.[28] The San Francisco Bay and the small seasonal wetlands on the site do not provide suitable aquatic habitat for amphibians, primarily due to high salinity. The few freshwater habitats on or near the Project site do not provide breeding habitat for amphibians such as frogs or toads, likely because of their very shallow and/or ephemeral nature.[29]

Reptiles also appeared to have relatively low diversity, with only five species observed. The abandoned fields, extensive debris (providing cover), and presence of prey (i.e., mice, invertebrates, salamanders) provide suitable habitat for these five species.[30] The upland areas, dominated by disturbed vegetation and non-native grassland, support the snake and lizard species.[31]

During one survey, 21 southern alligator lizards were observed in silvery beachweed along the shoreline of the South Basin (refer to Map 2 of the Yosemite Slough Watershed Wildlife Survey for a graphic representation of the location of the South Basin).[32] The lizards were all juveniles and may have been from a single clutch that had been laid in the silvery beachweed.[33]

Although the Yosemite Slough Watershed Wildlife Survey covered only Candlestick Point and the southern shoreline of HPS Phase II, it is expected that a lower abundance of these common reptile and amphibian species would be found within the disturbed areas within HPS Phase II than at Candlestick Point. Recent, intensive disturbance due to ongoing remediation activities has undoubtedly reduced populations of these species on HPS Phase II. A few individuals of these

[27] Ibid.
[28] Stebbins, R., Peterson, *Field Guides: Western Reptiles and Amphibians*, Houghton Mifflin Company, 1966.
[29] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid.

reptiles and amphibians may occur within the developed portions of the Project site, which represents approximately 80 percent of the overall acreage of the site, but numbers are expected to be very low in such low-quality habitat.

Birds

One hundred and eighteen bird species (which are named herein according to the American Ornithologists' Union Checklist of North American Birds[34] except for sensitive subspecies recognized by CDFG or USFWS) were observed during the Yosemite Slough Watershed Wildlife Survey.[35] Of these, 51 species were represented by a maximum count of five or fewer individuals, indicating that, for many bird species, the site is used by relatively low numbers of individuals.[36] The majority of the species observed were terrestrial species, followed by shorebirds, waterfowl, gulls and terns, and raptors (in descending order). Terrestrial habitats supported large numbers of some common bird species such as white-crowned sparrows (*Zonotrichia leucophrys*), western meadowlarks (*Sturnella neglecta*), and house finches (*Carpodacus mexicanus*). The landbirds that are most abundant on the site are those associated with the weedy, ruderal habitats dominating the Project site and those tolerant of the urbanization and associated disturbance resulting from the site's location. In contrast, very few Neotropical and other long-distance migrant songbirds were recorded during this study. Studies have documented that bird species diversity is closely associated with structural habitat complexity. Bird species diversity (a measure of the number of species in a given area) increases with increasing foliage height diversity (a measure of the number and diversity of vertical layers of vegetation in that area).[37,38] While this has been best studied in breeding birds, the structural complexity of habitat also influences the degree to which an area provides resources to migrant birds. Multi-layered vegetation, with well-developed ground, understory, and canopy layers, would support greater diversity of migrants than the structurally simple vegetation that dominates most of Candlestick Point and HPS Phase II. Also, breeding bird abundance is often closely associated with the density or volume of vegetation, with increasingly dense vegetation supporting more individual birds[39]. The sparse vegetation present on most of the Project site limits the value of the site to breeding and migratory birds. Numbers and diversity of landbirds on HPS Phase II are likely lower than on Candlestick Point owing to the recent, intensive disturbance and even lower abundance of trees and shrubs on HPS Phase II.

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[34] American Ornithologists' Union (AOU), *Check-list of North American Birds (1998)* through Forty-ninth Supplement, July 2008.

[35] Ibid.

[36] Ibid.

[37] MacArthur, R. H. and J. W. MacArthur. 1961. On bird species diversity. Ecology 42:594-598.

[38] Karr, J. R. 1968. Habitat and avian diversity on strip-mined land in east-central Illinois. Condor 70:348-357.

The waters of the South Basin and the Bay surrounding the Study Area are used by a variety of waterbirds, some of which are fairly abundant. Common waterbirds observed in these waters include double-crested cormorant (*Phalacrocorax auritus*), California gull (*Larus californicus*), greater scaup (*Aythya affinis*), ruddy duck (*Oxyura jamaicensis*), surf scoter (*Melanitta perspicillata*), and bufflehead (*Bucephala albeola*). While these birds forage primarily or solely in aquatic habitats, some species, such as cormorants, California brown pelicans (*Pelecanus occidentalis californicus*), gulls, and possibly terns roost in large numbers on piers on HPS Phase II. Small numbers (fewer than 10 pairs) of western gulls (*Larus occidentalis*) nest on two rocks in South Basin known as Double Rock. Shorebirds such as the western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), and dunlin (*Calidris alpina*) forage on intertidal mud flats and along the shoreline of Candlestick Point and the southern part of HPS Phase II, typically in low numbers but occasionally in higher numbers when migratory pulses of shorebirds are present in the Bay. The majority of the Study Area is developed or urbanized and supports relatively few species of birds.

In addition to the 118 bird species recorded during the Yosemite Slough Watershed Wildlife Survey, that survey's report listed an additional 36 species that had been recorded by a local birder, Mr. Alan Hopkins, over the past 20 years.[40]

Mammals

The most abundant mammal observed during the Yosemite Slough Watershed Wildlife Survey was the California ground squirrel (*Spermophilus beecheyi*). This species was observed along the shoreline and riprap areas of HPS Phase II and Candlestick Point, as well as in grassland and ruderal habitats and under trees and shrubs on Candlestick Point. The substrate along the shoreline is composed mostly of small rubble such as broken bricks that had been used as fill. Riprap composed of large rocks was placed along exposed sections of the shoreline, providing refugia for small mammals.[41] Other mammals observed during the survey included feral domestic cat (*Felis silvestris*), feral domestic dog (*Canis familiaris*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), harbor seal (*Phoca vitulina*), black-tailed jackrabbit (*Lepus californicus*), Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), and Norway rat (*Rattus norvegicus*). Of the 10 species recorded by the LSA study, three are non-natives (domestic dog, domestic cat, and Norway rat); two are common urban-adapted species (raccoon and striped skunk); and one occurs infrequently in aquatic areas (harbor seal). Of the remaining four species, the Botta's pocket gopher and California vole were represented by no more than one individual on a given survey and thus may be uncommon

[39] Mills, G. S., J. B. Dunning, Jr., and J. M. Bates. 1991. The relationship between breeding bird density and vegetation volume. Wilson Bulletin 103:468-479.

[40] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[41] Ibid.

on the site. As mentioned for reptiles and amphibians above, mammal diversity and abundance on HPS Phase II are expected to be lower than on Candlestick Point, as recent, intensive disturbance by remediation activities has likely reduced mammal populations there. The shorelines, vacant lots, and undeveloped ruderal/non-native grassland areas of HPS Phase II and CPSRA are surrounded by urban and industrial development, which limits the potential for dispersal of mammals in and out of the site. There are no CNDDB reports of the occurrence of any special-status mammal species in the Study Area.

COMMON AQUATIC RESOURCES

Fish, Crabs, and Mollusks

San Francisco Bay supports a diverse assemblage of fish species. These vary from resident fish such as assorted flat fish (flounder and sole) to a variety of rockfish (*Sebastes* spp.) and to migratory species such as Pacific herring, Pacific sardines, anchovies, and salmonids (*Oncorhynchus* spp.) which spend varying portions of their life cycle in the Bay. Estuaries provide important spawning habitat for fish and the San Francisco Bay is no exception. Pacific herring spawn in the Bay and support a small commercial fishery. Other fish for which adults spawn in the Bay include flounder, sole, and Pacific halibut. Juvenile sturgeon (*Acipenser* spp.) rear in the Bay for an undetermined length of time before moving to the ocean.

Shellfish found in the Bay and within the vicinity of the Study Area include Dungeness crab (*Cancer magister*), other rock crab, and shrimp. Dungeness are the target of an important commercial fishery in the open ocean and the Bay is important rearing habitat for young crab. Crab hatch in the Gulf of the Farallones and after several larval stages, migrate into the Bay and rear primarily in San Pablo and Suisun bays,[42] over 20 miles north of the Study Area.

The Bay also supports a variety of mollusks. These include native clams, mussels, oysters, and snails (gastropods). Some of these are native (i.e., bent-nosed macoma [*Macoma nasuta*], Olympia oyster [*Ostrea conchaphila*], and limpets [*Acmaea* spp.]) while others have been introduced either intentionally such as the Atlantic oyster (*Crassostrea virginica*) or unintentionally such as overbite clam (a.k.a. Asian clam; *Corbula amurensis*). Many of the clams use soft-bottom sediments and could be found on the seafloor near the Project site. Most oysters require a solid substrate for attachment. Suitable habitat for oysters and mussels is found throughout the Study Area on bulkheads, pilings, and riprap associated with the shoreline.

[42] California Department of Fish and Game (CDFG), 2009. Dungeness crabs (*Cancer magister*). Website: http://www.delta.dfg.ca.gov/baydelta/monitoring/cmag.asp. Accessed July 16, 2009.

In addition to the native fish and shellfish, the Bay supports a vast array of introduced species. Most of these have been introduced in ballast water of trans-Pacific traveling cargo ships. Species suspected of being ballast water introductions include Chinese mitten crab (*Eriocheir sinensis*), yellowfin goby (*Acanthogobius flavimanus*), and overbite clam. Other species, including striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*), have been introduced to support sport fisheries. The complex interaction between introduced and native species within the Bay continues to be the topic of much debate and study.

The open water of the Study Area is part of or directly connected to the Bay and all of the Bay fish species can move freely into and out of the Study Area at any time. Because of this, the species assemblage within and adjacent to the Project site is expected to be representative of the central Bay as a whole.

The portion of the San Francisco Bay immediately adjacent to the Project site has been highly modified over the years to support commercial shipping, industrial uses, and US Naval activities, and virtually the entire shoreline of the Study Area is composed of fill of various kinds. As a result, the shorelines are almost exclusively comprised of bulkheads and riprap. Dredging of shipping channels has occurred within the nearshore areas. All of these actions have combined to reduce the aquatic habitat complexity. Reductions in habitat complexity reduce the number of species that routinely utilize a particular area,[43] and, therefore, the numbers of resident fish species within the Study Area are expected to be similar to other developed areas of the Bay.

Marine Mammals

The most common marine mammals within San Francisco Bay are harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*), both of which are protected under the *Marine Mammal Protection Act*. The *Marine Mammal Protection Act* does not bestow a particular status designation for the species it protects, which is similar to the *Migratory Bird Treaty Act*. Instead, the *Marine Mammal Protection Act* and the *Migratory Bird Treaty Act* equally protect all marine mammals and native birds, respectively.

Harbor Seal (*Phoca vitulina*)

Harbor seals are year-round residents found throughout the Bay. They use haulouts scattered through the Bay to bask, rest, and use as pupping sites. The most frequently used pupping sites are in the North (Castro Rocks) and South bays (Mowry Slough); both sites are over 15 miles from the Study Area. Pupping season begins in late March and peaks in early May.[44] The closest haulout site

[43] Moyle, P.B. *Inland Fishes of California, 2nd Edition*, University of California Press.

[44] Richmond Bay Bridge Harbor Seal Team. No date. Harbor Seal. Website: http://userwww.sfsu.edu/~halmark/educati.htm. Accessed October 31, 2008.

is on Yerba Buena Island, about 6 miles from the Project site.[45] There are no known haulout locations within the Study Area. During the 2003–2004 Yosemite Slough Watershed Wildlife Survey, LSA observed nine harbor seals in the outer South Basin (open water between Candlestick Point and HPS Phase II); however, no haulouts were detected during the survey.[46] No harbor seals or haulouts were observed during surveys by PBS&J biologists for this Project.

California Sea Lion (*Zalophus californianus*)

California sea lions do not breed in the Bay, preferring offshore islands such as the Channel Islands near Santa Barbara or the Farallon Islands, but sea lions forage and rest at various locations around the San Francisco Peninsula.[47] They are relatively social animals, frequently seen basking or foraging in large groups. On May 2, 2003, a total of ten sea lions were observed hauled out on a flat, floating structure in the outer South Basin.[48] Sea lions may occur in the Study Area, but the site does not support any known haulout locations.

SENSITIVE/JURISDICTIONAL VEGETATION COMMUNITIES AND HABITATS

Waters of the United States/State and Navigable Waters

The Study Area contains several categories of jurisdictional waters of the United States, including jurisdictional wetlands that are subject to Section 404 of the *Clean Water Act* (Section 404). The types of wetlands include salt marsh and seasonal freshwater wetlands. In addition, the Study Area also contains open waters of the San Francisco Bay, which are subject to both Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899* (Section 10). Section 404 regulates the placement of fill into any "waters of the United States." Waters of the United States are broadly defined to include navigable waterways, their tributaries, lakes, ponds, and wetlands, including tidal waters and wetlands from the HTL seaward. Section 10 regulates the placement of fill into navigable waters of the United States, including tidal waters from the MHW elevation seaward. All of these wetlands and other waters are also regulated by the State under Section 401 of the *Clean Water Act* and under the *Porter-Cologne Water Quality Control Act*. A more detailed discussion of the regulations protecting wetlands and other waters is provided in the Regulatory Framework section below.

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[45] San Francisco State University. No date. *Richmond Bridge Harbor Seal Survey Site Map*. Website: http://userwww.sfsu.edu/~halmark/map.htm. Accessed October 31, 2008.

[46] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

[47] Marine Mammal Center 2002. *California Sea Lion information sheet*. Website: http://www.marinemammalcenter.org/learning/education/pinnipeds/casealion.asp. Accessed October 31, 2008.

[48] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

A wetland delineation was conducted by H.T. Harvey & Associates for the Study Area that distinguished jurisdictional wetlands and other waters of the United State/State.[49] The revised H.T. Harvey & Associates wetland delineation was submitted to the USACE in July 2009 and was verified in August 2009. The study area for that delineation included the Project site and the off-site areas where Project activities would occur (Figure 4). As indicated on Figure 4, the study area for H.T. Harvey's original wetland delineation did not included several limited areas that are now considered part of the Project site. As a result, H.T. Harvey expanded its original delineation by inspecting these additional areas in the field on October 8, 2009. H.T. Harvey & Associates has amended its wetland delineation report, and verification of jurisdictional boundaries in these additional areas by the USACE is pending.

According to USACE regulations and guidance, other waters may include lakes, seasonal ponds, channels, tributary waters, non-wetland linear drainages, and seasonal springs. Such areas are identified by the (seasonal or perennial) presence of standing or running water and generally lack hydrophytic vegetation.

In tidal waters, Section 404 other waters extend to the landward extent of vegetation associated with salt or brackish water or the HTL. The HTL is defined as the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The HTL may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gauges, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm. Confirmation of this definition and approach used by the San Francisco District of the USACE in determining the MHW and HTL locations was obtained from the Regulatory Branch of the USACE on January 29, 2009.[50] The HTL represents the upper limit of Section 404 other waters and is approximately 1.5 to 2 vertical feet above the MHW mark.[51]

[49] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[50] Ibid.

[51] Ibid.

SOURCE: HT Harvey, 2009; Moffat & Nichol, 2009; PBS&J, 2009. PBS&J 10.27.09

FIGURE 4 Candlestick Point - Hunters Point Shipyard Phase II EIR

WETLANDS AND OTHER WATERS

Table 2 (Wetlands and Other Waters of the United States [Section 404] within the Study Area) presents the acreage of waters of the United States (including jurisdictional wetlands) that were delineated for the Study Area. The acreages of jurisdictional wetlands and waters identified in Table 2 include the HT Harvey study area boundary as identified in Figure 4 (which includes open waters adjacent to Candlestick Point and HPS Phase II), as well as off-site areas of Yosemite Slough that are located outside of this boundary.

TABLE 2 WETLANDS AND OTHER WATERS OF THE UNITED STATES (SECTION 404) WITHIN THE STUDY AREA

	Area		Yosemite Slough		
Jurisdictional Feature (Waters of the United States)	**Candlestick Point**	**Hunters Point Shipyard**	**On Site**	**Off Site**	**Total Acreage**
Freshwater Wetland	—	0.20	—	—	0.20
Non-tidal Salt Marsh	—	1.81	—	—	1.81
Tidal Salt Marsh	0.93	1.75	0.01	0.05	2.74
"Other 404 Waters"	21.82	169.29	1.66	2.77	195.54
Totals for Section 404 Wetlands and Waters of the US	***22.75***	***173.05***	***1.67***	***2.82***	***200.29***

SOURCE: H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California*, February 2009 and revised July 13, 2009 and October 13, 2009.

a. Total equals sum of Freshwater Wetland, Non-tidal Salt Marsh, Tidal Salt Marsh, and Other 404 Waters

b. On-site areas within Yosemite Slough refer to areas within the Study Area. Off-site areas within Yosemite Slough are those areas adjacent to the slough that are outside of the Study Area boundary.

SPECIAL-STATUS AND SENSITIVE SPECIES

The potential for special-status plant and wildlife species to occur within the Study Area was determined by assessing habitat suitability information collected during biological reconnaissance surveys conducted in August 2007 and July 2008, a rare plant survey conducted in May 2008, and a review of the CNDDB, CNPS Inventories, and USFWS databases, as previously described. In addition, approximately 29 wildlife surveys were conducted in the vicinity of Yosemite Slough between January 2003 and April 2004 (in association with the Yosemite Slough Watershed Wildlife Survey), and that survey's report included a list of additional bird species that had been observed by Mr. Alan Hopkins over the past 20 years.[52] The list of potentially occurring special-status species provided in Table 3 (Special-Status Species Potentially Occurring within the Study Area) is informed by all of these sources, as well as a search of known sensitive species occurrences within a 5-mile radius of the Project site.

[52] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

- Special-status species are defined as follows:
- Species listed, proposed, or candidate for listing as Threatened or Endangered by the USFWS pursuant to the federal *Endangered Species Act of 1973* (FESA), as amended
- Species designated by the USFWS as Species of Conservation Concern
- Species designated by the National Marine Fisheries Service (NMFS) as Species of Special Concern
- Species listed as Rare, Threatened, or Endangered by the CDFG pursuant to the *California Endangered Species Act of 1984* (CESA), as amended
- Species designated as Fully Protected under Sections 3511 (birds), 4700 (mammals), and 5050 (reptiles and amphibians) of the *California Fish and Game Code*
- Species designated by the CDFG as California Species of Special Concern
- Plant species listed as Category 1B and 2 by the CNPS; CNPS Category 3 and 4 species were not considered special-status species for the sake of this assessment, as they are not considered sufficiently rare on a regional level to warrant such status, though no such plants were recorded in the Study Area.
- Species not currently protected by statute or regulation, but considered rare, threatened or endangered under Section 15380 of the CEQA Guidelines (such as the Olympia oyster and Pacific herring)

Table 3 identifies the special-status plant and wildlife species that have been recorded or could occur within five miles of the Study Area, along with a description of their habitat requirements, protection status, and a brief description of each species' likelihood to be present within the Study Area. Several species known to occur within five miles of the Study Area and listed in Table 3 were determined not likely to occur or to be absent from the Study Area because (1) the site lacks suitable habitat or is outside of the species' range and, (2) no instances of such species were observed during any of the field surveys). Consequently, the detailed species' discussions and impact analysis in this technical report address only those species in Table 3 that have a "Low" or better probability to occur within the Study Area. Those species or habitats with a "Not Likely" or "Absent" likelihood of occurrence in Table 3 are not addressed further because they are not expected to occur on the Study Area or be affected by Project implementation.

Special-status species lists from the CNDDB, CNPS, and USFWS, originally consulted in 2008, appear in Appendices A, B, and C, respectively. These lists were re-checked on November 2, 2009 to determine whether any species that could potentially occur on the site were added to these databases between the date of initial consultation of these lists and the preparation of the updated

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
			Plants	
Adobe sanicle	*Sanicula maritima*	none/SR/1B.1	Chaparral, coastal prairie, meadows and seeps, and valley and foothill grasslands in association with clay or serpentine soils. 98–787 feet (30–240 meters); blooms February–May	**Not Likely.** Suitable habitat for this species occurs in the Study Area. However, there are no recorded occurrences of this species within 5 miles of the Study Area, and none were observed during rare plant surveys of suitable habitat in 2007 and 2008 by PBS&J.
Alkali milk-vetch	*Astragalus tener* var. *tener*	none/none/1B.2	Playas, valley and foothill grassland with adobe clay, and vernal pools with alkaline soils. 0–2051 feet (0–625 meters); blooms May–September.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
Arcuate bush-mallow	*Malacothamnus arcuatus*	none/none/1B.2	Chaparral and cismontane woodland. 82–295 feet (25–90 meters); blooms April–September.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
Beach layia	*Layia carnosa*	FE/SE/1B.1	Coastal dunes and coastal scrub with sandy soils. 0–197 feet (0–60 meters); blooms March–July.	**Not Likely.** Coastal scrub does not occur in the Study Area. This species was not observed during surveys conducted by PBS&J in 2007 and 2008.
Bent-flowered fiddleneck	*Amsinckia lunaris*	none/none/1B.2	Coastal bluff scrub, cismontane woodland, and valley and foothill grassland habitats. 10–1,640 feet (3– 500 meters); blooms March–June	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Amsinckia* were observed during floristic surveys conducted in 2005 by CNPS[53] and in 2007 and 2008 by PBS&J.

[53] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Big-scale balsamroot	*Balsamorhiza macrolepis* var. *macrolepis*	none/none/1B.2	Occurs in chaparral, cismontane woodland, and valley and foothill grassland, sometimes in serpentine soil substrates at elevations ranging from 295–4,593 feet (90–1,400 meters); blooms March–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Balsamorhiza* were observed during floristic surveys conducted in 2005 by CNPS[54] and in 2007 and 2008 by PBS&J.
Blue coast gilia	*Gilia capitata* ssp. *chamissonis*	none/none/1B.1	Coastal dunes and coastal scrub. 7–656 feet (2–200 meters); blooms April–July.	**Not Likely.** Coastal scrub does not occur in the Study Area. There are no recorded occurrences of this species within 5 miles of the Study Area.
Bristly sedge	*Carex comosa*	none/none/2.1	Coastal prairie, marshes and swamps (along lake margins), and valley and foothill grassland. 0–2,051 feet (0–625 meters); blooms May–September.	**Not Likely.** Marsh habitat in the Study Area has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[55]
California seablite	*Suaeda californica*	FE/none/1B.1	Marshes and swamps with coastal salt marsh. 0–49 feet (0–15 meters); blooms July–October.	**Not Likely.** Marsh habitat in the Study Area has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[56]
Coastal triquetrella	*Triquetrella californica*	none/none/1B.2	A moss that occurs in coastal bluff scrub and coastal scrub. 33–328 feet (10–100 meters).	**Not Likely.** Coastal scrub does not occur in the Study Area.

[54] Ibid.

[55] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[56] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Compact cobwebby thistle	*Cirsium occidentale* var. *compactum*	none/none/1B.2	Chaparral, coastal dunes, coastal prairie, and costal scrub. 16–492 feet (5–150 meters); blooms April–June.	**Not Likely.** Coastal scrub does not occur in the Study Area. No native species of *Cirsium* were observed during floristic surveys conducted in 2005 by CNPS[57] and in 2007 and 2008 by PBS&J.
Crystal Springs lessingia	*Lessingia arachnoidea*	none/none/1B.2	Cismontane woodland, coastal scrub, and valley and foothill grassland habitats, in association with serpentinite soils along roadsides. 197–656 feet (60–200 meters); blooms July–October	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Lessingia* were observed during floristic surveys conducted by CNPS[58] and PBS&J in 2007 and 2008.
Diablo helianthella	*Helianthella castanea*	none/none/1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. 197–4,265 feet (60–1,300 meters); blooms March–June.	**Not Likely.** Chaparral or oak woodland absent in Study Area.
Fountain thistle	*Cirsium fontinale* var. *fontinale*	FE/SE/1B.1	Openings in chaparral habitats; valley and foothill grassland habitats in association with serpentinite seeps. 295–574 feet (90–175 meters); blooms June–October	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Cirsium* were observed during floristic surveys conducted by CNPS[59] and PBS&J in 2007 and 2008.

[57] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

[58] Ibid.

[59] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Fragrant fritillary	*Fritillaria liliacea*	none/none/1B.2	Cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland habitats often in association with serpentinite soils. 10–1,345 feet (3–410 meters); blooms February–April	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Fritillaria* were observed during floristic surveys conducted by CNPS[60] and PBS&J in 2007 and 2008.
Franciscan manzanita	*Arctostaphylos hookeri* ssp. *franciscana*	none/none/1A	Coastal scrub with serpentinite soil substrates. 197–984 feet (60–300 meters); blooms February–April.	**Not Likely.** Serpentinite soil substrates do not occur within Study Area. No recorded occurrences of this species within 5 miles of the Study Area. No species of *Arctostaphylos* were observed during surveys conducted by Caltrans in 2007[61] and PBS&J in 2007 and 2008.
Franciscan onion	*Allium peninsulare* var. *franciscanum*	SLC/none/1B.2	Clay and serpentine soils on dry hillsides in woodlands and valley and foothill grasslands 170–984 feet (52–300 meters); blooms May–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Allium* were observed during floristic surveys conducted by CNPS[62] and PBS&J in 2007 and 2008.
Franciscan thistle	*Cirsium andrewsii*	none/none/1B.2	Broadleafed upland forest, coastal bluff scrub, coastal prairie, and coastal scrub habitats, often in association with serpentinite soils. 0–492 feet (0–150 meters); blooms March–July	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Cirsium* were observed during floristic surveys conducted by CNPS[63] and PBS&J in 2007 and 2008.

[60] Ibid.

[61] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[62] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

[63] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Hillsborough chocolate lily	*Fritillaria biflora* var. *ineziana*	none/none/1B.1	Cismontane woodland and valley and foothill grassland habitats in association with serpentinite soils. 492 feet (150 meters); blooms March–April	**Not Likely.** Known only from the Hillsborough area. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Fritillaria* were observed during floristic surveys conducted by CNPS[64] and PBS&J in 2007 and 2008.
Kellogg's horkelia	*Horkelia cuneata* ssp. *sericea*	none/none/1B.1	Closed-cone coniferous forest, chaparral, coastal dunes, and coastal scrub with sandy or gravelly openings. 33–656 feet (10–200 meters); blooms April–September.	**Not Likely.** Coastal scrub does not occur in the Study Area.
Marin western flax	*Hesperolinon congestum*	FT/ST/1B.1	Chaparral and valley and foothill grassland habitats in association with serpentinite soils. 16–1214 feet (5–370 meters); blooms April–July	**Not Likely.** Although there are recorded occurrences of this species within 5 miles of the Study Area, no species of *Hesperolinon* were observed during floristic surveys conducted by CNPS and PBS&J in 2007 and 2008.
Montara manzanita	*Arctostaphylos montaraensis*	none/none/1B.2	Chaparral and coastal scrub. 492–1,640 feet (150–500 meters); blooms January–March.	**Not Likely.** Coastal scrub does not occur in the Study Area. No species of *Arctostphylos* were observed during surveys conducted by Caltrans in 2007[65] and PBS&J in 2007 and 2008.
Most beautiful jewel-flower	*Streptanthus albidus* ssp. *permoenus*	none/none/1B.2	Chaparral, cismontane woodland, valley and foothill grasslands, often on serpentine soils. 361–3,281 feet (110–1,000 meters); blooms April–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Streptanthus* were observed during floristic surveys conducted by CNPS and PBS&J in 2007 and 2008.

[64] Ibid.

[65] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Pacific manzanita	*Arctostaphylos pacifica*	none/SE/1B.2	Chaparral and coastal scrub. 1,083 feet (330 meters); blooms February–April.	**Not Likely.** Coastal scrub does not occur in the Study Area. Species of *Arctostaphylos* not identified during surveys.
Point Reyes bird's-beak	*Cordylanthus maritimus* ssp. *palustris*	none/none/1B.2	Coastal salt marsh. 0–33 feet (0–10 meters); blooms June–October.	**Not Likely.** Marsh habitat in the Study Area is of marginal quality and has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[66] Observed in adjacent off-site locations to the Yosemite Slough area according to the Yosemite Slough IS/MND.[67] Was not observed in the Yosemite Slough area during 2005 surveys conducted by LSA.
Presidio clarkia	*Clarkia franciscana*	FE/SE/1B.1	Occurs in coastal scrub and valley and foothill grassland, often on serpentine soils. 82–1,099 feet (25–335 meters); blooms May–July	**Not Likely.** Known from fewer than five occurrences. The closest two known populations are in the San Francisco Presidio approximately 6 miles northwest. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Clarkia* were observed during floristic surveys conducted by CNPS[68] and PBS&J in 2007 and 2008.
Presidio manzanita	*Arctostaphylos hookeri ssp. ravenii*	FE/SE/1B.1	Chaparral, coastal prairie, and coastal scrub with serpentinite outcrops. 148–705 feet (45–215 meters); blooms February–March.	**Not Likely.** Serpentinite soil substrates do not occur within Study Area; however, there are no recorded occurrences of this species within 5 miles of the Study Area. Species of *Arctostaphylos* not identified during surveys.

[66] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[67] California State Parks Foundation, Draft Initial Study –Mitigated Negative Declaration for the Candlestick Point State Recreation Area Yosemite Slough Restoration Project, December 2005.

[68] California Native Plant Society, California Native Plant Society, Yerba Buena Chapter, Electronic plant list; R. Hunter and J. Sigg, 2005.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Robust spineflower	*Chorizanthe robusta* var. *robusta*	FE/none/1B.1	Chaparral, cismontane woodlands (in openings), coastal dunes, coastal scrub with sandy or gravelly soil. 10–984 feet (3–300) meters; blooms April–September.	**Not Likely.** Coastal dunes are absent from the Study Area. Remnant dunes in the Study Area are disturbed habitat. This species was not observed during surveys conducted by PBS&J in 2007 and 2008.
Rose leptosiphon	*Leptosiphon rosaceus*	none/none/1B.1	Coastal bluff scrub. 0–328 feet (0–100 meters); blooms April–July.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
San Bruno Mountain manzanita	*Arctostaphylos imbricata*	none/SE/1B.1	Chaparral and coastal scrub with rocky substrate. 902–1,214 feet (275–370 meters); blooms February–May.	**Not Likely.** Coastal scrub does not occur in the Study Area. Species of *Arctostaphylos* not identified during surveys.
San Francisco Bay spineflower	*Chorizanthe cuspidate* var. *cuspidata*	none/none/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub with sandy soils. 10–705 feet (3–215 meters); blooms April–July (uncommon in August).	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco campion	*Silene vercunda* ssp. *verecunda*	none/none/1B.2	Coastal bluff scrub, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland with sandy soil. 98–2,116 feet (30–645 meters); blooms March–June (uncommon in August).	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco Collinsia	*Collinsia multicolor*	none/none/1B.2	Closed-cone coniferous forest and coastal scrub (sometimes with serpentinite soil). 98–820 feet (30–250 meters); Blooms March–May.	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco gumplant	*Grindelia hirsutula* var. *maritima*	none/none/1B.2	Coastal bluff scrub, coastal scrub, and valley and foothill grassland habitats in association with sandy or serpentinite soils. 49–1,312 feet (15–400 meters); blooms June–September	**Not Likely.** Although there are a number of recorded occurrences of this species within 5 miles of the Study Area, this species was not observed during floristic surveys conducted by CNPS[69] and PBS&J in 2007 and 2008.

[69] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
San Francisco Lessingia	*Lessingia germanorum*	FE/SE/1B.1	Coastal scrub (remnant dunes). 82–295 feet (25–90 meters); blooms July–November (uncommon in June).	**Not Likely.** Coastal scrub does not occur in the Study Area. This species was not observed in sandy soil areas during surveys; no species of *Lessingia* were observed during floristic surveys conducted by CNPS[70] and PBS&J in 2007 and 2008.
San Francisco owl's-clover	*Triphysaria floribunda*	none/none/1B.2	Coastal prairie, coastal scrub, and valley and foothill grassland habitats in association with serpentinite soils. 33–525 feet (10–60 meters); blooms April–June	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Triphysaria* has been observed during floristic surveys conducted by CNPS[71] and PBS&J in 2007 and 2008.
San Francisco popcornflower	*Plagiobothrys diffusus*	None/SE/ 1B.1	Occurs in coastal prairie and valley and foothill grassland. 197–1,181 feet (60–360 meters); blooms March–June.	**Not Likely.** Known from fewer than ten occurrences. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Plagiobothrys* were observed during floristic surveys conducted by CNPS[72] and PBS&J in 2007 and 2008.
SanMateo thorn-mint	*Acanthomintha duttonii*	FE/SE/1B.1	Chaparral and valley and foothill grassland habitats, often on serpentinite soil substrates. 164–984 feet (50–300 meters); blooms April–June	**Not Likely.** Serpentinite soil substrates do not occur within Study Area, however there are no recorded occurrences of this species within 5 miles of the Study Area; species of *Acanthomintha* were not observed during floristic surveys conducted by CNPS[73] and PBS&J in 2007 and 2008.

[70] Ibid.
[71] Ibid.
[72] Ibid.
[73] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Santa Cruz microseris	*Stebbinsoseris decipiens*	none/none/1B.2	Openings in broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, valley and foothill grasslands, sometimes on serpentine soils. 33–1,640 feet (10–500 meters); blooms April–May.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Stebbinsoseris* were observed during floristic surveys conducted by CNPS[74] and PBS&J in 2007 and 2008.
Short-leaved evax	*Hesperevax sparsiflora* var. *brevifolia*	none/none/2.2	Coastal bluff with sandy soil and coastal dunes. 0–705 feet (0–215 meters); blooms March–June.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
White-rayed pentachaeta	*Pentachaeta bellidiflora*	FE/SE/List 1B.1	Occurs in cismontane woodland and valley and foothill grassland, often in serpentinite. 115–2034 feet (35–620 meters); blooms March–May	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Pentachaeta* were observed during floristic surveys conducted by CNPS[75] and PBS&J in 2007 and 2008.
Sensitive Natural Communities				
Coastal brackish marsh (salt marsh)		CDFG Sensitive Habitat		**Known.** The Study Area supports representative assemblages of plant species associated with this community type. Degraded occurrences of this sensitive natural community are present along the southern portion of HPS Phase II site, along Yosemite Slough, and patches along the Candlestick Point shoreline.[76]
Invertebrates				

[74] Ibid.

[75] Ibid.

[76] H.T. Harvey & Associates, Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California, February 2009 and revised July 13, 2009 and October 2, 2009.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT/none/none Critical habitat	All habitats for the bay checkerspot are on shallow, serpentine-derived, or similar soils. These soils support the plants on which the caterpillars (larvae) feed the primary larval host plant is dwarf plantain (*Plantago erecta*). In many years, the plantain dries up and the larvae transfer to a second host plant, Indian paintbrush, or purple owl's clover (*Castilleja exserta* spp. *exerta*), which remains edible later in the season.	**Not Likely.** It is not likely that there is a sufficient population of plantain to support Bay checkerspot in the Study Area.[77] Sites that support this species provide greater topographic heterogeneity than the serpentine grassland in the Study Area. Although there are a number of recorded occurrences for this species within 5 miles of the Study Area, this species was extirpated from the closest location of historical occurrence (San Bruno Mountain) in the 1980's.
Callippe silverspot butterfly	*Speyeria callippe callippe*	FE/none/none	Occurs in grassland habitats around the northern Bay Area containing Johnny jump-up (*Viola pedunculata*), which is the larval host plant for this species.	**Not Likely.** Although there are a number of recorded occurrences within 5 miles of the Study Area, *V. pedunculata* has not been observed within the Study Area. In addition, although there are nearby occurrences, there is an insufficient population of this species' host plant within the Study Area to sustain a population of this species.[78]

[77] Kobernus, P., Senior Biologist, TRA Environmental Sciences, Inc., email to PBS&J, August 30, 2007.
[78] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Mission blue butterfly	*Plebejus* [*Icaricia*] *icarioides missionensis*	FE/none/none	The adults feed on hairy false goldenaster (*Heterotheca villosa*), blue dicks (*Dichelostemma capitatum*), and seaside buckwheat (*Eriogonum latifolium*). They do not wander far from the three species of lupine that are the larval food plant: silver lupine (*Lupinus albifrons*), summer lupine (*L. formosus*), and many-colored lupine (*L. versicolor*). Females lay eggs throughout the mating flight. The eggs are laid singly on leaves, stems, flowers, and seedpods of lupine species.	**Not Likely.** Although there are a number of recorded occurrences for this species within 5 miles of the Study Area, including one from the Bayview Hill area, the Study Area does not support a substantial stand of lupine (*Lupinus* spp.) to support this species. [79] Isolated lupine plants intermixed within ruderal vegetation was observed along the Candlestick Point area, near Yosemite Slough. One or two lupine plants were observed in this area during the May 5, 2008 survey, but this would not constitute habitat for this species.
Monarch butterfly (wintering)[80]	*Danaus plexippus*	none/none/ESHA	Occur in many open habitats including fields, meadows, weedy areas, marshes, and roadsides. Adults migrate from August to October, flying south to hibernate along the California coast and in central Mexico. During migration and wintering, butterflies roost in trees and form huge aggregations. Caterpillars feed exclusively on milkweed (*Asclepias* spp.); early in the season, adults sip nectar from dogbane (*Apocynum* spp.), lilac (*Ceanothus* spp.), red clover (*Trifolium pratense*), *Lantana* spp., and thistles (*Cirsium* spp.). In the fall adults visit composites including goldenrods (*Solidago californica*), blazing stars (*Liatris spicata*), ironweed (*Vernonia* spp.), and tickseed sunflower (*Bidens* spp.).	**Known, but Not Likely roosting.** Although individuals have been observed on the site, there is no record of monarch butterfly autumnal (i.e., temporary bivouac site) or over-wintering use of the Study Area in the CNDDB and other records, including anecdotal observations. The nearest observations of such roosts are at Fort Mason, the Presidio of San Francisco, and Stern Grove. The modification of Hunters Point and Candlestick Park would not affect those sites.[81]

[79] United States Fish and Wildlife Service (USFWS), Endangered and Threatened Wildlife and Plants*: Proposed Determination of Critical Habitat for Six Butterflies and Two Plants*, 42 Federal Register 7972, February 8, 1977.

[80] Wintering habitat is considered an Environmentally Sensitive Habitat Area by the California Coastal Commission.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE/none/none	Occurs in grassland habitats around the northern Bay Area. The larval host plant is hookspur violet (*Viola adunca*). Adults feed on nectar from flowers including hairy gumweed, coastal sand verbena (*Abronia latifolia*), mints (or monardella) (*Monardella* spp.), bull thistle (*Cirsium vulgare*), and seaside fleabane (*Erigeron glaucus*).	**Not Likely.** There are no recorded occurrences of this species within 5 miles of the Study Area. The Study Area does not support the suitable host plants for this species.
San Bruno elfin butterfly	*Callophyrs* [*Incisalia*] *mossii bayensis*	FE/none/none	Endemic to the coastal mountains near San Francisco Bay. Eggs are laid in small clusters or strings on the upper or lower surface of broadleaf stonecrop (*Sedum spathulifolium*). The adult food plants have not been fully determined but Montara Mountain colonies are suspected to use Montara manzanita (*Arctostaphylos montaraensis*) and California huckleberry (*Vaccinium ovatum*).	**Not Likely.** There are a number of recorded occurrences for this species within 5 miles of the Study Area. However, the San Bruno elfin is found in the fog-belt of steep north facing slopes that receive little direct sunlight. It lives near prolific growths of the larval food plant, stonecrop, which is a low growing succulent. The Study Area does not support suitable larval and adult host plants.[82]
		Mollusks		
Black abalone	*Haliotes cracherodii*	FC/none/none	Endemic to Santa Barbara Channel Islands.	**Absent.** The Study Area is outside the range of this species.
White abalone	*Haliotes sorenseni*	FE/none/none	Rocky marine subtidal (to 200 feet deep) and extreme lower intertidal (below 15 feet deep) habitats. Current population extremely depleted.	**Absent.** The Study Area is too shallow and modified to provide suitable habitat.

[81] Monroe, M., Ranger, Muir Woods National Monument, telephone conversation with Todd Wong, July 16, 2008.

[82] Kobernus, P., Senior Biologist, TRA Environmental Sciences, Inc., email to PBS&J, August 30, 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Olympia oyster	*Ostreola conchaphila*	none/none/CEQA	Native Olympia oysters were historically abundant in San Francisco Bay, and small populations of native oysters have been documented within the Bay. Suitable substrate includes solid surfaces to which the larvae can easily attach.	**High.** Because the larval forms of oysters are free-floating in the Bay and a large population exists south of the Study Area at Oyster Point Marina, native oysters are likely present on suitable substrate throughout the Study Area.
			Fish	
Pacific herring	*Clupea pallasi*	none/none/CEQA	Pacific herring generally enter the Bay from November through April of each year and spawn in intertidal and sub-tidal habitats.	**Known.** According to NMFS, known herring spawning areas within the Study Area include several piers and areas of shoreline both north and south of the proposed marina.
Chinook salmon –Spring-run ESU	*Oncorhynchus tshawytscha*	FT/ST/none	Central Valley streams with stable water supply, clean gravel, and good quality riparian habitat. Spawning occurs only in tributaries to the Sacramento River.	**Low.** The Study Area is outside the migratory corridor for this species. Adults migrate from the Golden Gate into the Sacramento River.
Chinook salmon –Winter-run ESU	*Oncorhynchus tshawytscha*	FE/ST/none Critical habitat	Central Valley streams with stable water supply, clean gravel, and good quality riparian habitat. Spawning occurs upstream of the Red Bluff Diversion Dam.	**Low.** The Study Area is generally outside the migratory corridor for this species. Adults migrate from the Golden Gate into the Sacramento River. Study Area is outside of designated critical habitat.
Chinook salmon –Fall/Late Fall-run ESUs	*Oncorhynchus tshawytscha*	SC/SSC/none	The most abundant Chinook in the Central Valley. Fall/Late fall-run fish spawn in streams with stable water supply, clean gravel, and good quality riparian habitat.	**Low.** The Study Area is generally outside the migratory corridor for this ESU. A population exists in the South Bay that would migrate past the Study Area on the way to and from the ocean. The origin and status of this population is unclear (refer to text).

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Coho salmon—Central California ESU	*Oncorhynchus kisutch*	FE/SE/none	Spawning in accessible coastal streams, generally in areas with complex instream habitat, heavy forest cover, and high quality water. Juveniles rear in these areas for two years before migrating to the ocean.	**Absent.** This species does not currently exist in the San Francisco Bay.[83]
Delta smelt	*Hypomesus transpacificus*	FT/SE/none	Endemic to the Sacramento-San Joaquin Delta. Adults spawn in freshwater in the upper Delta. The rest of the year, they reside primarily in the interface between salt and freshwater of the Sacramento-San Joaquin Delta at salinities less than 2 parts per million.	**Absent.** The Study Area is outside the known range of this species.
Longfin Smelt	*Spirinchus thaleichthys*	none/ST/none	Native to San Francisco Bay. Adults spawn in upper estuary in early winter. Larvae are dispersed by downstream flow and distribution is determined by outflow. Adults found outside the Bay in some years.	**Moderate.** Based on a 2009 status review, distribution of larval fish is determined by outflow from the Sacramento-San Joaquin River Estuary where adults spawn.[84] As they develop swimming ability, they could disperse into the Study Area. They are captured as by-catch in the Bay for bay shrimp (*Crangon franciscorum*).
Green sturgeon	*Acipenser medirostris*	FT/SSC/none Proposed Critical Habitat	Migrates through the San Francisco Bay to spawning grounds in the upper Sacramento River. Juveniles move into the estuary and likely rear in San Francisco Bay.	**High.** The species likely forages in the Bay including the area near the Study Area. The Study Area is within proposed critical habitat for this species.

[83] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[84] California Department of Fish and Game (CDFG), *A Status Review of the Longfin Smelt (Spirinchus thaleichthys) in California, January 2009*.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Steelhead — Central California Coast DPS	*Oncorhynchus mykiss*	FT/none/none Critical habitat	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for one or more years before migrating to the ocean.	**High.** Juveniles and adult steelhead could be found in the open waters adjacent to the Study Area as they migrate to and from streams in the San Francisco Bay. Populations are known from relatively nearby creeks on the peninsula (i.e., San Francisquito Creek). The Study Area is within designated critical habitat for this DPS.
Steelhead — Central Valley DPS	*Oncorhynchus mykiss*	FT/none/none Critical habitat	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in freshwater for one or more years before migrating to the ocean.	**Low.** Even though their primary migratory pathway is into the Sacramento River, juveniles and adult steelhead could potentially be found in the Bay near the Project. The Study Area is outside of designated critical habitat for this DPS.
Tidewater goby	*Eucyclogobius newberryi*	FE/SSC/none	Brackish water habitats along coast, fairly still but not stagnant water and high oxygen levels.	**Absent.** The shoreline of the Study Area is influenced by tidal activity. Brackish water habitat absent. Due to degradation lagoon/estuary habitat does not exist.[85]
		Amphibians		
California red-legged frog	*Rana aurora draytonii*	FT/SSC/none	Permanent and semi-permanent freshwater habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation.	**Not Likely.** Perennial freshwater habitat is absent from the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
		Reptiles		
Green turtle	*Chelonia mydas*	FT/none/none	Shallow water with sufficient submergent vegetation. Breeds on islands often but also on mainland sandy beaches.	**Absent.** Suitable habitat for this species does not occur in the Study Area.

[85] Caltrans, *Biological Assessment for the Bayview Transportation Improvements Project*, Jones and Stokes, July 2007.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Leatherback turtle	*Dermochelys coriacea*	FE/none/none	Marine, open ocean often near continental shelf. Nests on sloped sandy beaches often near deep water.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
Loggerhead turtle	*Caretta caretta*	FT/none/none	Open ocean up to 500 miles off shore. Nests on sandy beaches seaward of well developed dunes.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
Olive (=Pacific) ridley sea turtle	*Lepidochelys olivacea*	FT/none/none	Near shore less and 15 km. bottom dwelling sea turtle, nests on sandy beaches.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE/ST/FP	Inhabits ponds, streams, rivers, and reservoirs, typically with riparian or emergent vegetation. Requires upland areas for aestivation and nesting, usually within 100 yards of permanent water source.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
Western pond turtle	*Actinemys marmorata*	none/SSC/none	Typically inhabit ponds, slow-moving streams and rivers, irrigation ditches, and reservoirs with abundant emergent and/or riparian vegetation.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
			Birds	
Alameda song sparrow	*Melospiza melodia pusillula*	none/SSC/none	Tidal salt marsh habitats along the edge of the Bay and streams where tidal flow effects the vegetation.	**Low.** Salt marsh along Yosemite Slough and the HPS shoreline provides marginal habitat for this species due to its limited extent. Song sparrows were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were Alameda song sparrows.
American peregrine falcon (nesting)	*Falco pergrinus anatum*	Delisted/SE (proposed delisted)/FP	Frequents bodies of water in open areas with cliffs and canyons nearby for cover and nesting. Known to nest on artificial substrates (bridges, buildings, etc)	**Known.** A pair of American Peregrine falcons was observed nesting in the Gantry Crane on Parcel D of the HPS Phase II site. The pair has raised several young at this location.[86]

[86] Nelson, G., Facility Coordinator, Navy, field visit with PBS&J, July 8, 2008.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Bank swallow (nesting)	*Riparia riparia*	none/ST/none	Nests in steep sandy banks where it excavates burrows.	**Not Likely.** Although individuals have been observed in the vicinity, the Study Area does not provide suitable nesting habitat.
Barrow's goldeneye	*Bucephala islandica*	none/SSC/none	Breeds in high central & northern Sierra Nevada Mountains, near wooded mountain lakes or large streams. Nest in tree cavities, such as a deserted nest-hole of a pileated woodpecker or flicker; also use nest boxes.	**Known.** Although observed near the site during migration and winter, the Study Area does not provide suitable nesting habitat and is well outside the species' breeding range.
Bryant's savannah sparrow	*Passerculus sandwichensis alaudinus*	none/SSC/none	Frequents low tidally influenced habitats, adjacent to ruderal areas, moist grasslands within and just above the fog belt, and grasslands.	**Low.** Salt marsh along Yosemite Slough and the HPS shoreline provides marginal habitat for this species due to its limited extent. Savannah sparrows were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were Bryant's savannah sparrows.
Burrowing owl	*Athene cunicularia*	none/SSC/none	Found in open, dry grasslands, deserts, and ruderal areas. Requires suitable small mammal burrows.	**Known.** This species has been observed in the past on Candlestick Point and at HPS, and suitable foraging habitat is present on the site. Although suitable conditions for nesting are present, the species is not known to have nested on the site. Currently, it is either absent, or it occurs sporadically as a non-breeding visitor.
California black rail	*Laterallus jamaicensis coturniculus*	none/ST/FP	Inhabits tidal salt marshes bordering larger bays, or other freshwater and brackish marshes, at low elevations.	**Not Likely.** Small mats of pickleweed adjacent to brackish wetlands are too limited in extent and too highly disturbed to provide suitable habitat. Tidal zone is very narrow.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
California brown pelican (rookery and communal roosts)	*Pelecanus occidentalis californicus*	FPD/SPD[87]/FP	Typically in littoral ocean zones, just outside the surf line; nests on offshore islands.	**Known.** This species was observed roosting on piers within the Study Area. However, suitable nesting habitat for this species does not occur in the Study Area. The Study Area is outside this species' current breeding range.
California clapper rail	*Rallus longirostris obsoletus*	FE/SE/FP	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickle-weed; feeds on mollusks removed from the mud in sloughs.	**Not Likely.** Suitable habitat does not occur in the Study Area. Salt marsh is highly disturbed and limited in the Study Area. Yosemite Slough is a tidal slough, but suitable habitat for the rail is absent because the existing salt marsh in Yosemite Slough is very narrow and unsuitable. The lack of tidal channels within those marshes, feeding into Yosemite Slough further reduce habitat quality.
California least tern (nesting colony)	*Sternula antillarum browni*	FE/ST/FP	Nests on sandy, upper ocean beaches, and occasionally uses mud flats; forages on adjacent surf line, estuaries, or the open ocean.	**Not Likely.** Suitable nesting habitat does not occur in the Study Area. Individuals may forage in the open water adjacent to the Study Area.
Common loon	*Gavia immer*	none/SSC/none	Nesting locations at certain large lakes & reservoirs in interior of state, primarily in northeastern plateau region. Bodies of water regularly frequented are extensive, fairly deep, and produce quantities of large fish.	**Known.** Although observed near the site during migration and winter, the Study Area does not provide suitable nesting habitat and is well outside the species' breeding range.

[87] California Department of Fish and Game (CDFG) news release: *Fish and Game Commission votes to remove California brown pelican from State Endangered Species List*. February 17, 2009.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Harlequin duck (nesting)	*Histrionicus histrionicus*	none/SSC/none	Usually nests along shores of shallow, swift rivers with plentiful aquatic invertebrates.[88]	**Known.** This species was observed perching on the piers in the HPS Phase II site. However, the Study Area does not provide suitable nesting habitat for this species. The Study Area is outside this species' current breeding range.
Loggerhead shrike	*Lanius ludovicianus*	none/SSC/none	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.	**Known.** Non-native grasslands provide suitable foraging habitat. Loggerhead shrike has been observed by Alan Hopkins at the CPSRA.[89] Although suitable conditions for nesting are present, the species is not known to have nested on the site. Currently, it is either absent, or it occurs sporadically as a non-breeding visitor.
Marbled murrelet	*Brachyramphus marmoratus*	FT/SE/none	Mature, coastal coniferous forests for nesting; nearby coastal water for foraging; nests in conifer stands greater than 150 years old and may be found up to 35 miles inland; winters on subtidal and pelagic waters often well offshore.	**Absent.** Suitable habitat not present in the Study Area.
Northern harrier	*Circus cyaneus*	none/SSC/none	Coastal salt & fresh-water marsh. Nest & forage in grasslands, from salt grass in desert sink to mountain cienegas. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	**Known.** Salt marsh and ruderal habitats provide suitable foraging habitat for this species, which has been observed by Alan Hopkins at the CPSRA.[90] However, suitable breeding habitat is absent due to the limited extent of marsh, human disturbance, and vulnerability of this ground-nesting species to predation.

[88] California Department of Fish and Game (CDFG). Website: http://www.dfg.ca.gov/whdab/html/B096.html. Accessed April 6, 2005.
[89] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.
[90] Ibid.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
San Francisco yellowthroat	*Geothlypis trichas sinuosa*	none/SSC/none	Inhabits emergent wetland habitat, and is a resident and summer visitor in the San Francisco Bay area. Nests are usually placed on or within 8 cm (3 inches) of ground; and may be positioned over water in emergent aquatic vegetation, dense shrubs, or other dense growth.	**Moderate.** Salt marsh along Yosemite Slough and the HPS shoreline provides potential habitat for this species. The existing salt marsh provides marginal habitat due to its limited extent. Common yellowthroats were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were San Francisco yellowthroats.[91]
Short-eared owl	*Asio flammeus*	none/SSC/none	Found in swamplands, both fresh and salt; lowland meadows; irrigated alfalfa fields. Tule patches/tall grass needed for nesting/daytime seclusion. Nests on dry ground in depression concealed in vegetation.	**Known.** Salt marsh and ruderal habitats provide suitable foraging habitat for this species, which has been observed by Alan Hopkins at the CPSRA.[92] However, suitable breeding habitat is absent due to the limited extent of marsh, human disturbance, and vulnerability of this ground-nesting species to predation.
Short-tailed albatross	*Phoebastria albatrus*	FE/none/none	Pelagic; nests on offshore islands in north Pacific.	**Absent.** Suitable habitat does not occur in the Study Area.
Tricolored Blackbird	*Agelaius tricolor*	none/SSC/none	Highly colonial species, most numerous in central valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, & foraging area with insect prey within a few km of the colony.	**Known.** Ruderal and developed areas on the site provide potential foraging habitat for this species, and the tricolored blackbird has been observed by Alan Hopkins at the CPSRA.[93] However, suitable nesting habitat is absent due to the lack of extensive freshwater marsh vegetation.

[91] Ibid.
[92] Ibid.
[93] Ibid.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Vaux's swift	*Chaetura vauxi*	none/SSC/none	Redwood, Douglas fir, & other coniferous forests. Nests in large hollow trees & snags. Often nests in flocks. Forages over most terrains & habitats.	**Known.** Suitable nesting habitat does not occur in the Study Area. However, individuals may forage aerially over the Study Area.
Western snowy plover (nesting)	*Charadrius alexandrinus nivosus*	FT/SSC/none	Coastal beaches above the normal high tide line in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent.	**Not Likely.** Extensive, open sandy substrate to provide nesting habitat within the Study Area is absent.
White-tailed kite	*Elanus leucurus*	none/none/FP	Preferred habitat is marshes and waste fields in the Central Valley and coastal plains of California.	**Known.** Non-native grasslands provide suitable foraging habitat. Large trees in the Study Area provide suitable nesting habitat for this species, although the species is not known to nest there.
			Mammals	
Blue whale	*Balaenoptera musculus*	FE/none/none	Coastal and pelagic environments frequently found on the continental shelf off the California coast.	**Absent.** Suitable habitat does not occur in the Study Area.
Finback whale	*Balaenoptera physalus*	FE/none/none	Pelagic; usually found 25 miles or more off shore.	**Absent.** Suitable habitat does not occur in the Study Area.
Guadalupe fur seal	*Arctocephalus townsendii*	FT/ST/FP	Rocky insular shorelines and sheltered coves.	**Absent.** Suitable habitat does not occur in the Study Area.
Right whale	*Eubalaena glacialis*	FE/none/none	Pelagic, occurs mainly over continental shelf in the Pacific Ocean.	**Absent.** Suitable habitat does not occur in the Study Area.
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE/SE/FP	Salt marshes with a dense plant cover or pickleweed or fat hen; adjacent to an upland site.	**Not Likely.** Small mats of pickleweed adjacent to brackish wetlands and salt marsh habitat in the Study Area are highly disturbed. This species has not been recorded on the Peninsula north of the Foster City/ San Mateo Bridge area in decades.
Sei whale	*Balaenoptera borealis*	FE/none/none	Pelagic; generally in deep water along continental shelf.	**Absent.** Suitable habitat does not occur in the Study Area.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Sperm whale	*Physeter catodon*	FE/none/none	Pelagic; prefers deep water but is sometimes found around islands or in shallow shelf waters.	**Absent.** Suitable habitat does not occur in the Study Area.
Steller sea-lion	*Eumetopias jubatus*	FT/none/none Critical habitat	Near shore, pelagic when in water. Otherwise on shore, talus or bare rocks. Critical habitat has been defined for stellar sea lion as a 20 nautical mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas.[94]	**Not Likely.** Suitable habitat does not occur in the Study Area. Designated critical habitat does not occur in the Study Area. The closest designated critical habitat for this species is the Farallon Islands, approximately 33 air miles east of the Study Area.
Western red bat	*Lasiurus blossevillii*	none/SSC/none	Roosts primarily in trees, less often in shrubs, adjacent to streams, fields, or urban areas. Preferred roost sites are protected from above, open below, and located above dark ground cover.	**Moderate.** Trees (such as eucalyptus) provide potential roost sites for solitary migrant individuals.

SOURCE: CDFG Natural Diversity Database (CNDDB), July 2008 for the US Geological Survey's (USGS) 7.5-minute San Francisco South and Hunters Point quadrangles.
California Native Plant Society (CNPS), July 2008 for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles.
US Fish and Wildlife Service (USFWS), July 2008 for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles

a. Status:

Federal

FE	*Federally listed as Endangered*
FT	*Federally listed as Threatened*
FC	*Federal candidate species*
FPD	*Federally Proposed Delisted*
SC	*National Marine Fisheries Service designated Species of Concern. Species of Concern status does not carry any procedural or substantive protections under the FESA.*

State

SE	*State listed as Endangered*
ST	*State listed as Threatened*
SPD	*State Proposed for Delisting*
SR	*State Rare*
FP	*California Department of Fish and Game designated "Fully Protected"*
SSC	*California Department of Fish and Game designated "Species of Special Concern"*

[94] National Marine Fisheries Service (NMFS), *Designated Critical Habitat; Stellar Sea Lion*, 58 Federal Register 45269, 1993.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area

Other

ESHA *Environmentally Sensitive Habitat Area by the California Coastal Commission*
SLC *California Native Plant Society (CNPS) Ranking Species of Local Concern*
1B *California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California and elsewhere.*
2 *California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California, but more common elsewhere.*
3 *California Native Plant Society (CNPS) Ranking. Plants About Which More Information is Needed—A Review List.*
CEQA *Species not currently protected by statute or regulation, but considered rare, threatened or endangered under Section 15380 of the CEQA Guidelines.*

Recent modifications to the CNPS Ranking System include the addition of a new Threat Code extension to listed species (i.e., List 1B.1, List 2.2 etc.). A Threat Code extension of .1 signifies that a species is seriously endangered in California; .2 is fairly endangered in California; and .3 is not very endangered in California.

b. Likelihood of occurrence evaluations

*A rating of "**Known**" indicates that the species/natural community type has been observed on the site.*

*A rating of "**High**" indicates that the species has not been observed, but sufficient information is available to indicate suitable habitat and conditions are present in the Study Area and the species is expected to occur in the Study Area.*

*A rating of "**Moderate**" indicates that it is not known if the species is present, but suitable habitat exists in the Study Area.*

*A rating of "**Low**" indicates that species was not found during biological surveys conducted to date on the Project site and may not be expected given the species' known regional distribution or the quality of habitats located in the Study Area.*

*A rating of "**Not Likely**" indicates that the taxon would not be expected to occur in the Study Area because the Study Area does not include the known range or does not support suitable habitat.*

*A rating of "**Absent**" indicates that no recorded occurrences or suitable habitat(s) occur within the Study Area to support this species. These species are not discussed further in this document.*

report on November 2, 2009. As indicated by the updated lists, which are also included in the aforementioned appendices (with 2009 database results following the 2008 results), no new special-status species known or expected to occur on the Project site were identified by the updated database searches.

Special-status Plants

The USFWS, CNDDB, and CNPS reported 41 special-status plant species as potentially occurring within the US Geological Survey's 7.5-minute San Francisco South and Hunters Point quadrangles.

The Study Area is largely developed and most vegetation in the area was introduced as landscape plants and turf grass. Much of the Study Area, including virtually all of CPSRA, is located on Bay fill. Ruderal (disturbed) habitats and ornamental landscaping predominate in those portions that are not landscaped. Jones & Stokes conducted botanical habitat assessments of the Candlestick Point and HPS on October 29, 2004; March 1, 2006; October 6, 2006; and May 17, 2007.[95] PBS&J botanists conducted rare plant surveys for the Candlestick Point area in May 2008. The general absence of suitable habitat over a majority of the Study Area in conjunction with the absence of observed special-status plants, either as observed during focused surveys or cited in CNDDB species accounts, supports the conclusion that no sensitive plant species occur within the Study Area.

Special-status and Sensitive Wildlife

Invertebrates

Monarch Butterfly (*Danaus plexippus*)

Monarch butterflies gather in winter roosting sites along the California coast in relatively few locations, and thus roost sites that are used traditionally by large numbers of individuals are considered sensitive biological resources. Wintering sites in California are associated with wind-protected groves of large trees (primarily eucalyptus or pine) with nectar and water sources nearby, generally near the coast.

A total of seven monarch butterflies were observed during the Yosemite Slough Watershed Wildlife Survey.[96] Ms. Mia Monroe, a Ranger with the Muir Woods National Monument (US National Parks Service) and co-coordinator of the Monarch Campaign for the past 15 years, was contacted in July 2008 and July 2009 to inquire about any known monarch wintering roosts that occur in the Project

[95] Caltrans, *Natural Environmental Study Report for the Bayview Transportation Improvements Project*, Jones and Stokes, July 2007.

[96] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

site. Ms. Monroe consulted with local monarch butterfly specialists and the Monarch Campaign Thanksgiving counts. The Monarch Campaign conducts surveys for peak monarch butterfly wintering population around the Thanksgiving holiday. Ms. Monroe reported there are no records of monarch butterfly autumnal (i.e., temporary bivouac site) nor over-wintering use of the Project site in the CNDDB or reported in other records, including anecdotal observations. The nearest observations of monarch butterfly roosts are at Fort Mason, the Presidio of San Francisco, and Stern Grove.[97]

Using the likelihood of occurrence definitions provided in Table 3, although individual monarch butterflies were observed, the sensitive winter roosting habitat is "not likely" to occur within the Study Area.

Birds

While the CNDDB reports no occurrences of any special-status bird species in the Study Area, special-status bird species have been recorded in the Study Area during the Yosemite Slough Watershed Wildlife Survey and by Alan Hopkins, as documented in that survey's report. Special-status bird species with potential to occur on the site are described below and are also summarized in Table 3. Although the harlequin duck (*Histrionicus histrionicus*), Barrow's goldeneye (*Bucephala islandica*), common loon (*Gavia immer*), yellow warbler (*Dendroica petechia*) and Vaux's swift (*Chaetua vauxi*) have all been observed within the site, these species are considered California Species of Special Concern only when breeding. [98] As they only occur within the site as non-breeders, none of them are discussed below, as they would be present only when they would not be considered Species of Concern.

Alameda Song Sparrow (*Melospiza melodia pusillula*)

The Alameda song sparrow is a CDFG Species of Special Concern. The Alameda song sparrow occurs only in the marshlands of the southern San Francisco Bay Region.[99] The primary range of the Alameda song sparrow extends from Coyote Creek, at the southern extremity of the Bay, northward along the west shore of South San Francisco Bay to Belmont Slough (south of the Study Area) and along the east shore to San Lorenzo. Song sparrows nest in dense riparian thickets,

[97] Monroe, M., Ranger, Muir Woods National Monument, telephone conversation with Todd Wong, PBS&J, July 16, 2008 and July 20, 2009.

[98] California Department of Fish and Game (CDFG). Electronic file: http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html, accessed on July 30, 2009.

[99] Walton, B., 1974. *Salt Marsh Song Sparrow Study*. California Department of Fish and Game (CDFG), 1974. Available at: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=4696. Accessed July 21, 2008.

emergent wetlands (including salt marshes), and dense thickets of other vegetation.[100] The Alameda song sparrow uses tidal salt marsh habitats along the edge of the Bay and streams where tidal flow affects the vegetation. Candlestick Point and HPS Phase II provide potential habitat for this species in salt marshes along the shoreline, but due to the very narrow nature of tidal salt marsh in the Study Area, such habitat is marginal at best for this species. Song sparrows were observed between January 2003 and April 2004 along Yosemite Slough, but the observed sparrows may or may not be Alameda song sparrows.[101] Observations in April may be of breeding birds although nesting has not been documented. Given the marginal quality of habitat on the site, the site's isolation from more extensive marshes that may serve as source populations for Alameda song sparrows, and the sedentary nature of Alameda song sparrows, it is possible that these are the more widespread race *gouldii* or that they represent migrants or wintering individuals from other races that occur in the region during the non-breeding season. The CNDDB does not report occurrences of Alameda song sparrow in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

American Peregrine Falcon (*Falco peregrinus anatum*)

The American peregrine falcon is a state-listed endangered species and a CDFG fully protected species pursuant to Section 3511 of the *California Fish and Game Code*; however, the California Fish and Game Commission voted to remove the species from the state endangered species list on August 6, 2009. The bird has experienced a remarkable resurgence in California and other parts of North America. This striking recovery is due in large measure to the ban on the use of DDT in many places. The peregrine has recovered in North America to the point that the USFWS removed the species from the federal Endangered Species List on August 25, 1999.[102] A pair of American peregrine falcons has nested in the Gantry Crane on Parcel D of the Shipyard, and has raised several broods at this location over the years.[103] These birds forage widely over the entire Study Area, likely feeding primarily on rock pigeons (*Columba livia*) and waterbirds.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

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[100] Madrone Audubon Society, *Sonoma County Breeding Bird Atlas*, 1995.

[101] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[102] United States Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Final Rule To Remove the American Peregrine Falcon From the Federal List of Endangered and Threatened Wildlife, and To Remove the Similarity of Appearance Provision for Free-Flying Peregrines in the Conterminous United States*; Final Rule, 64 Federal Register 46542, August 1999.

[103] Nelson, G., Facility Coordinator, Department of the Navy, field visit with PBS&J, July 8, 2008.

Bryant's Savannah Sparrow (*Passerculus sandwichensis alaudinus*)

Bryant's savannah sparrow is a CDFG Species of Special Concern. Bryant's savannah sparrow is a California endemic restricted to a narrow coastal strip from Humboldt Bay south to the Morro Bay; its center of abundance appears to be the San Francisco Bay area.[104] This sparrow occupies low tidally influenced habitats, adjacent ruderal areas, moist grassland within and just above the fog belt, and infrequently, drier grasslands. Adjacent to salt marshes this sparrow also occupies weedy spoil areas, canal banks, and bottomland pastures. In South San Francisco Bay, it nests mainly on levee tops grown to grasses and in areas of high pickleweed on levee banks. Bare ground, whether provided by tidal mud flats or upland interstitial areas between clumps of vegetation, appears to be an important component of occupied habitat. The Study Area provides potential habitat for this species in salt marshes along the shoreline, but because of the very narrow nature of tidal salt marsh in the Study Area only marginal quality habitat is available. Savannah sparrows were observed between January 2003 and April 2004 along Yosemite Slough, although the observed sparrows may or may not be Bryant's savannah sparrows.[105] Observations in April 2004 may be of breeding birds although nesting has not been documented. Given the marginal quality of habitat on the site and the site's isolation from more extensive marshes that may serve as source populations for savannah sparrows, it is possible that these represent migrants or wintering individuals from other races that occur in the region during the non-breeding season. The CNDDB does not report occurrences of the Bryant's savannah sparrow bird in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

Burrowing Owl (*Athene cunicularia*)

Burrowing owl, a CDFG Species of Special Concern, is an owl that dwells in generally flat, open, dry grasslands, pastures, deserts, and shrub lands, and in grass, forbs and open-shrub stages of pinyon-juniper and ponderosa pine habitats. Burrowing owls use communal ground squirrel and other small mammal burrows for nesting and cover, as well as artificial structures such as roadside embankments, levees, and berms. They can exhibit high site fidelity, often reusing burrows year after year. Occupancy of suitable burrowing owl habitat by breeding birds can be verified at a site by observation of a pair of burrowing owls during their breeding season (March to August) or, alternatively, by the presence of molted feathers, cast pellets, prey remains (rodents, small reptiles,

[104] California Department of Fish and Game (CDFG). *California Birds Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California*. Studies of Western Birds 1. 2008.

[105] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

and large insects), eggshell fragments, or whitewash (guano), at or near a burrow. Burrowing owls are fairly tolerant of human activity near their nest burrows as long as suitable foraging habitat exists nearby. Owl populations have declined sharply in some portions of California during the past two decades (i.e., the San Francisco Bay Area, Sacramento County, San Joaquin County, etc.), but they have increased greatly in some agricultural counties (particularly Imperial). Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[106] The CNDDB does not report occurrences of this species in the area, but burrowing owls have been recorded previously on the site. Historically, they occurred in a rubble pile in the northeastern corner of Candlestick Point, and there have been sporadic sightings of the species in various locations on HPS as well. Breeding is not known to have occurred in the Study Area, and these individuals may all have been migrants and wintering individuals.[107] The frequency of occurrence has apparently declined in recent years, and although suitable breeding, roosting, and foraging habitat is present within the Study Area, the species does not currently breed here and occurs sporadically and in low numbers, at best.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

California Brown Pelican (*Pelecanus occidentalis californicus*)

The California brown pelican is on the verge of recovery. It has been proposed for delisting by the Fish and Game Commission[108] and also recently proposed for delisting under the FESA.[109] It is fully protected by CDFG under Section 3511 of the *California Fish and Game Code*. The California brown pelican is found in estuarine, marine sub-tidal, and marine pelagic (deep) waters along the California coast. Pelicans nest from the Channel Islands of Southern California southward along the Baja California coast and in the Gulf of California to coastal southern Mexico.[110] The pelican builds nests of sticks on the ground, typically on islands or offshore rocks. Post-breeding adults and immature birds are found along the Pacific Coast from Oregon south into Baja, Mexico. This species has been observed perching on piers within HPS Phase II, particularly the three piers in the southeastern corner of HPS Phase II, and it forages within San Francisco Bay; however, the species has never nested as far north as the Bay and nesting habitat for this species is not present in the

[106] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[107] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 10, 2009.

[108] California Department of Fish and Game (CDFG) news release: *Fish and Game Commission votes to remove California brown pelican from State Endangered Species List*. February 17, 2009.

[109] United States Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Species Account: California Brown Pelican* (*Pelecanus occidentalis californicus*); Classification: Proposed for delisting; Federal Register 73:9407; February 20, 2008.

[110] California Department of Fish and Game (CDFG) B043, *Brown Pelican*. Website: http://www.dfg.ca.gov/whdab/html/B043.html. Accessed April 19, 2005.

Study Area. In addition, CNDDB does not report occurrences of California brown pelican communal roosts in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

Loggerhead Shrike (*Lanius ludovicianus*)

The loggerhead shrike, a CDFG Species of Special Concern, is a common resident and winter visitor in lowlands and foothills throughout California and prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. Highest density occurs in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. It occurs only rarely in heavily urbanized areas, but is often found in open cropland. The *San Francisco Breeding Bird Atlas*, for which field work was conducted in 1991-1993, reported a record of possible breeding in the atlas block that included HPS and referred to a historical breeding record in the atlas block that includes Candlestick Point.[111] Low numbers of loggerhead shrikes have been observed on Candlestick Point and HPS by Alan Hopkins, and non-native grasslands provide suitable foraging habitat and on-site trees provide suitable nesting habitat for this species. However, there is no evidence of confirmed breeding in recent years, and the species currently occurs as an uncommon migrant and winter resident.[112]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

Northern Harrier (*Circus cyaneus*)

The northern harrier, a CDFG Species of Special Concern, prefers coastal prairies, marshes, grasslands, swamps and other open areas. Although this species primarily eats small rodents (mice and voles), amphibians, small reptiles, small rabbits, and other birds, northern harriers will eat some invertebrates as well. Northern harriers usually return to the same area to nest in consecutive years. They nest on the ground in well-concealed locations, often near low shrubs or in tall clumps of vegetation. Nesting locations are usually in abandoned fields, wet meadows, and coastal and inland marshes. Wetlands and non-native grasslands provide suitable foraging habitat for small numbers of this species on the site, and northern harriers have been observed by Alan Hopkins in the Study

[111] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.
[112] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 10, 2009.

Area.[113] However, due to the extent of disturbance by humans and pets, the lack of extensive wetlands suitable for nesting, and the vulnerability of ground-nesting birds to predation in upland portions of the Study Area, harriers are not expected to nest there. Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[114]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*)

The San Francisco common yellowthroat is a California Species of Concern and is one of four subspecies of common yellowthroat that breed in California. The breeding range of the San Francisco common yellowthroat as described by Foster is bounded by Tomales Bay on the north, Carquinez Strait on the east, and Santa Cruz County on the south, which would include the Study Area.[115] Yellowthroats are found in freshwater marshes, coastal swales, swampy riparian thickets, brackish marshes, salt marshes, and the edges of disturbed weed fields and grasslands that border soggy habitats.[116] In the San Francisco Bay region as a whole, about 60 percent of yellowthroats breed in brackish marsh, 20 percent in riparian woodland/swamp, 10 percent in freshwater marsh, 5 percent in salt marsh, and 5 percent in upland vegetation.[117] The brackish marsh in the Study Area provides potential habitat for this species, although the limited extent of such habitat limits the possibility that the species currently breeds here. Common yellowthroats were observed between January 2003 and April 2004 during surveys along Yosemite Slough, though it is unknown whether these were San Francisco common yellowthroats or migrants/wintering birds of other races.[118] Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the eastern part of the City, including the Project vicinity.[119]

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[113] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[114] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[115] Foster, M. L., *Status of the salt marsh common yellowthroat (Geothylpis trichas sinuosa) in the San Francisco Bay Area, California 1975–1976*, California Department of Fish and Game (CDFG), 1977.

[116] Shuford, W.D., The Marin County breeding bird atlas. Bushtit Books. Bolinas, California. pp. 479, 1993.

[117] Hobson, K., P. Perrine, E.B. Roberts, M.L. Foster and P. Woodin, *A breeding season survey of salt marsh common yellowthroats (Geothylpis trichas sinuosa) in the San Francisco Bay Region*. Report of the San Francisco Bay Bird Observatory to the US Fish and Wildlife Service, 1986.

[118] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[119] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Short-eared owl (*Asio flammeus*)

The short-eared owl, a California Species of Concern, is usually found in open areas with few trees such as annual and perennial grasslands, prairies, meadows, dunes, irrigated lands, and saline and fresh emergent marshes. Its prey consists of small mammals, marsh birds, insects, reptiles, and amphibians.[120] The short-eared owl will usually nest on dry ground in a depression that is concealed in vegetation; occasionally the nest will be placed in a burrow. It requires dense vegetation for roosting and resting cover. This includes tall grasses, brush, ditches, and wetlands. Open, treeless areas containing elevated sites for perching are also needed. This species was observed by Alan Hopkins on the site[121] and the Study Area provides suitable foraging habitat for this species. As a result, short-eared owls are expected to forage occasionally in low numbers on the site. However, due to the extent of disturbance by humans and pets, the lack of extensive wetlands suitable for nesting, and the vulnerability of ground-nesting birds to predation in upland portions of the Study Area, short-eared owls are not expected to nest there. Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[122]

Using the likelihood of occurrence definitions provided in Table 3, this is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

Tricolored Blackbird (*Agelaius tricolor*)

The tricolored blackbird, a California Species of Concern, is a highly social, marsh-nesting bird that lives in flocks numbering from less than one hundred to many thousands. Tricolored blackbirds are permanent residents of California, but birds make extensive migrations and movements, both in the breeding season and in winter, within their restricted range.[123] Tricolored blackbirds live in large colonies, and they prefer open accessible water, a protected nesting substrate such as flooded, thorny or spiny vegetation, and a suitable foraging space providing insect prey within a few miles of nesting colonies. Nesting habitat includes cattails and bulrushes or ungrazed grasslands

[120] http://www.delta.dfg.ca.gov/gallery/shearowl.asp.

[121] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[122] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[123] Shuford, W. D., and Gardali, T., editors. 2008. *California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in*

containing tall grasses. Other plant species that are used for nesting include young willow thickets and wild rose. This species has been observed by Alan Hopkins on the Study Area[124] and the site provides suitable foraging habitat for the species. However, no suitable breeding habitat is present, no colonies are known to occur in the area, and the *San Francisco Breeding Bird Atlas* did not confirm breeding by this species anywhere in the City.[125]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

White-tailed Kite (*Elanus leucurus*)

The white-tailed kite is listed as a fully protected species under Section 3511 of the *California Fish and Game Code*. White-tailed kites feed on rodents, small reptiles, and large insects in fresh emergent wetlands, annual grasslands, pastures, and ruderal vegetation. They breed between February and October. Kites often roost, and occasionally nest, communally especially during the non-breeding season. Therefore, disturbance of a relatively small roost or nesting area could affect a large number of birds. The white-tailed kite can commonly be observed foraging in extensive open grasslands throughout most of the San Francisco Bay region. While white-tailed kites were not observed during surveys conducted by PBS&J biologists on the Project site, small numbers of individuals were observed during the Yosemite Slough Wildlife surveys.[126] The species is not known to nest on the site[127], but the grasslands and ruderal habitats on the Project site provide suitable foraging habitat for small numbers of non-breeding individuals that occasionally occur there.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

[124] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[125] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[126] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

[127] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 20, 2009.

Terrestrial Mammals

Western Red Bat (*Lasiurus blossevillii*)

The only special-status bat species likely to occur within the Study Area is the western red bat (*Lasiurus blossevillii*). The western red bat is not known to breed in San Francisco, but the species is migratory, and red bats occur here during migration and possibly during winter. Western red bats are not colonial, and, thus, the species is expected to occur in the Study Area only in small numbers. They are known to roost in the foliage of a number of tree species, including eucalyptus. Potential habitat for this species is present within the eucalyptus and other mature trees within the Project site. However, most bat species are sensitive to human-generated disturbance. Identification of bats requires special surveys that were not conducted for this analysis. Therefore, the conservative assumption is that this species of sensitive bat is present within the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Mollusks

Olympia Oyster (*Ostreola conchaphila*)

Native Olympia oysters were historically abundant in San Francisco Bay. Oyster beds are a cornerstone in the benthic habitat, improving water quality, and providing habitat complexity that favors fish and vegetation. They also provide an important link between pelagic and benthic food webs. Their function in the estuarine food web—oyster beds generally increase fish abundance and thus make up an essential part of the Essential Fish Habitat (EFH)[128]—they are considered an important resource for the purposes of this technical report as only a few relict populations remain in the Bay.[129]

Recently, small populations of native oysters have been documented within the Bay.[130,131] Detailed surveys for native oysters were not conducted as part of this Project. Suitable habitat is distributed

[128] National Marine Fisheries Service (NMFS). 2006. Fisheries Management Plan (FMP) Species Distributions In San Francisco, San Pablo and Suisun Bays. Website: http://swr.nmfs.noaa.gov/hcd/loclist.htm#South%20SF%20Bay. Accessed October 29, 2008.

[128] National Marine Fisheries Service (NMFS). Essential Fish Habitat (EFH) for Pacific Coast Groundfish. Map dated July 26, 2008.

[129] National Marine Fisheries Service (NMFS), No Date. *Native Oyster Habitat Restoration, Program Briefing Document*. Fisheries Southwest Region.

[130] Harris, H.E., 2004. *Distribution and limiting factors of Ostrea conchaphila in San Francisco Bay, MS Thesis,* San Francisco State University.

[131] Latta, M., 2006. Personal communication with Marilyn Latta, Habitat Restoration Director, Save the Bay, with D. Ebert and others at a meeting on October 18, 2006.

throughout the shoreline of Study Area. Suitable substrate is solid surfaces to which the larvae can easily attach.[132] Because the larval forms of oysters are free-floating in the Bay and a large population exists south of the Study Area at Oyster Point Marina,[133] native oysters are likely present on suitable substrate throughout the Study Area.

Fish

Green Sturgeon (*Acipenser medirostris*)

The southern distinct population segment of green sturgeon (including those that reside in the Sacramento River) was listed as threatened under the FESA by NMFS on April 7, 2006.[134] Green sturgeon is a long-lived, anadromous, native fish that occurs in low numbers in the San Francisco Estuary and Sacramento River. Adults spawn in freshwater rivers from British Columbia south to the Sacramento River. In the Sacramento River, spawning occurs near Red Bluff and possibly in the Feather River. Larvae develop within these freshwater systems, migrate downstream, and remain in the estuaries for between 1 and 4 years before migrating to the ocean. Mature adults move into estuaries in the spring and spawning adults move up the rivers of their origins in late spring/early summer. Post spawning adults return to the estuary before migrating back to the ocean in late fall. Sub-adult fish also are thought to enter estuaries during summer and fall months. The Study Area is along the San Francisco Bay, which is a saltwater habitat; the Study Area does not support the necessary freshwater spawning habitat for adult fish.[135] Juvenile fish and sub-adults may rear in the adjacent waters of San Francisco Bay.

The NMFS designated critical habitat for green sturgeon on October 2009.[136] Specific areas designated as critical habitat include: coastal US marine waters within 60 fathoms depth (360 feet) from Monterey Bay, California, north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; and certain coastal bays and estuaries in California, Oregon, and Washington. The areas designated comprise approximately 320 miles of freshwater river habitat, 897 square miles of estuarine habitat (including the San Francisco Bay), 11,421 square miles of

[132] Harris, H.E., 2004. *Distribution and limiting factors of Ostrea conchaphila in San Francisco Bay, MS Thesis*, San Francisco State University.

[133] MACTEC Engineering and Consulting, Inc. 2008. *Oyster Point Marina Olympia Oyster Surveys Pre- and Post-Dredging February 2008, Oyster Point Marina, South San Francisco, California*. Prepared for PBS&J.

[134] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon*, 71 Federal Register 17757, 2006.

[135] Moyle, Peter B. *Inland Fishes of California*, 2002, University of California Press.

[136] National Marine Fisheries Service (NMFS), *Endangered and Threatened Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon*. 74 Federal Register 52300, October 9, 2009.

marine habitat, and 135 square miles of habitat within the Yolo and Sutter bypasses. [137] Under the FESA, critical habitat includes those areas necessary to support the continued existence and recovery of this species. Critical habitat for green sturgeon includes all of San Francisco Bay. Critical habitat designations include the specific habitat and habitat functions that are necessary for the survival and recovery of the species; these are called primary constituent elements (PCEs). Within the estuarine category of critical habitat, the PCEs include food, flow, water quality, migratory pathways, depth, and sediment quality.[138] Food is an abundance of prey items, benthic invertebrates and shrimp, within the substrate upon which sturgeon can forage. Flow refers to ample movement of water within the estuary to allow adults to orient to the Sacramento River during their spawning migrations. Water quality refers to adequate levels of dissolved oxygen, salinity, and temperatures to allow for survival and growth. Water quality also includes low levels of contaminants that could affect survival or reproductive fitness. A migratory pathway refers to the fact that sturgeon migrate through the Bay to and from upstream spawning areas. The PCE for migratory pathways allows for safe and timely passage of fish between the ocean and upstream spawning areas, but it also includes localized movement of rearing and holding sturgeon within the Bay. The depth PCE refers to the variety of water depths required to provide suitable foraging, holding, and migratory areas. Sediment quality is important because sturgeons are benthic foragers (bottom feeders) and contaminant-free sediments support higher quality prey that do not affect the survival or reproductive fitness of the fish. The Study Area includes elements of all these PCEs. However, the sediment quality may be impaired by decades of industrial use, which has resulted in contamination. This in turn probably reduces the foraging quality.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "high" likelihood to occur within the Study Area.

Chinook Salmon (*Oncorhynchus tshawytscha*)

Populations of Chinook salmon potentially found adjacent to the Project site fall into three Evolutionary Significant Units (ESUs): Winter-run, Spring-run, and Fall/late-Fall-run[139] Chinook salmon. The runs of Chinook are distinguished based on the timing of the adult return to freshwater on their spawning migration. At almost any time of year, there are Chinook at some life cycle stage or another within San Francisco Bay (Table 4 [Life Cycle Stages and Periods of Freshwater Residency for Chinook Salmon]). The occurrence of Chinook adjacent to the Project site could involve any of those life stages. Juvenile fish are more likely to be found adjacent to the Project site than adults because they are moving downstream from their natal streams and do not have the

[137] Ibid.
[138] Ibid.
[139] Fall and late-fall run Chinook are treated as a single ESU by NMFS.

same swimming ability as adults. Juvenile fish from the Sacramento River populations would be expected to occur in low numbers as they stray south of the Golden Gate. Small numbers of Chinook have also recently appeared in Coyote Creek and Guadalupe River, which are both tributaries to south San Francisco Bay near Alviso; these fish are derived from hatchery releases within the native range of the species, which did not include the South Bay.[140,141] Adult or juvenile fish from either of these populations would be expected to migrate through or past the Study Area on their way to and from the Pacific Ocean because the Study Area is between the Pacific Ocean and spawning sites in the South Bay. The overall likelihood of finding a substantial number of Chinook salmon within or adjacent to the Project site at any one time is relatively low because the open water of the Study Area is not considered suitable rearing habitat for either life stage. The residence time that either life stage may spend within or adjacent to the Project site is unknown.

TABLE 4 LIFE CYCLE STAGES AND PERIODS OF FRESHWATER RESIDENCY FOR CHINOOK SALMON

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)
Winter Run	Dec–July (Mar)	Apr–Aug (May–June)	5–10 months	July Oct
Spring Run	Mar–Sep (May–June)	Aug–Oct (Sep)	3–15 months	Nov–Mar (Jan–Mar)
Fall Run	June–Dec (Sep–Oct)	Sep–Dec (Oct–Nov)	1–7 months	Dec–Mar
Late Fall Run	Oct–Feb (Dec)	Jan–Apr (Feb–Mar)	7–13 months	Apr–June (Dec–Mar)

SOURCE: Moyle, 2002.

Winter-run Chinook are listed as endangered under the California and federal *Endangered Species Act*s. They spawn in the Sacramento River upstream of Red Bluff Diversion Dam and are distinguishable from other Chinook runs based on the timing of both upstream migration and the spawning season (Table 4). Prior to the construction of Shasta and Keswick dams in 1943 and 1955, respectively, winter-run Chinook spawned in the upper reaches of the Sacramento, McCloud, and

[140] Santa Clara County, *Santa Clara County Habitat Plan, 1st Administrative Draft* August 2008. Website: http://www.scv-habitatplan.org/www/site/alias__default/292/1st_administrative_draft_hcp.aspx. Accessed July 2009.

[141] National Marine Fisheries Service (NMFS). No Date. *Central Valley Chinook Salmon Distributions*. Southwest Regional Office. Website: http://swr.nmfs.noaa.gov/hcd/dist2.htm. Accessed July 17, 2009.

lower Pit rivers,[142] and Battle Creek. Presently, the majority of winter-run Chinook spawning occurs on the main stem of the Sacramento River between Keswick Dam and the Red Bluff Diversion Dam.[143] Designated critical habitat extends from Keswick Dam, Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Critical habitat does not extend into the Study Area.

Spring-run Chinook salmon are listed as a threatened species under the California and federal ESAs. Spring-run Chinook enter the Sacramento River between March and September and move upstream into the headwaters, where they hold in pools until they spawn between August and October. Juveniles emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October.[144] Typically, spring-run Chinook salmon use mid- to high-elevation streams that provide appropriate low water temperatures and sufficient flow, cover, and pool depth to allow over summering. Spawning occurs between August and October and, depending on water temperature, emergence occurs between November and March. Although Spring-run Chinook salmon emigration is highly variable, the emigration period extends from November to early May, with up to 69 percent of young-of-the-year out migrants passing through the lower Sacramento River between mid-November and early January.[145] Designated critical habitat extends from Keswick Dam, Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Critical habitat does not extend into the Study Area.

Central Valley Fall and Late Fall-run Chinook salmon are not listed under the state or federal endangered species act but are classified as a Species of Special Concern. Fall-run Chinook salmon is the most abundant ESU, documented to comprise about 80 percent of the Sacramento Basin stock in the early 1980s. The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries, east of Carquinez Strait,

[142] Moyle, P. B. 2002. *Inland Fishes of California*, University of California Press. 2002.
[143] Ibid.
[144] Ibid
[145] Snider, B., and R.G. Titus. 2000. *Timing, composition, and abundance of juvenile anadromous salmonid emigration in the Sacramento River near Knights Landing*, October 1996.

California. Juvenile fall and late fall-run fish could stray into open waters within and adjacent to the Project site if they miss the entrance to the Golden Gate and the Pacific Ocean.

A small population of Chinook salmon has become established in recent years in Coyote Creek and the Guadalupe River.[146] The regulatory status of this population is unclear because the fall/late fall-run ESU only includes naturally spawned fish from upstream of Carquinez Strait. There is not an ESU that includes fish spawning within the tributaries of San Francisco Bay. These fish exhibit a fall-run pattern similar to the fall-run ESU of the Central Valley, and are apparently derived from wandering individuals, likely hatchery-released fish, from that ESU.[147] Regardless of where they came from or what their regulatory status may be, these fish would pass the Study Area on their way to and from the ocean.

Using the likelihood of occurrence definitions provided in Table 3, the spring-run, winter-run/ and fall/late fall-run of this species has a "High" likelihood to occur within the Study Area.

Central Valley Steelhead (*Oncorhynchus mykiss*)

Central Valley steelhead (rainbow trout) were federally listed as a threatened species in 1998[148] and this status was reaffirmed in 2006.[149] The Central Valley steelhead population is a Distinct Population Segment (DPS; aka ESU) that includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries. Final critical habitat, designated in September 2005 for this species, does not include the Study Area.[150] Critical habitat is designated by hydrologic unit, the closest of which to the Study Area is the Sacramento Delta Hydrologic Unit, over 25 miles north of the Project site.[151] Central Valley steelhead, especially juveniles, may occasionally stray into the South Bay during their migration to the ocean, but the area adjacent to the Project site is generally outside their migratory pathway.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

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[146] Santa Clara County, *Santa Clara County Habitat Concept Plan, 1st Administrative Draft* August 2008. Website: http://www.scv-habitatplan.org/www/site/alias__default/292/1st_administrative_draft_hcp.aspx. Accessed July 2009.

[147] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California*, 63 Federal Register 13347, 1998.

[148] Ibid.

[149] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead*; Final Rule, 71 Federal Register 834, 2006.

[150] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Designation of Critical Habitat for Seven Evolutionarily Significant Unites of Pacific Salmon and Steelhead in California*; Final Rule, 70 Federal Register 52488, 2005.

[151] Ibid.

Central California Coast Steelhead (*Oncorhynchus mykiss*)

The Central California Coast DPS of steelhead is a federally threatened species.[152] This DPS includes all naturally spawned populations of steelhead from the Russian River south to, and including, Aptos Creek and includes the populations within San Francisco Bay.[153] Steelhead begin their migration from the ocean when winter rains provide large amounts of cold water for migration and spawning. Peak migration period for adult fish is in mid-winter. They typically spawn in smaller streams and tributaries to mainstream rivers. Juvenile steelhead generally spends one to three years in freshwater before migrating to the ocean.[154]

It is highly likely that both adults and juvenile steelhead from this DPS could be found adjacent to the Project site. The closest potential steelhead spawning streams in South San Francisco Bay are San Mateo Creek (approximately 10 miles south of the Study Area), Alameda Creek (approximately 16 miles south of the Study Area), and San Francisquito Creek (approximately 22 miles south of the Study Area). Other South Bay watersheds that support populations of steelhead include the Coyote Creek and Guadalupe River watersheds. Because the Study Area is between their spawning and rearing streams and the Pacific Ocean, fish from any of these streams could be found in the Bay adjacent to the Project site during adult migrations from the Pacific Ocean to spawning sites or during juvenile migrations from their natal streams to the Pacific Ocean.

The final critical habitat designation for the Central California Coast steelhead DPS was issued on September 2, 2005.[155] The specific primary constituent elements considered in the designation were freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas. The lateral extent of critical habitat in estuarine areas is the area inundated by extreme high tide. The Study Area is within the designated critical habitat for this species.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "high" likelihood to occur within the Study Area.

[152] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California*, 63 Federal Register 13347, 1998.

[153] National Marine Fisheries Service (NMFS).*Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead*; Final Rule. 71 FR 834

[154] Moyle, P. B. *Inland Fishes of California*, 2002, University of California Press, 2002.

[155] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Designation of Critical Habitat for Seven Evolutionarily Significant Unites of Pacific Salmon and Steelhead in California*; Final Rule, 70 Federal Register 52488, 2005.

Longfin Smelt (*Spirinchus thaleichthys*)

Longfin smelt were listed under the California Endangered Species account as a threatened species in March 2009. This species is endemic to the west coast of North America with small populations likely still present in the Klamath River and Russian River estuaries.[156] However, the bulk of the longfin smelt population appears to be in San Francisco Bay.[157] Adults spawn in the Sacramento-San Joaquin Estuary almost as far upstream as the City of Sacramento on the Sacramento River and to Turner Cut on the San Joaquin River.[158] Adults spawn in these upstream freshwater locations in early winter. The larval smelt are distributed downstream by natural river flow. Because of this, the higher the outflow of freshwater from the Sacramento-San Joaquin Delta, the greater the distribution of smelt in the Bay. As they mature, swimming ability improves and their distribution expands. Adults occur into the South Bay and are also found in the ocean just outside the Golden Gate.[159] This species could be found in the Study Area from spring to fall before adults return upstream to spawn.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Pacific Herring (*Clupea pallasi*)

San Francisco Bay supports a small, yet productive commercial Pacific herring fishery. Pacific herring are not protected by either the state or the federal government; however, because herring are harvested for their roe, they are an important species in the economy of the San Francisco Bay Area and their populations are closely monitored by CDFG. Pacific herring are also an important species in the ecology of San Francisco Bay because herring, along with sardines and anchovies, are a primary food source for salmon and other sport fish. Pacific herring generally enter the Bay from November through April[160] of each year and spawn in intertidal and sub-tidal habitats.[161] The actual sites where Pacific herring spawn in San Francisco Bay change from year to year and spawning may occur within numerous locations around the Bay. The North Bay is typically the preferred spawning

[156] Moyle, P. B. *Inland Fishes of California*, 2002, University of California Press, 2002.

[157] California Department of Fish and Game (CDFG), A Status Review of the Longfin Smelt (*Spirinchus thaleichthys*) in California, January 2009.

[158] Ibid.

[159] Ibid.

[160] National Oceanic and Atmospheric Administration (NOAA). 2008. San Francisco Bay Project Impact Evaluation System—Pile Driving. Coastal Restoration and Protection Division. Interactive GIS mapping software Website: http://mapping2.orr.noaa.gov/website/portal/pies/ naturalhistory.html. Accessed December 2, 2008.

[161] Barnhart, R.A. 1988. *Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—Pacific herring*. *US Fish and Wildlife Service Biol. Rep*. 82(11.79). US Army Corps of Engineers, TR EL-82-4. 14 pp.

area, although limited spawning has historically been observed at San Mateo Point.[162] The preferred substrate for herring spawning is eelgrass, followed by rocky seafloors, and lastly flat surfaces such as marina pilings, retaining walls, and bulkheads along the San Francisco Bay waterfront.[163] According to NMFS, known herring spawning areas within the area immediately adjacent to the Project site include several piers and areas of shoreline both north and south of the proposed marina (refer to Figure 5 [Pacific Herring Spawning Habitat]).[164] Where Figure 5 shows habitat as including piers, this refers to in-water portions of those structures. Also, the mapping data left gaps between the shoreline and the delineated habitat that is an artifact of the mapping. Spawning grounds could extend to the shoreline, especially in those areas where bulkheads define a vertical shoreline. The open channel to the northwest of the proposed marina between Blandy and E streets may be used by herring even though NMFS does not map it as spawning habitat.

OTHER SENSITIVE HABITATS

Essential Fish Habitat

The tidal aquatic habitats adjacent to the Project site are considered EFH by the NMFS for a species assemblage that includes anchovies, sardines, rockfish, sharks, sole, and flounder. Areas supporting the native Olympia oyster found in San Francisco Bay are also considered EFH by NMFS because oyster beds generally increase fish abundance. A more detailed discussion of the provisions of the Magnuson-Stevens Fisheries Conservation Act, by which effects on EFH are regulated, is provided below in the "Regulatory Framework" section.

Eelgrass Beds

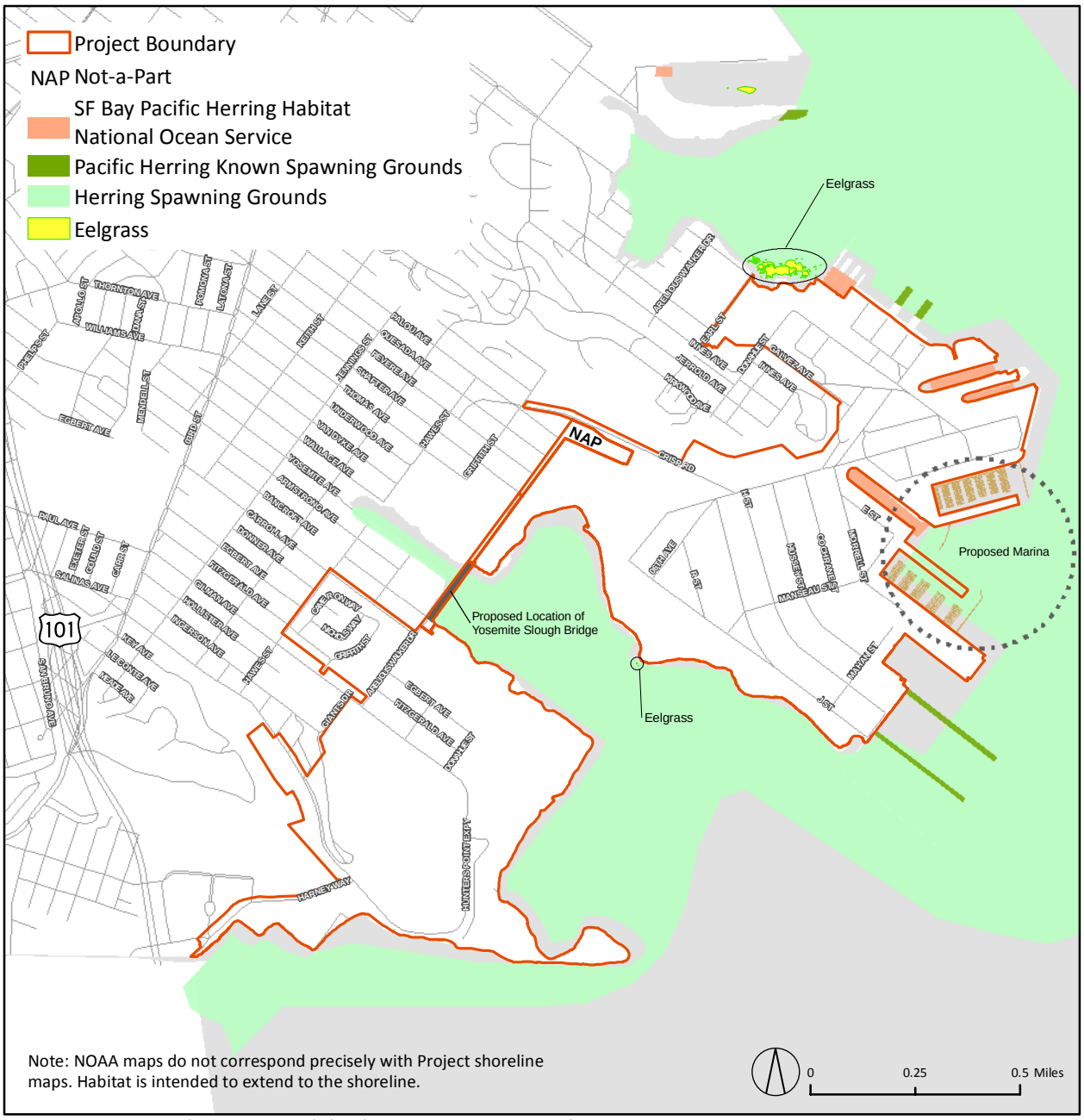
Eelgrass occurs in both subtidal and intertidal areas of San Francisco Bay. The distribution of eelgrass has been mapped relatively recently (in 2003) and the results of this effort indicate that low-density eelgrass beds are found on the north side of Hunters Point peninsula offshore from the end of Earl Street and in a small patch in the South Basin.[165] Eelgrass beds form areas of important habitat for birds, fish, and crustaceans and are one of the preferred spawning habitats of Pacific

[162] Miller, D. J. and J. Schmidtke. 1956. *Report on the distribution and abundance of Pacific herring (Clupea pallasi) along the coast of Central and Southern California*. California Fish and Game (CDFG) 42(3):163-187.

[163] Barnhart, R.A. 1988. *Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—Pacific herring. US Fish and Wildlife Service Biol. Rep. 82(11.79).* US Army Corps of Engineers, TR EL-82-4. 14 pp.

[164] National Oceanic and Atmospheric Administration (NOAA). 2008. *San Francisco Bay Project Impact Evaluation System—Pile Driving*. Coastal Restoration and Protection Division. Interactive GIS mapping software Website: http://mapping2.orr.noaa.gov/website/portal/pies/ naturalhistory.html. Accessed December 2, 2008..

[165] San Francisco Bay Eelgrass Inventory, June-October 2003. Prepared for Caltrans and NOAA Fisheries. Prepared by Merkel and Associates, 2003.



SOURCE: NOAA PIES Website, 2008, Merkel and Associates 2003 SF Bay eelgrass survey. **PBS&J 10.27.09**

FIGURE 5 Candlestick Point - Hunters Point Shipyard Phase II EIR

PACIFIC HERRING SPAWNING HABITAT

herring.[166] These plants also support grazing crustaceans, shrimp, and amphipods. Because it requires light for photosynthesis, eelgrass is limited by water clarity to depths of about 6 feet or less. Because little accurate information exists about the historic distribution of eelgrass beds, and because of their current relative scarcity and importance in the overall ecology of the Bay, both the USACE and CDFG consider eelgrass beds a sensitive resource.

WILDLIFE MOVEMENT

Wildlife movement activities usually fall into one of three movement categories: (1) dispersal (i.e., juvenile animals from natal areas, or individuals extending range distributions); (2) seasonal migration; and (3) local movements related to home range activities (foraging for food or water, defending territories, searching for mates, breeding areas, or cover). A number of terms have been used in various wildlife movement studies, such as "wildlife corridor," "travel route," "habitat linkage," and "wildlife crossing," to refer to areas in which wildlife move from one area to another. To clarify the meaning of these terms and facilitate the discussion of wildlife movement in this analysis, these terms are defined as follows:

- **Travel route**—A landscape feature (such as a ridgeline, drainage, canyon, or riparian strip) within a larger natural habitat area that is used frequently by animals to facilitate movement and provide access to necessary resources (i.e., water, food, cover, den sites). The travel route is generally preferred because it provides the least amount of topographic resistance in moving from one area to another. It contains adequate food, water, and/or cover while moving between habitat areas and provides a relatively direct link between target habitat areas.
- **Wildlife corridor**—A patch of habitat, usually linear in nature, that connects two or more habitat patches that would otherwise be fragmented or isolated from one another. Wildlife corridors are usually bounded by urban land areas or other areas unsuitable for wildlife. The corridor generally contains suitable cover, food, and/or water to support species and facilitate movement while in the corridor.
- **Habitat linkage**—Larger, landscape-level movement features (often referred to as "habitat or landscape linkages") can provide both transitory and resident habitat for a variety of species to a more substantial, or wider, land connection between two habitat areas. Habitat linkages allow for the periodic exchange of animals between habitat areas, which is essential to maintain adequate gene pools.
- **Wildlife crossing**—A small, narrow area, relatively short in length and generally constricted in nature, that allows wildlife to pass under or through an obstacle or barrier that otherwise hinders or prevents movement. Crossings may be manmade and include culverts, underpasses, drainage pipes, and tunnels to provide access across or under roads,

[166] Wyllie-Echeverria, S. and M. Fonseca. Eelgrass (*Zostera marina*) research in San Francisco Bay, California from 1920 to the Present. 2003.

highways, pipelines, or other physical obstacles. These often represent "choke points" along a movement corridor.

Surveys of the Project site did not identify any major or regional wildlife corridor/travel route. The Project site is surrounded by open water and urban development that isolate habitats in the Study Area from large expanses of similar habitats in undeveloped areas elsewhere along the San Francisco Bay shoreline and in the San Bruno Mountain State Park (approximately 2 miles to the southwest). There is localized movement, as ground-dwelling animals forage for food, mate, and move between habitat patches within the Project site. Although there is localized movement between Bayview Hill and the CPSRA, Bayview Hill is also isolated from larger expanses of habitat, and movement by mammals, reptiles, and amphibians between the site and any larger expanses of natural habitat (such as San Bruno Mountain to the southwest) is severely impeded by US-101 and other roads and urban development.

In addition, although bird flyways are not traditionally considered "wildlife movement corridors," the San Francisco Bay's wetlands and tidal lands serve as important habitat for bird species during migration through the Pacific Flyway. Many bird species use these areas as an annual stopover location for several days of rest and feeding prior to continuing migration. These habitats also provide critical staging areas for migratory species. Thus, the Study Area is a minor, but important component of the much larger Bay system that provides habitat for migratory birds.

REGULATORY FRAMEWORK

Federal

Section 404 of the Clean Water Act

Section 404 of the *Clean Water Act* (CWA) (33 *United States Code* [USC] §§ 1344) requires that a permit be obtained from the USACE prior to the discharge of dredged or fill materials into any "waters of the United States or wetlands." Waters of the United States are broadly defined in the USACE regulations to include navigable waterways, their tributaries, lakes, ponds, and wetlands. Wetlands are defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."[167] Wetlands that are not specifically exempt from Section 404 regulations (such as drainage channels excavated on dry land) are considered to be "jurisdictional wetlands." The USACE is required to consult with the USFWS, NMFS, Environmental Protection Agency, and State Regional Water Quality Control Board (SWRCB) in carrying out its discretionary authority under Section 404.

The USACE grants three types of permits: individual, general, and nationwide. Project-specific individual permits are required for certain activities that may have a potential for more than a minimal impact and necessitate a detailed application. A permit from the USACE would be required for any placement of fill in waters of the US as part of the Project.

Section 402 of the Clean Water Act

The primary mechanism in the CWA regulating the discharge of pollutants is the National Pollutant Discharge Elimination System (NPDES), which is administered by the Environmental Protection Agency (EPA). Under the NPDES program, a permit is required from EPA or an authorized state for the discharge of any pollutant from a point source into the waters of the US (33 USC §§1342). Storm water pollution prevention plans must be prepared for construction activities as part of the NPDES permitting process.

Section 401 of the Clean Water Act

Section 401 of the CWA (33 USC §§ 1341) requires a state-issued Water Quality Certification for all projects requiring a Section 404 permit, or other federal permit or license. There are nine Regional Water Quality Control Boards (RWQCBs) across the state that issue Water Quality Certifications for various actions within their respective region. The RWQCB, San Francisco Bay Region, issues

[167] US Army Corps of Engineers, *Definition of Waters of the United States*, 33 CFR 328, November 1986.

Section 401 Water Quality Certifications for the City and County of San Francisco. A Section 401 certification requires a determination that the Project will comply with all state water quality standards.

Federal Endangered Species Act (FESA)

The FESA was enacted in 1973. Under the FESA, the Secretary of the Interior and the Secretary of Commerce have the authority to list a species as threatened or endangered (16 USC 1533[c]). The FESA is administered by both the NMFS and the USFWS. The NMFS is accountable for animals that spend most of their lives in marine waters, including marine fish, most marine mammals, and anadromous fish such as Pacific salmon. The USFWS is accountable for all other federally listed plants and animals.

Pursuant to the requirements of FESA, a federal agency authorizing, funding or carrying out a project within its jurisdiction must determine whether any federally listed threatened or endangered species may be present within the Study Area and determine whether the agency's action could affect any federally listed species (16 USC 1536(a)(2), (3).) If the action would likely affect a listed species, the agency must consult with the USFWS or NMFS under Section 7 of the FESA to determine whether the action is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat (16 USC 1536(a)(2).) Project-related adverse effects to these species or their habitats are typically considered significant under CEQA and thus would require mitigation.

The USFWS Regional Office in Sacramento maintains a list of "species of concern" that receive special attention from other federal agencies (i.e., NMFS) during environmental review, although they are not protected under FESA. Project-related impacts to such species could be considered significant under CEQA Guidelines section 15380 and could require mitigation.

Section 9 of the FESA prohibits any person or federal agency from "taking" endangered or threatened wildlife. The definition of "take" includes harassing, harming, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting to engage in any such conduct. A notable component of this definition is the definition of "harm." "Harm" in the definition of "take" means an act that actually kills or injures protected wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering.

Projects that would result in "take" of any federally listed threatened or endangered species are required to obtain incidental take authorization from NMFS or USFWS through either the Section 7 (interagency consultation) process described above or Section 10(a) (incidental take permit) of FESA. The Section 7 authorization process is used to determine if a project with a federal nexus would

jeopardize the continued existence of a listed species and what mitigation measures would be required to avoid jeopardizing the species. The Section 10(a) process allows take of endangered species or their habitat when no other federal government action is involved. Because the Project could affect a federally listed species and would require a federal (Section 404) permit, pursuant to Section 7 of the FESA, the USACE must initiate consultation with USFWS or NMFS prior to carrying out its discretionary authority under Section 404 of the CWA.

Migratory Bird Treaty Act (MBTA)

The federal *Migratory Bird Treaty Act* (MBTA; 16 USC, Sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading in any native bird that may occur within the Study Area except in accordance with regulations prescribed by the Secretary of the Interior. It is an international treaty for the conservation and management of bird species that migrate through more than one country, and is enforced in the United States by the USFWS. This act encompasses whole birds, parts of birds, and bird nests and eggs and provides protection to over 800 species in the United States. All native birds in the Study Area are protected by the MBTA.

Marine Mammal Protection Act

The *Marine Mammal Protection Act* (MMPA) was enacted in 1972 and amended through 2007(16 USC 1631). All marine mammals are protected by the MMPA, which prohibits their take in US Waters. Take is defined in the MMPA as "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect" [16 USC 1631 Section 3(13)]. This is a slightly different definition than the FESA, which also encompasses "attempts" to engage in these activities. Under the MMPA, "harassment" is further defined as any action that of pursues, torments, or annoys a marine mammal and which has the potential to injure or disturb a marine mammal or marine mammal stock in the wild including alteration of behavior patterns including migration, breathing, nursing, breeding, feeding, or sheltering [16 USC 1631 Section 3(18(A))].

Species that occur within San Francisco Bay on a regular basis that are protected by the MMPA include the harbor seal and the California sea lion. The MMPA would apply to the Project, because in-water construction activities such as pile driving could harass these animals.

Magnuson-Stevens Fisheries Conservation Act and Management Act

The NMFS has the authority to implement the *Magnuson-Stevens Fisheries Conservation and Management Act* (Public Law 94-264; MSA). The *Magnuson-Stevens Act* (MSA) was amended and reauthorized on January 12, 2007, by the *Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act* (PL 109-479). The MSA was put into place to promote conservation and management of the Nation's fishery resources. The MSA established the Pacific Fishery

Management Council, which was tasked with creating the Pacific Coast Groundfish Fishery Management Plan (FMP).[168] The most recent amendment to the FMP was adopted by NMFS in May 2006.[169] The FMP develops recommendations for the management of groundfish fisheries, and in some cases, it contains specific fishery management recommendations. [170] In addition, the FMP addresses provisions in the MSA relating to EFH to ensure that fishery resources are managed through the regulation of EFH. The MSA defines EFH as "... those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" [16 USC 1802 MSA Section 3(10)]. The terms in this definition have been further defined to include:[171]

- Aquatic habitat and associated physical, chemical, and biological properties that are used by fish (historically used areas may be included)
- Sediment, stream substrates, instream structure, and associated biological communities
- The habitat required to support a sustainable fishery including that particular species' place in a properly functioning ecosystem
- The habitat required to support a full life cycle for the species under consideration

The tidal aquatic habitats adjacent to the Project site are considered EFH by NMFS for a species assemblage that includes anchovies, sardines, rockfish, sharks, sole, and flounder.[172,173] Areas supporting the native Olympia oyster found in San Francisco Bay are also considered EFH by NMFS because oyster beds generally increase fish abundance. The NMFS consults with federal action agencies under the MSA in a process similar and often parallel to the Section 7 FESA consultation. Because the Project would modify designated EFH, consultation with NMFS under the MSA is anticipated and would be initiated by the USACE during the permitting process for the Project.

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[168] PFMC (Pacific Fisheries Management Council) 2006. *Pacific Coast Groundfish Fishery Management Plan as revised through Amendment 19* (March 2006).

[169] National Marine Fisheries Service (NMFS). 2006. *Magnuson-Stevens Act Provisions; Fisheries off West Coast States; Pacific Coast Groundfish Fishery: Final Rule*. 71 FR 27408.

[170] National Marine Fisheries Service (NMFS). 2006. *Magnuson-Stevens Act Provisions; Fisheries off West Coast States; Pacific Coast Groundfish Fishery: Final Rule*. 71 FR 27408.

[171] Pacific Fisheries Management Council (PFMC) 2003. *Pacific Coast Salmon Plan – Fishery management plan for commercial and recreational salmon fisheries off the coast of Washington, Oregon, and California as revised through Amendment 14* (adopted March 1999).

[172] National Marine Fisheries Service (NMFS). 2006. Fisheries Management Plan (FMP) *Species Distributions In San Francisco, San Pablo and Suisun Bays*. Website: http://swr.nmfs.noaa.gov/hcd/loclist.htm#South%20SF%20Bay. Accessed October 29, 2008.

[173] National Marine Fisheries Service (NMFS).Essential Fish Habitat (EFH) for Pacific Coast Groundfish. Map dated July 26, 2008.

Section 10 of the Rivers and Harbors Act of 1899

Section 10 of the *Rivers and Harbors Act of 1899* (33 USC 403) gives the USACE jurisdiction over tidal waters of the US from the MHW elevation seaward (33 USC 403.382.4b). Specifically, it prohibits the construction, dredging, or fill of any navigable water without a permit from the USACE. This includes construction of breakwaters or marinas, installation of pilings, docks, or bridges, and excavation of existing substrates.

The Project would require placement of fill for bridge construction, shoreline revetments, breakwaters, installation of pilings and marina floats, and installation of gangways for access to the docks. All of these activities would be subject to the USACE jurisdiction under Section 10 of the *Rivers and Harbors Act*, and USACE authorization of these activities must be obtained through the permitting process for the Project.

State

California Endangered Species Act (CESA)

The CESA was enacted in 1984. Under the CESA, the California Fish and Game Commission has the responsibility for maintaining a list of threatened and endangered species. Pursuant to the requirements of CESA, an agency reviewing a project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the Study Area and determine whether the Project would have an adverse affect on such species. In addition, CDFG encourages informal consultation on any project that may impact a candidate species. Peregrine falcons nest within the Study Area, as noted above, and are listed as endangered under the CESA, although the species is proposed to be delisted.

Section 2080 of the *California Fish and Game Code* prohibits "take" of any species that the commission determines to be an endangered species or a threatened species. Take is defined in Section 86 of the *California Fish and Game Code* as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Sections 2081(b) and (c) of the *California Fish and Game Code* allow CDFG to issue an incidental take permit for a state-listed threatened or endangered species only if specific criteria are met, such as take incidental to an otherwise lawful activity. CESA emphasizes early consultation to avoid potential impacts to rare, endangered, and threatened species and to develop appropriate mitigation planning to offset project-caused losses of listed species populations and their essential habitats.

Fish and Game Code—Sections 1602, 3503, 3503.5, 3511, 3513, 4150, 4700, 5050, and 5515

California Fish and Game Code Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by the code. Birds of prey are

further protected under *California Fish and Game Code* Section 3503.5, which states that "it is unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by this code or any regulation adopted pursuant thereto." Construction disturbance during the breeding season could result in the incidental loss of eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG. Similarly, Section 4150 of the *California Fish and Game Code* describes protections for nongame mammals.

California Species of Special Concern is a designation used by the CDFG for some declining wildlife species that are not state candidates for listing as threatened or endangered. This designation does not provide legal protection but signifies that these species are recognized as having special status by the CDFG. Under CEQA Guidelines (Section 15380), potential impacts to these species must be assessed.

California laws relating to Fully Protected species (i.e., Section 3511) were among the first attempts in the nation to provide additional protection to animals that were rare or faced possible extinction, predating even the FESA. Most fully protected species have also been given additional protection under more recent laws and regulations, and many have been listed under state and federal versions of the FESA. Fully Protected species (such as the peregrine falcon and white-tailed kite) may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. Four sections of the *California Fish and Game Code* list 37 fully protected species (*California Fish and Game Code* Sections 3511, 4700, 5050, and 5515). Each of these statutes (1) prohibits take or possession "at any time" of the species listed in the statute, with few exceptions, (2) states that no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to "take" the species, and (3) states that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

Section 1602 of the *California Fish and Game Code* requires a Streambed Alteration Agreement for any activity that may alter the bed and/or bank of a lake, stream, river, or channel. Typical activities that require a Streambed Alteration Agreement include excavation or fill placed within a channel, vegetation clearing, structures for diversion of water, installation of culverts and bridge supports, cofferdams for construction dewatering, and bank reinforcement. A Streambed Alteration Agreement would be required as part of the permitting process for this Project.

CEQA Guidelines Section 15380

Although threatened and endangered species are protected by specific federal and state statutes, CEQA Guidelines section 15380(b) provides that a species not listed on the federal or state list of protected species may be considered rare or endangered if the species can be shown to meet certain criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants and animals, and allows a public agency to undertake a review to determine if a significant effect on species that have not yet been listed by either the USFWS or CDFG (i.e., species of concern) would occur. Whether a species is rare, threatened, or endangered can be legally significant because, under CEQA Guidelines Section 15065, an agency must find an impact to be significant if a project would "substantially reduce the number or restrict the range of an endangered, rare, or threatened species." Thus, CEQA provides an agency with the ability to protect a species from a project's potential impacts until the respective government agencies have an opportunity to list the species as under an endangered species act, if warranted.

The CEQA Guidelines for biological resources are influenced by the California Native Plant Society's inventory of special-status plant species. CNPS maintains four species lists of varying rarity.[174] Vascular plants listed as rare or endangered by the CNPS,[175] but which have no designated status or protection under federal or state-endangered species legislation, are defined as follows:

List 1A Plants Believed Extinct.

List 1B Plants Rare, Threatened, or Endangered in California and elsewhere.

List 2 Plants Rare, Threatened, or Endangered in California, but more numerous elsewhere.

List 3 Plants About Which More Information is Needed - A Review List.

List 4 Plants of Limited Distribution - A Watch List.

In general, plants appearing on CNPS List 1 or 2 are considered to meet CEQA Guidelines section 15380 criteria and project effects to these species may be considered significant.

It is this section that provides for the inclusion of the various species of special concern and CNPS List 1 and 2 plants presented previously (Table 3).

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[174] Recent modifications to the CNPS Ranking System include the addition of a new Threat Code extension to listed species (e.g., List 1B.1, List 2.2 etc.). A Threat Code extension of .1 signifies that a species is seriously endangered in California; .2 is fairly endangered in California; and .3 is not very endangered in California.

[175] California Native Plant Society, *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California* (sixth edition), Sacramento, CA., 2001.

Porter-Cologne Water Quality Control Act

The *Porter-Cologne Water Quality Control Act* (California Water Code Sections 13000 et seq.) charges the SWRCB and the nine RWQCBs statewide with protecting water quality throughout California. Typically, the SWRCB and RWQCB act in concert with the USACE under Section 401 of the *Clean Water Act* in relation to permitting fill of federally jurisdictional waters. The US Supreme Court has acted to limit the regulatory jurisdiction of the USACE under Section 404 of the *Clean Water Act*.[176] This action did not limit the State's regulatory jurisdiction over Waters of the State.[177] Waters of the State are defined in Section 13050(e) of the *Porter-Cologne Water Quality Control Act* as "…any surface water or groundwater, including saline waters, within the boundaries of the state."

Wetlands are delineated in accordance with methodology presented in the 1987 *Corps of Engineers Wetlands Delineation Manual*[178] and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*.[179] Applicants have this delineation verified by the USACE and, in cases where an area meets the criteria to be considered a wetland, but the USACE does not have jurisdiction, the applicant is referred to the appropriate RWQCB. For the Study Area, the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) could exercise its jurisdiction over wetlands where a project does not require a federal permit, but involves removal or placement of material into Waters of the State. The USACE has indicated that the waters and wetlands potentially impacted by the Project are subject to its jurisdiction. A Section 401 clean water certification or waiver would be required as part of the permitting process for this Project.

Regional and Local

The McAteer-Petris Act (California Government Code 66600–66682)

The *McAteer-Petris Act* created the San Francisco Bay Conservation and Development Commission (BCDC) in 1965. BCDC's mission is the preservation of San Francisco Bay from indiscriminate filling. BCDC's first task was compilation of a comprehensive study of the Bay and determination of how future development of the Bay should occur. This effort resulted in the San Francisco Bay Plan in 1968. In 1969 the findings and policies of the Bay Plan were incorporated into the *McAteer-Petris*

[176] United States Supreme Court (USSC), *Solid Waste Agency of Northern Cook County v. US Army Corps of Engineers*. 531 US 159(2001), also known as the "SWANCC decision."

[177] Guzy, G.S. and R.J. Andersen., *Memorandum from the Corps regarding: Supreme Court ruling concerning CWA jurisdiction over isolated waters.* Website: http://www.spn.usace.army.mil/regulatory/ swancc.pdf, 2001.

[178] Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station. Vicksburg, Miss., 1987.

[179] US Army Corps of Engineers, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*, Wetlands Regulatory Assistance Program, Vicksburg, Miss., September 2008.

Act, which was amended making BCDC a permanent state agency. The Bay Plan continues to evolve and remains the guiding document for BCDC's actions. Section 66610 of the *McAteer-Petris Act* establishes the boundaries of San Francisco Bay in relation to BCDC's jurisdiction. Essentially, all areas below the mean high tide line and an area within a shoreline band that extends landward for 100 feet from the mean high tide line are subject to their jurisdiction. Section 66632 of the *McAteer-Petris Act* establishes the permitting process for projects that would place fill in, on, or over any part of BCDC's jurisdiction as defined in Section 66610. Some aspects of the Project would be in the water or within the shoreline band and, therefore, subject to BCDC's jurisdiction.

Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) Management Plan

In 1999, under the authority of the federal FESA, NOAA Fisheries and the USFWS, and the CDFG, under the CESA, completed a programmatic consultation for the Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) Management Plan[180]. NOAA Fisheries, USFWS and CDFG concluded that the LTMS program was not likely to jeopardize the continued existence of listed species under their jurisdiction. The respective biological opinions provided an incidental take statement, which authorized the take of listed species that may inadvertently occur during dredging and dredged material disposal activities that adhere to the environmental work windows set forth in the LTMS Management Plan. Therefore, permitted dredging activities that conform to the Environmental Work Windows can be completed without the need to consult with the resource agencies under the FESA and the CESA. Any project proposing to conduct dredging activities outside of the LTMS environmental work windows is required to undertake either informal or formal consultation with the appropriate resource agencies (NOAA Fisheries, USFWS, and CDFG).

San Francisco Bay Trail Plan

Environmental Protection Policies of the San Francisco Bay Trail Plan relevant to the Project are listed below. [181]

> 23. The Committee is aware of the ecological value of wetlands; in many cases, they provide habitat for a variety of endangered species. In the San Francisco Bay Area, these areas serve as a vital link in the Pacific flyway for feeding, breeding, nesting and cover for migratory birds. To

[180] LTMS Environmental Work Windows Work Group. LTMS Informal work windows, Informal consultation preparation packet. Draft version 1.4. February 2004. Website: http://www.spn.usace.army.mil/conops/informal.pdf.

[181] Bay Trail Plan. 1999. Electronic file: http://baytrail.abag.ca.gov/baytrailplan.html#designguidelines. July 30.

avoid impacts in wetlands habitats, the Bay Trail should not require fill in wetlands, and should be designed so that use of the trail avoids adverse impacts on wetland habitats.

24. Future support facilities serving the Bay Trail should be designed and constructed in such a manner that they do not impact fish and wildlife resources, especially wetlands. These facilities should be located and designed in a way that no fill of wetlands will be required.

26. The path will not always follow the Bay shoreline; inland reaches may be more appropriate, especially for bicycle travel, in some parts of the San Francisco Bay region.

28. Where the alignment of the Bay Trail may more appropriately be located away from the shoreline in order to protect particularly sensitive habitats, access to shoreline areas may be possible by connecting the Bay Trail to existing loop trails and other interpretive facilities. These access points should be planned and designed to make clear the distinction between the continuous Bay Trail and the interpretive trail. (Features may include different trail surfaces, marked entry points to interpretive areas, expanded facilities for education and shoreline interpretation, signage, regulation and enforcement of regulations.)

29. Provision of land or funds for Bay Trail planning or construction shall not be considered mitigation for wetland losses.

Candlestick Point State Recreation Area General Plan

The following excerpt from the CPSRA General Plan is related to natural resource management:[182]

> It is the policy of the department to protect the scenic values and to enhance, manage, and protect the biotic and natural resources of the area, while fully realizing the potential of the area for fulfillment of outdoor recreation needs. A wetland restoration and management plan shall be developed for the area north and east of the extension of Yosemite Avenue to the Bay, an area known as the Nature Area. The plan shall include provisions for natural restoration and removal of debris, design of a shoreline configuration that provides a healthy intertidal action, revegetation, and wildlife habitat enhancement. This plan shall be developed in coordination with local, Bay protection, and wildlife agencies.

San Francisco Bay Plan

A summary of the policies of the San Francisco Bay Plan related to biological resources is provided below.

[182] State Department of Parks and Recreation. Candlestick Point State Recreation Area General Plan, March, 1988.

Policies Concerning Fish, Other Aquatic Organisms and Wildlife in the Bay, Tidal Marshes and Tidal Flats Around the Bay , and Subtidal Areas in the Bay [183]

The SFBCDC shall protect native fish species, other aquatic organisms, other listed wildlife species and their specific habitats under the *California Endangered Species Act* or federal *Marine Mammal Protection Act* within the Bay's tidal marshes, tidal flats, and subtidal habitat. To the greatest extent feasible, specific habitats such as tidal marsh, tidal flats, and subtidal habitats shall be conserved, restored, and increased. Specific habitats that are needed to conserve, increase or prevent the extinction of any native species, species threatened or endangered, species that the CDFG has determined are candidates for listing as endangered or threatened under the California *Endangered Species Act*, or any species that provides substantial public benefits, should be protected, whether in the Bay or behind dikes. In reviewing or approving habitat restoration programs the SFBCDC should follow the recommendations in the Baylands Ecosystem Habitat Goals and provide a diversity of habitats for native aquatic and terrestrial plant and animal species. For projects that may adversely affect an endangered or threatened plant, fish, other aquatic organism or wildlife species the SFBCDC should consult and give appropriate consideration to the recommendations of the California Department of Fish and Game and the US Fish and Wildlife Service or the National Marine Fisheries Service and not authorize projects that would result in the "taking" of any plant, fish, other aquatic organism or wildlife species listed as endangered or threatened pursuant to the state or federal endangered species acts, or species that are candidates for listing under the CESA, unless the project applicant has obtained the appropriate "take" authorization from the US Fish and Wildlife Service, National Marine Fisheries Service or the California Department of Fish and Game. However, the SFBCDC may permit a minor amount of fill or dredging in wildlife refuges, shown on the Plan Maps, necessary to enhance fish, other aquatic organisms and wildlife habitat or to provide public facilities for wildlife observation, interpretation and education.

Policies Concerning Shoreline Protection around the Bay[184]

New shoreline erosion control projects and the maintenance or reconstruction of existing erosion control facilities should be authorized if *(a)* the project is necessary to protect the shoreline from erosion; *(b)* the type of the protective structure is appropriate for the project site and the erosion conditions at the site; and *(c)* the project is properly designed and constructed. Professionals knowledgeable of the Commission's concerns, such as civil engineers experienced in coastal processes, should participate in the design of erosion control projects.

Policies Concerning Dredging in the Bay[185]

[183] SFBCDC, San Francisco Bay Plan, Reprinted February 2008.
[184] Ibid.
[185] Ibid.

Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner. Dredgers should reduce disposal in the Bay and certain waterways over time to achieve the LTMS goal of limiting in-Bay disposal volumes to a maximum of one million cubic yards per year. The LTMS agencies should implement a system of disposal allotments to individual dredgers to achieve this goal only if voluntary efforts are not effective in reaching the LTMS goal. In making its decision regarding disposal allocations, the Commission should confer with the LTMS agencies and consider the need for the dredging and the dredging projects, environmental impacts, regional economic impacts, efforts by the dredging community to implement and fund alternatives to in-Bay disposal, and other relevant factors. Small dredgers should be exempted from allotments, but all dredgers should comply with the SFBCDC policies.

Yosemite Slough Restoration Plan

The Yosemite Slough Restoration Plan (2005) was developed on behalf of the State Parks Department, in accordance with the CPSRA GP. The restoration of Yosemite Slough would create the largest contiguous wetland area in San Francisco. The restoration project would help restore essential wildlife habitat, improve water quality, and prevent erosion along the shoreline of the City—an area of the bay where tidal wetlands have been most impacted and suffered the greatest loss due to urbanization.

Goals and objectives of the restoration include the following:

- Increase the area subject to tidal influence by excavating three areas that were formerly part of San Francisco Bay.
- Restore habitat diversity by adding 12 acres of tidally influenced wetlands and marsh area and remove chemically impacted soils from upland areas to improve the quality of existing habitat.
- Improve habitat for special-status species (i.e., western snowy plover and double-crested cormorants) by creating two nesting islands.
- Improve the quality of life for the surrounding community by creating a clean, beautiful local park for viewing wildlife habitat.
- Create an environmental area that local schools can use for field trips.
- Connect to the Blue Greenway, an important effort to build 13 miles of Bay Trail along the southern waterfront of the San Francisco Bay Trail.

City of San Francisco General Plan

The following goals and policies related to biological resources protection are included in the Environmental Protection Element of the *San Francisco General Plan*, and are relevant to the Project:

General

Objective 1 Achieve a proper balance among the conservation, utilization, and development of San Francisco's natural resources.

Policy 1.1 Conserve and protect the natural resources of San Francisco.

Policy 1.2 Improve the quality of natural resources.

Policy 1.3 Restore and replenish the supply of natural resources.

Policy 1.4 Assure that all new development meets strict environmental quality standards and recognizes human needs.

Bay, Ocean, and Shorelines

Objective 3 Maintain and improve the quality of the bay, ocean, and shoreline areas.

Policy 3.1 Cooperate with and otherwise support regulatory programs of existing regional, state, and federal agencies dealing with the Bay, Ocean, and Shorelines.

Policy 3.2 Promote the use and development of shoreline areas consistent with the General Plan and the best interest of San Francisco.

Land

Objective 7 Assure that the land resources in San Francisco are used in ways that both respect and preserve the natural values of the land and serve the best interests of all the City's citizens.

Policy 7.3 Require that filling of land adhere to the highest standards of soils engineering consistent with the proposed use.

Flora and Fauna

Objective 8 Ensure the protection of plant and animal life in the City.

Policy 8.1 Cooperate with and otherwise support the California Department of Fish and Game and its animal protection programs.

Policy 8.2 Protect the habitats of known plant and animal species that require a relatively natural environment.

Policy 8.3 Protect rare and endangered species.

San Francisco Municipal Code

Urban Forestry Ordinance

The City provides protection for trees around the City by way of its Urban Forestry Ordinance (Ord. 165-95, App. 5/19/95), Article 16, Sections 806 (Planting and Removal of Street Trees) through 810 (Significant Trees) of the *Public Works Code*. "Significant trees" are defined as trees within 10 feet of a public right-of-way that also meet one of the following size requirements: 20 feet or greater in height; 15 feet or greater in canopy width; or 12 inches or greater diameter of trunk measured at 4.5 feet above grade. Among the factors considered in the removal of significant trees are the following: their size, age, and species; visual and aesthetic characteristics; cultural or historic characteristics; ecological and location characteristics. Street trees are also protected by the City's Urban Forestry Ordinance and both require a permit for removal. The ordinance also provides a process for designating trees as landmark trees, and protects significant, landmark, and street trees during construction activities. This ordinance applies to limited areas of the Project site where there are significant trees, street trees, and/or landmark trees.

Planning Code

Section 143 of the San Francisco Planning Code requires the installation of one street tree for each 20 feet of property frontage along each street or alley, with any remaining fraction of 10 feet or more of frontage requiring an additional tree for the owner or developer of a new or relocated building, or a building with 20% or more floor area expansion in specified districts.[186] This ordinance applies to the R, SPD, RSD, NC, C-3, DTR, MUG, MUO, MUR, UMU, SLR, SLI, and SSO Districts.

DISCUSSION

This Biological Technical Report describes the existing biological resources of the CPHPS Project site and vicinity and the regulatory framework under which Project activities must be conducted. The Biological Resources Chapter of the Project's EIR will analyze impacts of the Project on these resources. In addition, pursuant to the regulations described in the "Regulatory Framework" section of this report, permits from various regulatory agencies must be obtained to authorize Project impacts to regulated resources.

[186] Amended by Ord. 414-85, App. 9/17/85; Ord. 69-87, App. 3/13/87; Ord. 115-90, App. 4/6/90; Ord. 298-08, File No. 081153, App. 12/19/2008.

APPENDIX A
CNDDB SPECIAL-STATUS SPECIES LIST

California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - San Francisco South and Hunter's Point quads

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	***Actinemys marmorata*** western pond turtle	ARAAD02030			G3G4	S3	SC
2	***Amsinckia lunaris*** bent-flowered fiddleneck	PDBOR01070			G2	S2.2	1B.2
3	***Arctostaphylos hookeri ssp. franciscana*** Franciscan manzanita	PDERI040J3			G3TXC	SX	1A
4	***Arctostaphylos hookeri ssp. ravenii*** Presidio manzanita	PDERI040J2	Endangered	Endangered	G3T1	S1.1	1B.1
5	***Arctostaphylos imbricata*** San Bruno Mountain manzanita	PDERI040L0		Endangered	G1	S1.2	1B.1
6	***Arctostaphylos montaraensis*** Montara manzanita	PDERI042W0			G2	S2.2	1B.2
7	***Arctostaphylos pacifica*** Pacific manzanita	PDERI040Z0		Endangered	G1	S1.1	1B.2
8	***Astragalus tener var. tener*** alkali milk-vetch	PDFAB0F8R1			G1T1	S1.1	1B.2
9	***Banksula incredula*** incredible harvestman	ILARA14100			G1	S1	
10	***Caecidotea tomalensis*** Tomales isopod	ICMAL01220			G2	S2	
11	***Callophrys mossii bayensis*** San Bruno elfin butterfly	IILEPE2202	Endangered		G4T1	S1	
12	***Carex comosa*** bristly sedge	PMCYP032Y0			G5	S2?	2.1
13	***Charadrius alexandrinus nivosus*** western snowy plover	ABNNB03031	Threatened		G4T3	S2	SC
14	***Chorizanthe cuspidata var. cuspidata*** San Francisco Bay spineflower	PDPGN04081			G2T2	S2.2	1B.2
15	***Chorizanthe robusta var. robusta*** robust spineflower	PDPGN040Q2	Endangered		G2T1	S1.1	1B.1
16	***Cicindela hirticollis gravida*** sandy beach tiger beetle	IICOL02101			G5T2	S1	
17	***Cirsium andrewsii*** Franciscan thistle	PDAST2E050			G2	S2.2	1B.2
18	***Cirsium occidentale var. compactum*** compact cobwebby thistle	PDAST2E1Z1			G3G4T2	S2.1	1B.2
19	***Collinsia multicolor*** San Francisco collinsia	PDSCR0H0B0			G2	S2.2	1B.2
20	***Dufourea stagei*** Stage's dufourine bee	IIHYM22010			G1?	S1?	
21	***Eucyclogobius newberryi*** tidewater goby	AFCQN04010	Endangered		G3	S2S3	SC
22	***Euphydryas editha bayensis*** Bay checkerspot butterfly	IILEPK4055	Threatened		G5T1	S1	
23	***Fritillaria liliacea*** fragrant fritillary	PMLIL0V0C0			G2	S2.2	1B.2

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
24	***Geothlypis trichas sinuosa*** saltmarsh common yellowthroat	ABPBX1201A			G5T2	S2	SC
25	***Gilia capitata ssp. chamissonis*** blue coast gilia	PDPLM040B3			G5T2	S2.1	1B.1
26	***Grindelia hirsutula var. maritima*** San Francisco gumplant	PDAST470D3			G5T2	S2.1	1B.2
27	***Helianthella castanea*** Diablo helianthella	PDAST4M020			G3	S3.2	1B.2
28	***Hesperevax sparsiflora var. brevifolia*** short-leaved evax	PDASTE5011			G4T2T3	S2S3	2.2
29	***Horkelia cuneata ssp. sericea*** Kellogg's horkelia	PDROS0W043			G4T1	S1.1	1B.1
30	***Hydroporus leechi*** Leech's skyline diving beetle	IICOL55040			G1?	S1?	
31	***Ischnura gemina*** San Francisco forktail damselfly	IIODO72010			G2	S2	
32	***Lasiurus cinereus*** hoary bat	AMACC05030			G5	S4?	
33	***Laterallus jamaicensis coturniculus*** California black rail	ABNME03041		Threatened	G4T1	S1	
34	***Layia carnosa*** beach layia	PDAST5N010	Endangered	Endangered	G2	S2.1	1B.1
35	***Leptosiphon rosaceus*** rose leptosiphon	PDPLM09180			G1	S1.1	1B.1
36	***Lessingia germanorum*** San Francisco lessingia	PDAST5S010	Endangered	Endangered	G1	S1.1	1B.1
37	***Lichnanthe ursina*** bumblebee scarab beetle	IICOL67020			G2	S2	
38	***Malacothamnus arcuatus*** arcuate bush-mallow	PDMAL0Q0E0			G2Q	S2.2	1B.2
39	***Melospiza melodia pusillula*** Alameda song sparrow	ABPBXA301S			G5T2?	S2?	SC
40	***Pentachaeta bellidiflora*** white-rayed pentachaeta	PDAST6X030	Endangered	Endangered	G1	S1.1	1B.1
41	***Phalacrocorax auritus*** double-crested cormorant	ABNFD01020			G5	S3	
42	***Plebejus icarioides missionensis*** Mission blue butterfly	IILEPG801A	Endangered		G5T1	S1	
43	***Rallus longirostris obsoletus*** California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	
44	***Rana draytonii*** California red-legged frog	AAABH01022	Threatened		G4T2T3	S2S3	SC
45	***Riparia riparia*** bank swallow	ABPAU08010		Threatened	G5	S2S3	
46	***Sanicula maritima*** adobe sanicle	PDAPI1Z0D0		Rare	G2	S2.2	1B.1

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
47	***Silene verecunda ssp. verecunda*** San Francisco campion	PDCAR0U213			G5T2	S2.2	1B.2
48	***Speyeria callippe callippe*** callippe silverspot butterfly	IILEPJ6091	Endangered		G5T1	S1	
49	***Suaeda californica*** California seablite	PDCHE0P020	Endangered		G1	S1.1	1B.1
50	***Thamnophis sirtalis tetrataenia*** San Francisco garter snake	ARADB3613B	Endangered	Endangered	G5T2	S2	
51	***Trachusa gummifera*** A leaf-cutter bee	IIHYM80010			G1	S1	
52	***Triphysaria floribunda*** San Francisco owl's-clover	PDSCR2T010			G2	S2.2	1B.2
53	***Triquetrella californica*** coastal triquetrella	NBMUS7S010			G1	S1.2	1B.2
54	***Tryonia imitator*** mimic tryonia (=California brackishwater snail)	IMGASJ7040			G2G3	S2S3	

California Department of Fish and Game
Natural Diversity Database
CNDDB Wide Tabular Report
Bayview 2009

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks						Population Status		Presence		
					A	B	C	D	X	U	Historic >20 yr	Recent <=20 yr	Pres. Extant	Poss. Extirp.	Extirp.
Actinemys marmorata western pond turtle	G3G4 S3	CDFG: SC	Fed: None Cal: None	1092 S:2	0	1	1	0	0	0	0	2	2	0	0
Amsinckia lunaris bent-flowered fiddleneck	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	50 S:1	0	0	0	0	0	1	1	0	1	0	0
Arctostaphylos hookeri ssp. franciscana Franciscan manzanita	G3TXC SX	CNPS: 1A	Fed: None Cal: None	3 S:1	0	0	0	0	1	0	1	0	0	0	1
Arctostaphylos hookeri ssp. ravenii Presidio manzanita	G3T1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	7 S:1	0	0	0	0	1	0	1	0	0	0	1
Arctostaphylos imbricata San Bruno Mountain manzanita	G1 S1.2	CNPS: 1B.1	Fed: None Cal: Endangered	3	0	0	0	0	0	3	1	2	3	0	0
Arctostaphylos montaraensis Montara manzanita	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	4 S:1	0	0	0	1	0	0	1	0	1	0	0
Arctostaphylos pacifica Pacific manzanita	G1 S1.1	CNPS: 1B.2	Fed: None Cal: Endangered	1	0	0	1	0	0	0	0	1	1	0	0
Astragalus tener var. tener alkali milk-vetch	G1T1 S1.1	CNPS: 1B.2	Fed: None Cal: None	66 S:1	0	0	0	0	1	0	1	0	0	1	0
Banksula incredula incredible harvestman	G1 S1	CDFG:	Fed: None Cal: None	1	0	0	0	0	0	1	0	1	1	0	0
Caecidotea tomalensis Tomales isopod	G2 S2	CDFG:	Fed: None Cal: None	6 S:2	0	0	1	1	0	0	2	0	2	0	0
Callophrys mossii bayensis San Bruno elfin butterfly	G4T1 S1	CDFG:	Fed: Endangered Cal: None	10 S:3	0	0	0	0	0	3	2	1	3	0	0
Carex comosa bristly sedge	G5 S2?	CNPS: 2.1	Fed: None Cal: None	11 S:1	0	0	0	0	1	0	1	0	0	1	0
Charadrius alexandrinus nivosus western snowy plover	G4T3 S2	CDFG: SC	Fed: Threatened Cal: None	116 S:1	0	0	0	0	0	1	1	0	1	0	0
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	G2T2 S2.2	CNPS: 1B.2	Fed: None Cal: None	20 S:7	0	0	3	0	0	4	4	3	7	0	0
Chorizanthe robusta var. robusta robust spineflower	G2T1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: None	23 S:2	0	0	0	0	2	0	2	0	0	2	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks						Population Status		Presence		
					A	B	C	D	X	U	Historic >20 yr	Recent <=20 yr	Pres. Extant	Poss. Extirp.	Extirp.
Cicindela hirticollis gravida sandy beach tiger beetle	G5T2 S1	CDFG:	Fed: None Cal: None	34 S:1	0	0	0	0	1	0	1	0	0	0	1
Cirsium andrewsii Franciscan thistle	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	27 S:1	0	0	0	0	1	0	1	0	0	1	0
Cirsium occidentale var. compactum compact cobwebby thistle	G3G4T2 S2.1	CNPS: 1B.2	Fed: None Cal: None	14 S:1	0	0	0	0	1	0	1	0	0	1	0
Collinsia multicolor San Francisco collinsia	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	22 S:7	0	0	0	0	0	7	7	0	7	0	0
Dufourea stagei Stage's dufourine bee	G1? S1?	CDFG:	Fed: None Cal: None	1	0	0	0	0	0	1	1	0	1	0	0
Eucyclogobius newberryi tidewater goby	G3 S2S3	CDFG: SC	Fed: Endangered Cal: None	116 S:1	0	0	0	0	1	0	1	0	0	0	1
Euphydryas editha bayensis Bay checkerspot butterfly	G5T1 S1	CDFG:	Fed: Threatened Cal: None	24 S:3	0	0	0	0	3	0	3	0	0	0	3
Fritillaria liliacea fragrant fritillary	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	59 S:1	0	0	0	0	1	0	1	0	0	1	0
Geothlypis trichas sinuosa saltmarsh common yellowthroat	G5T2 S2	CDFG: SC	Fed: None Cal: None	110 S:2	0	0	0	0	0	2	2	0	2	0	0
Gilia capitata ssp. chamissonis blue coast gilia	G5T2 S2.1	CNPS: 1B.1	Fed: None Cal: None	29 S:3	0	1	0	0	0	2	2	1	3	0	0
Grindelia hirsutula var. maritima San Francisco gumplant	G5T2 S2.1	CNPS: 1B.2	Fed: None Cal: None	15 S:8	0	0	1	1	1	5	8	0	7	0	1
Helianthella castanea Diablo helianthella	G3 S3.2	CNPS: 1B.2	Fed: None Cal: None	82 S:3	0	1	0	0	0	2	2	1	3	0	0
Hemizonia congesta ssp. congesta seaside tarplant	G5T2T3 S2S3	CNPS: 1B.2	Fed: None Cal: None	33 S:2	0	0	0	0	1	1	2	0	1	1	0
Hesperevax sparsiflora var. brevifolia short-leaved evax	G4T2T3 S2S3	CNPS: 1B.2	Fed: None Cal: None	36 S:1	0	0	0	0	0	1	1	0	1	0	0
Horkelia cuneata ssp. sericea Kellogg's horkelia	G4T1 S1.1	CNPS: 1B.1	Fed: None Cal: None	38 S:3	0	0	0	0	0	3	3	0	3	0	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks						Population Status		Presence		
					A	B	C	D	X	U	Historic >20 yr	Recent <=20 yr	Pres. Extant	Poss. Extirp.	Extirp.
Hydroporus leechi Leech's skyline diving beetle	G1? S1?	CDFG:	Fed: None Cal: None	13 S:1	0	0	0	0	0	1	1	0	0	1	0
Ischnura gemina San Francisco forktail damselfly	G2 S2	CDFG:	Fed: None Cal: None	6 S:2	0	0	0	0	0	2	2	0	2	0	0
Lasiurus cinereus hoary bat	G5 S4?	CDFG:	Fed: None Cal: None	235 S:4	0	0	0	0	0	4	3	1	4	0	0
Laterallus jamaicensis coturniculus California black rail	G4T1 S1	CDFG:	Fed: None Cal: Threatened	233 S:1	0	0	0	0	0	1	1	0	1	0	0
Layia carnosa beach layia	G2 S2.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	22 S:1	0	0	0	0	1	0	1	0	0	0	1
Leptosiphon rosaceus rose leptosiphon	G1 S1.1	CNPS: 1B.1	Fed: None Cal: None	25 S:1	0	0	0	0	1	0	1	0	0	1	0
Lessingia germanorum San Francisco lessingia	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	5 S:2	0	0	1	0	1	0	1	1	1	1	0
Lichnanthe ursina bumblebee scarab beetle	G2 S2	CDFG:	Fed: None Cal: None	8 S:2	0	0	0	0	0	2	2	0	2	0	0
Malacothamnus arcuatus arcuate bush-mallow	G2Q S2.2	CNPS: 1B.2	Fed: None Cal: None	21 S:1	0	0	0	0	0	1	1	0	1	0	0
Melospiza melodia pusillula Alameda song sparrow	G5T2? S2?	CDFG: SC	Fed: None Cal: None	38 S:3	0	0	0	0	0	3	3	0	3	0	0
Mylopharodon conocephalus hardhead	G3 S3	CDFG: SC	Fed: None Cal: None	32 S:1	0	0	0	0	0	1	1	0	1	0	0
Pentachaeta bellidiflora white-rayed pentachaeta	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	14 S:1	0	0	0	0	1	0	1	0	0	1	0
Phalacrocorax auritus double-crested cormorant	G5 S3	CDFG:	Fed: None Cal: None	37 S:2	0	0	2	0	0	0	0	2	2	0	0
Plebejus icarioides missionensis Mission blue butterfly	G5T1 S1	CDFG:	Fed: Endangered Cal: None	14 S:12	0	2	1	0	1	8	2	10	12	0	0
Rallus longirostris obsoletus California clapper rail	G5T1 S1	CDFG:	Fed: Endangered Cal: Endangered	90 S:2	0	0	1	0	0	1	1	1	2	0	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks						Population Status		Presence		
					A	B	C	D	X	U	Historic >20 yr	Recent <=20 yr	Pres. Extant	Poss. Extirp.	Extirp.
Rana draytonii California red-legged frog	G4T2T3 S2S3	CDFG: SC	Fed: Threatened Cal: None	1238 S:6	1	2	1	0	0	2	1	5	6	0	0
Riparia riparia bank swallow	G5 S2S3	CDFG:	Fed: None Cal: Threatened	190 S:3	0	1	0	0	0	2	3	0	3	0	0
Sanicula maritima adobe sanicle	G2 S2.2	CNPS: 1B.1	Fed: None Cal: Rare	16 S:1	0	0	0	0	1	0	1	0	0	1	0
Silene verecunda ssp. verecunda San Francisco campion	G5T2 S2.2	CNPS: 1B.2	Fed: None Cal: None	12 S:2	0	0	0	0	0	2	1	1	2	0	0
Speyeria callippe callippe callippe silverspot butterfly	G5T1 S1	CDFG:	Fed: Endangered Cal: None	6 S:5	0	1	0	0	0	4	0	5	5	0	0
Suaeda californica California seablite	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: None	17 S:2	0	0	0	0	1	1	1	1	1	0	1
Thamnophis sirtalis tetrataenia San Francisco garter snake	G5T2 S2	CDFG:	Fed: Endangered Cal: Endangered	41 S:2	1	0	0	1	0	0	0	2	2	0	0
Trachusa gummifera A leaf-cutter bee	G1 S1	CDFG:	Fed: None Cal: None	2 S:1	0	0	0	0	0	1	1	0	1	0	0
Triphysaria floribunda San Francisco owl's-clover	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	41 S:5	0	0	0	0	2	3	5	0	3	1	1
Triquetrella californica coastal triquetrella	G1 S1.2	CNPS: 1B.2	Fed: None Cal: None	11 S:1	0	0	0	0	0	1	0	1	1	0	0
Tryonia imitator mimic tryonia (=California brackishwater snail)	G2G3 S2S3	CDFG:	Fed: None Cal: None	34 S:1	0	0	0	0	1	0	1	0	0	0	1

APPENDIX B
CNPS SPECIAL-STATUS SPECIES LIST

Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results for "+"San Francisco South (448B) 3712264"" - Mon, Jul. 7, 2008, 14:48 b

+"San Francisco South (448B) 3712264" Search

Tip: `CNPS_LIST:"List 3"` (note the field name) returns only taxa on List 3. `"List 3"` by itself, matches the phrase wherever found. Browse the list of **field names**.[all tips and help.][search history]

Hits 1 to 19 of 19
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press | check all | check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Amsinckia lunaris**	bent-flowered fiddleneck	Boraginaceae	List 1B.2
		1	**Arctostaphylos imbricata**	San Bruno Mountain manzanita	Ericaceae	List 1B.1
		1	**Arctostaphylos montaraensis**	Montara manzanita	Ericaceae	List 1B.2
		1	**Arctostaphylos pacifica**	Pacific manzanita	Ericaceae	List 1B.2
		1	**Centromadia parryi ssp. parryi**	pappose tarplant	Asteraceae	List 1B.2
		1	**Chorizanthe cuspidata var. cuspidata**	San Francisco Bay spineflower	Polygonaceae	List 1B.2
		1	**Cirsium andrewsii**	Franciscan thistle	Asteraceae	List 1B.2
		1	**Collinsia multicolor**	San Francisco collinsia	Scrophulariaceae	List 1B.2
		1	**Equisetum palustre**	marsh horsetail	Equisetaceae	List 3
		1	**Gilia capitata ssp. chamissonis**	blue coast gilia	Polemoniaceae	List 1B.1
		1	**Grindelia hirsutula var. maritima**	San Francisco gumplant	Asteraceae	List 1B.2
		1	**Helianthella castanea**	Diablo helianthella	Asteraceae	List 1B.2
		1	**Horkelia cuneata ssp. sericea**	Kellogg's horkelia	Rosaceae	List 1B.1
		1	**Lessingia germanorum**	San Francisco lessingia	Asteraceae	List 1B.1
		1	**Malacothamnus arcuatus**	arcuate bush-mallow	Malvaceae	List 1B.2
		1	**Plagiobothrys chorisianus var. chorisianus**	Choris' popcorn-flower	Boraginaceae	List 1B.2
		1	**Silene verecunda ssp. verecunda**	San Francisco campion	Caryophyllaceae	List 1B.2
		1	**Triphysaria floribunda**	San Francisco owl's-clover	Scrophulariaceae	List 1B.2
		1	**Triquetrella californica**	coastal triquetrella	Pottiaceae	List 1B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

No more hits.

Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results - Mon, Jul. 7, 2008, 14:48 b

{QUADS_123} =~ m/\(448B\)*/ Search

Tip: Want to search by county? Try the **county index**.[all tips and help.][search history]

Hits 1 to 7 of 7
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Arctostaphylos hookeri ssp. franciscana**	Franciscan manzanita	Ericaceae	List 1A
		1	**Arctostaphylos hookeri ssp. ravenii**	Presidio manzanita	Ericaceae	List 1B.1
		1	**Astragalus tener var. tener**	alkali milk-vetch	Fabaceae	List 1B.2
		1	**Chorizanthe robusta var. robusta**	robust spineflower	Polygonaceae	List 1B.1
		1	**Cirsium occidentale var. compactum**	compact cobwebby thistle	Asteraceae	List 1B.2
		1	**Hesperevax sparsiflora var. brevifolia**	short-leaved evax	Asteraceae	List 2.2
		1	**Pentachaeta bellidiflora**	white-rayed pentachaeta	Asteraceae	List 1B.1

No more hits.

Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results for "+"Hunters Point (448A) 3712263"" - Mon, Jul. 7, 2008, 14:46 b

+"Hunters Point (448A) 3712263" Search

Tip: `CNPS_LIST:"List 3"` (note the field name) returns only taxa on List 3. `"List 3"` by itself, matches the phrase wherever found. Browse the list of **field names**.[all tips and help.][search history]

Hits 1 to 1 of 1
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press · check all check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Suaeda californica**	California seablite	Chenopodiaceae	List 1B.1

No more hits.

Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results for "+"San Francisco South (448B) 3712264"" - Mon, Nov. 2, 2009, 18:48 b

+"San Francisco South (448B) 3712264" Search

Tip: Want to search by habitat? Try the **Checkbox and Preset** search page.[all tips and help.] [search history]

Hits 1 to 20 of 20

Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press check all check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Amsinckia lunaris**	bent-flowered fiddleneck	Boraginaceae	List 1B.2
		1	**Arctostaphylos imbricata**	San Bruno Mountain manzanita	Ericaceae	List 1B.1
		1	**Arctostaphylos montaraensis**	Montara manzanita	Ericaceae	List 1B.2
		1	**Arctostaphylos pacifica**	Pacific manzanita	Ericaceae	List 1B.2
		1	**Centromadia parryi ssp. parryi**	pappose tarplant	Asteraceae	List 1B.2
		1	**Chorizanthe cuspidata var. cuspidata**	San Francisco Bay spineflower	Polygonaceae	List 1B.2
		1	**Cirsium andrewsii**	Franciscan thistle	Asteraceae	List 1B.2
		1	**Collinsia multicolor**	San Francisco collinsia	Scrophulariaceae	List 1B.2
		1	**Equisetum palustre**	marsh horsetail	Equisetaceae	List 3
		1	**Gilia capitata ssp. chamissonis**	blue coast gilia	Polemoniaceae	List 1B.1
		1	**Grindelia hirsutula var. maritima**	San Francisco gumplant	Asteraceae	List 1B.2
		1	**Helianthella castanea**	Diablo helianthella	Asteraceae	List 1B.2
		1	**Hemizonia congesta ssp. congesta**	pale yellow hayfield tarplant	Asteraceae	List 1B.2
		1	**Horkelia cuneata ssp. sericea**	Kellogg's horkelia	Rosaceae	List 1B.1
		1	**Lessingia germanorum**	San Francisco lessingia	Asteraceae	List 1B.1
		1	**Malacothamnus arcuatus**	arcuate bush-mallow	Malvaceae	List 1B.2

		1	**Plagiobothrys chorisianus var. chorisianus**	Choris' popcorn-flower	Boraginaceae	List 1B.2
		1	**Silene verecunda ssp. verecunda**	San Francisco campion	Caryophyllaceae	List 1B.2
		1	**Triphysaria floribunda**	San Francisco owl's-clover	Scrophulariaceae	List 1B.2
		1	**Triquetrella californica**	coastal triquetrella	Pottiaceae	List 1B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

No more hits.

Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results - Mon, Nov. 2, 2009, 18:50 b

{QUADS_123} =~ m/\(448B\)*/ Search

Tip: Having trouble with a multi-word search? Try a single word, e.g. `ginger` or `cobra`.
[all tips and help.][search history]

Hits 1 to 7 of 7
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press check all check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Arctostaphylos hookeri ssp. franciscana**	Franciscan manzanita	Ericaceae	List 1A
		1	**Arctostaphylos hookeri ssp. ravenii**	Presidio manzanita	Ericaceae	List 1B.1
		1	**Astragalus tener var. tener**	alkali milk-vetch	Fabaceae	List 1B.2
		1	**Chorizanthe robusta var. robusta**	robust spineflower	Polygonaceae	List 1B.1
		1	**Cirsium occidentale var. compactum**	compact cobwebby thistle	Asteraceae	List 1B.2
		1	**Hesperevax sparsiflora var. brevifolia**	short-leaved evax	Asteraceae	List 1B.2
		1	**Pentachaeta bellidiflora**	white-rayed pentachaeta	Asteraceae	List 1B.1

No more hits.

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Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results for "+"Hunters Point (448A) 3712263"" - Mon, Nov. 2, 2009, 18:52 b

+"Hunters Point (448A) 3712263" Search

Tip: `Lathyrus Astragalus` returns species from both genera.[all tips and help.]
[search history]

Hits 1 to 1 of 1
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press check all check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Suaeda californica**	California seablite	Chenopodiaceae	List 1B.1

No more hits.

APPENDIX C
USFWS SPECIAL-STATUS SPECIES LIST

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 080707032523

Database Last Updated: January 31, 2008

Quad Lists

HUNTERS POINT (448A)

Listed Species

Invertebrates

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

SAN FRANCISCO SOUTH (448B)

Listed Species

Invertebrates

Euphydryas editha bayensis
Critical habitat, bay checkerspot butterfly (X)

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Thamnophis sirtalis tetrataenia
San Francisco garter snake (E)

Birds

Brachyramphus marmoratus
marbled murrelet (T)

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Steller (=northern) sea-lion (T) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Lessingia germanorum
San Francisco lessingia (E)

Candidate Species

Invertebrates

Haliotes cracherodii
black abalone (C) (NMFS)

County Lists

San Francisco County

Listed Species

Invertebrates

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

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loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

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leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

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western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus

California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Mammals

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Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Critical Habitat, Steller (=northern) sea-lion (X) (NMFS)
Steller (=northern) sea-lion (T) (NMFS)

Megaptera novaeangliae
humpback whale (E) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Arctostaphylos hookeri ssp. ravenii
Presidio (=Raven's) manzanita (E)

Clarkia franciscana
Presidio clarkia (E)

Hesperolinon congestum
Marin dwarf-flax (=western flax) (T)

Lessingia germanorum
San Francisco lessingia (E)

Candidate Species

Invertebrates

Haliotes cracherodii

black abalone (C) (NMFS)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

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Important Information About Your Species List

How We Make Species Lists

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The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts.

More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 05, 2008.

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 091102032902

Database Last Updated: January 29, 2009

Quad Lists

Listed Species

Invertebrates

Euphydryas editha bayensis
Critical habitat, bay checkerspot butterfly (X)

Haliotes cracherodii
black abalone (E) (NMFS)

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)

green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Thamnophis sirtalis tetrataenia
San Francisco garter snake (E)

Birds

Brachyramphus marmoratus
marbled murrelet (T)

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Steller (=northern) sea-lion (T) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Lessingia germanorum
San Francisco lessingia (E)

Proposed Species

Amphibians

Rana aurora draytonii
Critical habitat, California red-legged frog (PX)

Quads Containing Listed, Proposed or Candidate Species:

HUNTERS POINT (448A)

SAN FRANCISCO SOUTH (448B)

County Lists

Listed Species

Invertebrates

Haliotes cracherodii
black abalone (E) (NMFS)

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white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

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Oncorhynchus tshawytscha
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Presidio clarkia (E)

Hesperolinon congestum
Marin dwarf-flax (=western flax) (T)

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Candidate Species

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lists provide essential information for land management planning and conservation efforts. More info

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Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be January 31, 2010.

APPENDIX D
PLANT SPECIES OBSERVED IN THE STUDY AREA

APPENDIX D
Candlestick Point - Hunters Point Shipyard Phase II Project
Plant Species Observed

Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Acacia melanoxylon	Blackwood acacia	Introduced*
Achillea millefolium	Yarrow	Native
Aesculus californica	California buckeye	Native
Agoseris grandiflora	California dandelion	Native
Ailanthus altissima	Tree-of-heaven	Introduced*
Alnus sp.	ornamental Alder	
Amaranthus albus	tumbleweed	Introduced
Ambrosia chamissonis	Silver beach bur	Native
Ammannia coccinea	red ammannia	Native
Anagallis arvensis	Scarlet pimpernel	Introduced
Aster sp.	Perennial aster	
Atriplex sp.	Salt bush	
Atriplex triangularis	spearscale	Native
Avena fatua	Wild oat	Introduced*
Baccharis pilularis	Coyote brush	Native
Bellardia trixago	Mediterranean linseed	Introduced*
Bolboschoenus robustus	saltmarsh bulrush	Native
Brassica nigra	Black mustard	Introduced*
Brodiaea elegans	Harvest brodiaea	Native
Brodiaea terrestris	Dwarf brodiaea	Native
Bromus carinatus	California brome grass	Native
Bromus carinatus var. carinatus	Mountain brome	Native
Bromus diandrus	Rip-gut brome	Introduced*
Bromus hordeaceus	Soft chess brome	Introduced*
Bromus madritensis ssp. rubens	Red brome	Introduced*
Cakile maritime	European sea rocket	Introduced*
Calandrinia ciliata	Red maids	Native
Calochortus luteus	Yellow mariposa lily	Native
Calystegia subacaulis	Stemless morning glory	Native
Capsella bursa-pastoris	Shepard's purse	Introduced
Carduus pycnocephalus	Italian thistle	Introduced*
Carpobrotus chilensis	Sea fig	Introduced*
Carpobrotus edulis	Ice plant	Introduced*
Ceanothus sp.	Ornamental buck brush	
Cedrus deodara	Deodar cedar	Introduced
Centaurea calcitrapa	purple star thistle	Introduced*
Centaurea melitensis	Napa star thistle	Introduced*
Centaurea solstitialis	yellow star-thistle	Introduced*
Centranthus ruber	red valerian	Introduced

APPENDIX D **Candlestick Point - Hunters Point Shipyard Phase II Project** **Plant Species Observed**		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Cercis occidentalis	redbud	Native
Chamomilla suaveolens	Pineapple weed	Introduced
Chenopodium album	Lamb's quarters	Introduced
Chlorogalum pomeridianum	Soap Root	Introduced
Chrysanthemum coronarium	Garland chrysanthemum	Introduced*
Cirsium vulgare	bull thistle	Introduced*
Cistus sp.	ornamental rock rose	Introduced
Claytonia perfoliata	Miner's lettuce	Native
Conium maculatum	poison hemlock	Introduced*
Convolvulus arvensis	field bindweed	Introduced*
Conyza canadensis	Horseweed	Native
Cortaderia jubata	Pampas grass	Introduced*
Cortaderia selloana	Uruguayan pampas grass	Introduced*
Cotula coronopidolia	Brass buttons	Introduced*
Crassula connata	Pygmy weed	Native
Crepis vesicaria	beaked hawksbeard	Introduced
Cupressus ssp.	Ornamental cypress	
Cynodon dactylon	bermuda grass	Introduced*
Cyperus eragrostis	tall flatsedge	Native
Dactylis glomerata	Orchard grass	Introduced*
Danthonia californica	California oatgrass	Native
Dichelostemma capitatum	Blue dicks	Native
Distichlis spicata	Salt grass	Native
Elymus glaucus	Blue wildrye	Native
Epilobium brachycarpum	Annual fireweed	Native
Epilobium ciliatum ssp. ciliatum	fringed willowherb	Native
Epilobium sp.	willowherb	Native
Eriodictyon californicum	Yerba Santa	Native
Eriogonum latifolium	coast buckwheat	Native
Erodium botrys	Filaree	Introduced*
Erodium cicutarium	Red stem filaree	Introduced*
Erodium moschatum	White stemmed filaree	Introduced*
Eschscholzia californica	California poppy	Native
Festuca arundinaceae	Tall Fescue	Introduced*
Festuca rubra	Red Fescue	Native
Filago gallica	narrowleaf cottonrose	Introduced
Foeniculum vulgare	fennel	Introduced*
Frankenia salina	Alkali Heath	Native
Fremontodendron californicum	Flannel bush	Native
Fumaria capreolata	White ramping fumitory	Native

APPENDIX D
Candlestick Point - Hunters Point Shipyard Phase II Project
Plant Species Observed

Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Fumaria officinalis	Fumitory	Introduced*
Galium sp.	Bedstraw	
Genista monspessulana	French broom	Introduced*
Geranium carolinianum	Carolina geranium	Native
Geranium dissectum	Cut-leaf geranium	Introduced*
Geranium molle	Cranesbill	Introduced*
Gilia clivorum	Purple spot gilia	Native
Gnaphalium sp.	Cudweed	
Grindelia sp.	gumweed	
Grindelia stricta	coastal gumweed	Native
Heteromeles arbutifolia	Toyon	Native
Heterotheca grandiflora	Telegraph weed	Native
Hordeum marinum ssp. gussoneanum	Mediterranean barley	Introduced
Hordeum murinum ssp. *leporinum*	hare barley	Introduced
Hypochaeris glabra	Smooth cat's ear	Introduced*
Jaumea carnosa	Fleshy jaumea	Native
Juncus effusus	Common rush	Native
Lactuca serriola	Prickly lettuce	Introduced*
Lantana sp.	Ornamental Lantana	
Lasthenia californica	California goldfields	Native
Lepidium latifolium	broad leaved pepper grass	Introduced*
Lepidium nitidum	Peppergrass	Native
Leptospermum laevigatum	Australian tea tree	Introduced*
Leymus triticoides	Creeping wildrye	Native
Limonium californicum	Sea lavender	Native
Limonium perezii	Perez's sea lavender	Introduced
Lobularia maritima	Sweet alyssum	Introduced*
Lolium multiflorum	Italian rye	Introduced*
Lomatium caruifolium	Alkali parsnip	Native
Lomatium utriculatum	common lomatium	Native
Lotus corniculatus	Bird's-foot trefoil	Introduced*
Lotus wrangelianus	Chile lotus	Native
Lupinus albifrons	Silver bush lupine	Native
Lupinus arboreus	Coastal bush lupine	Native*
Lupinus bicolor	Miniature lupine	Native
Lupinus succulentus	arroyo lupine	Native
Lythrum hyssopifolium	hyssop loosestrife	Introduced*
Malva neglecta	common mallow	Introduced
Malva nicaeensis	Bull mallow	Introduced
Malva parviflora	cheeseweed mallow	Introduced

APPENDIX D
Candlestick Point - Hunters Point Shipyard Phase II Project
Plant Species Observed

Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Marah fabaceus	California man-root	Native
Medicago polymorpha	California bur-clover	Introduced*
Melica sp.	Onion grass	Native
Melilotus alba	White sweetclover	Introduced*
Melilotus indica	Yellow sweet clover	Introduced
Microseris douglasii	Douglas' microseris	Native
Muhlenbergia rigens	deergrass	Native
Myoporum laetum	Lollypop tree	Introduced*
Nassella pulchra	Purple needlegrass	Native
Oxalis corniculata	Yellow sorrel	Introduced*
Oxalis pes-caprae	Bermuda buttercup	Introduced*
Paspalum dilatatum	Dallis grass	Introduced
Picris echioides	Prickly ox-tongue	Introduced*
Pinus radiata	Monterey pine	Native*
Piptatherum miliaceum	Smilo grass	Introduced*
Plantago coronopus	Cut leaf plantain	Introduced*
Plantago erecta	California plantain	Native
Plantago major	common plantain	Introduced
Plantago maritima	alkali plantain	Native
Platanus racemosa	California sycamore	Native
Poa annua	Blue grass	Introduced
Polygonum arenastrum	Common knotweed	Introduced
Polypogon monspelienensis	Rabbit's foot grass	Introduced*
Pyracantha sp.	Firethorn	Introduced
Quercus agrifolia	Live oak	Introduced
Ranunculus muricatus	Spiny-fruited buttercup	Introduced
Raphanus raphanistrum	painted charlock	Introduced
Raphanus sativa	Wild radish	Introduced*
Rhamnus californica	Coffeeberry	Native
Ribes sp.	Gooseberry	Native
Robinia pseudoacacia	Black locust	Introduced*
Rubus discolor	Himalayan blackberry	Introduced*
Rumex acetosella	Sheep sorrel	Introduced*
Rumex crispus	Curly dock	Introduced*
Rumex pulcher	Fiddle dock	Introduced
Rumex salicifolius	willow dock	Native
Salicornia virginica	Pickleweed	Native
Salix lasiolepis	Arroyo willow	Native
Salsola kali	Russian thistle	Introduced*
Salsola tragus	tumbleweed	Introduced*

APPENDIX D **Candlestick Point - Hunters Point Shipyard Phase II Project** **Plant Species Observed**		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Salvia mellifera	Black sage	Native
Salvia spathacea	hummingbird sage	Native
Sambucus nigra ssp. caerulea	Blue elderberry	Native
Sanicula bipinnatifida	Purple sanicle	Native
Schinus molle	Peruvian peppertree	Introduced *
Senecio vulgaris	Common groundsel	Introduced
Silene gallica	Campion, Catchfly	Introduced
Silybum marianum	Milk thistle	Introduced*
Sisyrinchium bellum	Blue-eyed grass	Introduced
Solanum physalifolium	hoe nightshade	Introduced
Soliva sessilis	common soliva	Introduced
Sonchus asper	Sow thistle	Introduced*
Sonchus oleraceus	common sow thistle	Introduced
Spartina sp.	Cord grass	
Spergularia macrotheca	Large flowered sand spurry	Native
Spergularia media	Coast sand spurry	Introduced
Stellaria media	Chickweed	Introduced
Tragopogon porrifolius	Salsify	Introduced
Trifolium campestre	Hop clover	Introduced
Trifolium hirtum	Rose clover	Introduced*
Triteleia laxa	Ithuriel's spear	Native
Typha latifolia	Broad -leaved cattail	Native
Umbellularia californica	California bay	Native
Vicia sativa	Spring vetch	Introduced
Vicia villosa	Hairy vetch	Introduced*
Vulpia bromoides	Six week fescue	Introduced*
Vulpia myuros	Rattail fescue	Introduced*
Vulpia myuros var. myuros	False foxtail fescue	Introduced

* California Invasive Plant Council (Cal-IPC) invasive plant

HT Harvey Wetland delineation
Julia's list
Julia's survey
Yosemite Slough report